UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
1595 Wynkoop Street
DENVER, CO 80202-1129
Phone 800-227-8917
http://www.epa.gov/region08

December 31, 2008

Ref: 8EPR-F

Mr. Robert T. Elliott
Environmental Restoration Branch
75th CEG/CEVR
72/74 Wardleigh Road
Hill Air Force Base, Utah 84056-5137

Dear Mr. Elliott:

The Environmental Protection Agency (EPA) has completed its review of the Final 2008 Five-Year Review Report received on December 29, 2008, for Hill AFB. This Five-Year Review was independently conducted by CH2M Hill Inc. for the U.S. Air Force following EPA's *Comprehensive Five-Year Review Guidance* (2001). It is the third Five-Year Review for Hill AFB and covers the period between October 2002 (the end of the period covered by the 2003 Five-Year Review) and September 2007.

This 2008 Five-Year Review Report evaluates the status of recommendations made for Hill AFB in the 2003 Five-Year Review Report and the activities performed during the 2008 Five-Year Review period in terms of protectiveness of human health and the environment. In addition, issues specific to this Five-Year Review period are described and recommendations to address these issues are provided. EPA concurs with these recommendations as well as the protectiveness statements for each of the 13 operable units and the Basewide Indoor Air Program. The report is accepted as submitted.

If you need further information regarding EPA's review of the 2008 Five-Year Review Report for Hill AFB, please contact Ms. Sandra A. Bourgeois, EPA's project manager for Hill AFB, at (303) 312-6666.

Sincerely,

Elisabeth Evans

for Carol Campbell
Assistant Regional Administrator
Office of Ecosystems Protection
And Remediation

cc: Mr. Duane Mortensen, UDEQ

FINAL

*Five-Year Review Report*

# 2008 Five-Year Review for Hill Air Force Base

Hill Air Force Base, Utah
Contract No: F42650-03-D-0002
Delivery Order 0020

Prepared for:

75 CONS/PKB and 75 CEG/CEVR
Environmental Management Division
Civil Engineer Group

Prepared by:

CH2MHILL
215 South State, Suite 1000
Salt Lake City, Utah 84111

DECEMBER 2008

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*Five-Year Review Report*

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215 South State, Suite 1000
Salt Lake City, Utah 84111

DECEMBER 2008

APPROVED BY: W R James DATE: 16 Dec 08

W. ROBERT JAMES, PH.D., P.E.
CHIEF, ENVIRONMENTAL MANAGEMENT DIVISION
75TH CIVIL ENGINEERING GROUP

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# Preface

This Final Five-Year Review Report describes the process and findings for the 2008 five-year review of remedial actions performed at Hill Air Force Base (AFB), Utah. This five-year review has been independently conducted by CH2M HILL, Inc. (CH2M HILL), using the process described in the United States Environmental Protection Agency (EPA) Office of Solid Waste and Emergency Response (OSWER) Directive 9355.7-03B-P, *Comprehensive Five-Year Review Guidance* (**EPA, 2001).** This five-year review covers the period between October 2002 (the end of the period covered by the 2003 five-year review) and September 2007.

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 United States Code §9601 et seq. and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 Code of Federal Regulations (CFR) 300 et seq., call for five-year reviews of CERCLA remedial actions. The purpose of a five-year review is to evaluate the implementation and performance of a remedy in order to determine if the remedy is or will be protective of human health and the environment. The Five-Year Review Report documents the methods, findings, and conclusions of the five-year review.

This 2008 Five-Year Review Report describes the status of recommendations made for Hill AFB in the 2003 Five-Year Review Report (**URS, 2003**) and evaluates the activities performed during the 2008 five-year review period in terms of protectiveness of human health and the environment. In addition, issues specific to this five-year review period are described and recommendations to address these issues are provided.

This final version of the report is the result of a detailed review process. DRAFT 1 of the report was prepared for the 75th Civil Engineer Group Environmental Restoration (CEVR) for transmittal to EPA and the Utah Department of Environmental Quality (UDEQ) for regulatory review. EPA and the UDEQ provided review comments, and these comments were considered during preparation of DRAFT 2. DRAFT 2 of the report was prepared for CEVR for transmittal to the Restoration Advisory Board (RAB) for their review. The RAB provided review comments, and these comments were considering during preparation of DRAFT 3. DRAFT 3 was prepared for CEVR for transmittal to the EPA and the UDEQ to undergo a second regulatory review. No comments were received on DRAFT 3. The CEVR, EPA, UDEQ, and RAB comments on DRAFTs 1 and 2, and responses that describe how the comments were addressed in the final document are provided in **Appendix A**.

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# Contents



## Tables

**Section 7 Tables (OU specific five-year review forms)**

## Figures



## Appendices

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# Acronyms

| | |
|---|---|
| 1,1-DCE | 1,1-Dichloroethene |
| 1,2-DCA | 1,2-Dichloroethane |
| AADA | Aspen Avenue Disposal Area |
| ADR | Analytical Data Report |
| AEEC | American Engineering and Environmental Consultants |
| AFB | Air Force Base |
| ARAR | Applicable or Relevant and Appropriate Requirements |
| ASTP | air stripper treatment plant |
| BASAP | Basewide Air Sampling and Analysis Program |
| bgs | below ground surface |
| BHMH | Boyer Hill Military Housing L.C. |
| BRA | Baseline Risk Assessment |
| BTEX | Benzene, toluene, ethylbenzene, and xylenes |
| BTEXN | Benzene, toluene, ethylbenzene, xylenes, and naphthalene |
| CEG | Civil Engineering Group |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CAP | Corrective Action Plan |
| CEVR | 75th Civil Engineer Group Environmental Restoration |
| CFR | Code of Federal Regulations |
| cfs | cubic feet per second |
| COC | Contaminant of Concern |
| COPC | Contaminant of Potential Concern |
| CPT | cone penetration test |
| CPU | central processing unit |
| CSM | conceptual site model |
| CWSID | Central Weber Sewer Improvement District |
| DCA | Dichloroethane |
| DCE | Dichloroethene |
| DERP | Defense Environment Restoration Program |
| DERR | Division of Environmental Response and Remediation |
| DNAPL | dense non-aqueous phase liquid |
| DoD | Department of Defense |
| DRMO | Defense Reutilization and Marketing Office |
| EM | Environmental Management |
| EPA | United States Environmental Protection Agency |
| ERPIMS | Environmental Restoration Program Information Management System |
| ESD | Explanation of Significant Differences |
| FFA | Federal Facilities Agreement |
| FS | Feasibility Study |
| ft | Feet |
| ft/ft | feet per foot |

| | |
|---|---|
| FYR | Five-Year Review |
| gpm | gallons per minute |
| G-Pool | Griffith Pool |
| HCS | hydraulic control system |
| HDUS | Horizontal Drain Upgrade System |
| HHRA | human health risk assessment |
| IAP | Indoor Air Program |
| IC | Institutional Controls |
| IMMR | Inspection, Monitoring, and Maintenance Report |
| IRA | Interim Remedial Action |
| IRP | Installation Restoration Program |
| IWTP | Industrial Wastewater Treatment Plant |
| LGAC | liquid-phase granular activated carbon |
| LMTA | Little Mountain Test Annex |
| LNAPL | Light non-aqueous phase liquid |
| LTM | long-term monitoring |
| LTO | Long Term Operation |
| LUC | Land Use Control |
| LUCAR | Land Use Control Assessment Report |
| LUST | leaking underground storage tank |
| MAL | Mitigation Action Level |
| MAMS | Missile Assembly Maintenance and Storage |
| MCL | maximum contaminant level |
| mg/kg | milligrams per kilogram |
| mg/L | milligrams per liter |
| MNA | Monitored natural attenuation |
| MOA | Memorandum of Agreement |
| MOU | Memorandum of Understanding |
| MTBE | methyl tert-butyl ether |
| MWH | MWH Americas, Inc. |
| NCP | National Oil and Hazardous Substances Pollution Contingency Plan |
| NDSD | North Davis Sewer District |
| NFRAP | No Further Response Action Planned |
| NIT | north interceptor trench |
| NPL | National Priorities List |
| O&M | operations and maintenance |
| OU | Operable Unit |
| OSWER | Office of Solid Waste and Emergency Response |
| OWS | Oil-water separator |
| PA | preliminary assessment |
| PCB | polychlorinated biphenyl |
| PMP | project monitoring plan |
| POTW | Publicly owned treatment works |
| PP | Proposed Plan |
| ppb | parts per billion |
| ppm | parts per million |
| PRB | Permeable Reactive Barrier |

| | |
|---|---|
| PRG | Preliminary Remediation Goals |
| PSVPlan | Performance Standard Verification Plan |
| PSVReport | Performance Standard Verification Report |
| RAB | Restoration Advisory Board |
| RA-C | remedial action under construction |
| RAO | Remedial Action Objective |
| RBC | Risk-based concentration |
| RCRA | Resource Conservation and Recovery Act |
| RfDi | inhalation reference dose |
| RfDo | oral reference dose |
| RI | Remedial Investigation |
| RME | reasonable maximum exposure |
| ROD | Record of Decision |
| RVMF | Refueling Vehicle Maintenance Facility |
| SARA | Superfund Amendments and Reauthorization Act of 1986 |
| SEAR | Surfactant Enhanced Aquifer Remediation |
| SF | slope factor |
| SFi | inhalation slope factor |
| SFo | oral slope factor |
| SI | Site Inspection |
| SRS | Source recovery system |
| SVE | soil vapor extraction |
| SVOC | Semi-volatile organic compound |
| TAG | Technical Assistance Grant |
| TARS | Tooele Army Rail Shop |
| TBC | To Be Considered |
| TCE | Trichloroethene |
| trans 1,2-DCE | trans 1,2-Dichloroethene |
| TS | Treatability Study |
| TSCA | Toxic Substances Control Act |
| TS-C | Treatability Study under construction |
| TSOR | Treatment System Operation Report |
| TTO | Total Toxic Organic |
| UDEQ | Utah Department of Environmental Quality |
| UDWR | Utah Division of Water Rights |
| µg/kg | micrograms per kilogram |
| µg/L | micrograms per liter |
| USAF | United States Air Force |
| USC | United States Code |
| UST | underground storage tank |
| VOC | Volatile organic compound |
| VOHC | Volatile halogenated organic compound |
| WWTP | Wastewater Treatment Plant |

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# Five-Year Review Summary Form

## SITE IDENTIFICATION

**Site name (from WasteLAN):** Hill Air Force Base (AFB)

**EPA ID (from WasteLAN):** UT0571724350

**Region:** EPA Region 8 | **State:** Utah | **City/County:** Hill AFB/Davis

## SITE STATUS

**NPL Status:** X Final __ Deleted __ Other (specify):

**Remediation status (choose all that apply):** X Under Construction X Operating __ Complete

**Multiple OUs?** X Yes __ No | **Construction completion date:** Various

**Has the site been put into reuse?** __ Yes X No

## REVIEW STATUS

**Reviewing agency:** __ EPA __ State __ Tribe X Other Federal Agency: Department of Defense (Air Force)

**Author:** Barbara L. Hall, PhD

**Author Title:** CEVR O&M Program Manager | **Author Affiliation:** Hill AFB 75 CEG/CEVR

**Review period:** October 2002 through September 2007

**Date(s) of site inspection:** September 24-28, 2007

**Type of review:**
X Statutory __ Policy
X Post-SARA __ Pre-SARA
__ NPL-Removal only __ Non-NPL Remedial Action site
__ NPL State/Tribe-lead __ Regional Discretion

**Review number:** __ 1 (first) __ 2 (second) X 3 (third) __ Other (specify):

**Triggering action:**
__ Actual RA Onsite Construction __ Actual RA Start
__ Construction Completion X Previous Five-Year Review Report
__ Other (specify):

**Triggering action date (from WasteLAN):** September 30, 2003

**Due date (five years after triggering action date):** December 31, 2008

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# Executive Summary

The U.S. Air Force has completed the 2008 Five-Year Review of remedial actions put in place at Hill Air Force Base (Hill AFB) environmental cleanup sites. These sites are located both on Hill AFB and in the communities of Clearfield, Clinton, Layton, Riverdale, Roy, South Weber, and Sunset.

This 2008 Five-Year Review was done to:

- Determine whether the remedies for cleanup at Hill AFB cleanup sites are protective of human health and the environment.
- Document the methods, findings and conclusions of the review in a report.
- Identify issues found during the review and make recommendations to address them.

Conducting a five-year review is required under the Comprehensive Environmental Response and Liability Act (CERCLA). This five-year review is the third for the Base, and covers the period between October 2002 (the end of the period covered by the 2003 Five-Year Review) and September 2007. It was conducted in accordance with United States Environmental Protection Agency (EPA) guidance on five-year reviews. This 2008 Five-Year Review does not generate new data or significantly reevaluate existing data or question previous conclusions regarding the data. It does not reevaluate the decisions made in the remedy selection process. It does include an evaluation of the status of recommendations made in the 2003 Five-Year Review and those recommendations in progress or not yet implemented are carried over as recommendations in this Five-Year Review.

Hill AFB contractor CH2M HILL, Inc. (CH2M HILL) conducted this review and the preparation of this report for the U.S. Air Force. Concordia Communications, Inc., another Hill AFB contractor, conducted the community interviews that appear in **Appendix B**.

Forty-six Installation Restoration Program (IRP) sites, managed in 13 operable units (OU), were evaluated as part of this review. The OUs are at various stages in the CERCLA process, ranging from initial assessment, through investigation and development of a cleanup plan, to long-term operations and monitoring of remedies that are in place. Of the 46 sites reviewed, 22 are designated as NFRAP, or "No Further Response Action Planned."

This 2008 Five-Year Review focused on Hill AFB sites that are active in the CERCLA process, with more focus on those with remedies in place. This review also provided a separate evaluation of the Indoor Air Program, which addresses vapor intrusion into homes from the groundwater plumes associated with several OUs.

The five-year review process consists of a document review, interviews with Hill AFB personnel, contractors, and community members, and site inspections performed to gather information necessary to answer three technical assessment questions contained in EPA's guidance. The three questions are:

A. Is the remedy functioning as intended by the decision documents?

B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

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

As defined in the EPA guidance, the protectiveness of each OU was determined, based on the answers to these questions, as one of the following:

- Protective
- Protective in the Short-Term
- Will Be Protective Once Remedy Is Complete
- Protectiveness Cannot Be Determined Until Additional Information is Obtained
- Not Protective
- Not Applicable

The summary of the protectiveness determinations is included in **Table ES-1**. Installation Restoration Program Sites with NFRAP status and OUs where the remedial investigation/ feasibility study is being conducted and a remedy has not been selected or completed were reviewed but no protectiveness was determined (Not Applicable). The 2003 Five-Year Review stated that NFRAP sites did not require review in 2008. However, additional information available for any NFRAP site published during the period of the 2008 Five-Year Review (October 2002 – September 2007) was reviewed. There are no OUs that are Not Protective based on this 2008 Five-Year Review.

TABLE ES-1
Summary of Protectiveness Determinations for Hill AFB

| Protectiveness Determination | Number of IRP Sites | Number of OUs | OUs |
|---|---|---|---|
| Protective | 13 | 3 | 3, 5, and 7 |
| Protective in the Short-Term | 21 | 4 and Indoor Air Program | 1, 2, 9, 12, and Indoor Air Program |
| Will be Protective Once Remedy is Complete | 1 | 1 | 13 |
| Protectiveness Cannot Be Determined | 9 | 3 | 4, 6, and 8 |
| Not Protective | 0 | 0 | |
| Not Applicable | 2 | 2 | 10 and 11 |

Upon completion of review by EPA and the Utah Department of Environmental Quality (UDEQ), the revised draft of this 2008 Five-Year Review Report was made available for a 30-day public comment period. Public comments received are included in **Appendix A**.

Section 1

# Introduction

In 2008, the United States Department of Defense, Hill Air Force Base (AFB) 75th Civil Engineer Group Environmental Restoration (CEVR) Branch conducted a third (2008) five-year review of the remedial actions implemented at Hill AFB. This five-year review included the period between October 2002 (the end of the period covered by the second five-year review that was completed in 2003) and September 2007. The purpose of a five-year review is to: 1) determine if remedial action(s) at a site remain protective of human health and the environment and 2) to document the methods, findings, and conclusions in a Five-Year Review Report. The Five-Year Review Report describes issues identified during the review and provides recommendations to address those issues.

This 2008 Five-Year Review Report documents the results of the third five-year review for Hill AFB. This five-year review was conducted in accordance with United States Environmental Protection Agency (EPA) guidance on five-year reviews. The EPA guidance on conducting five-year reviews is provided by Office of Solid Waste and Emergency Response (OSWER) Directive 9355.7-03B-P, *Comprehensive Five-Year Review Guidance* (**EPA, 2001**) (replaces and supersedes all previous guidance on conducting five-year reviews). Hill AFB and contractor personnel followed the guidance provided in this OSWER directive in conducting the five-year review for Hill AFB. Hill AFB contractor CH2M HILL, Inc (CH2M HILL) provided support for conducting this review and the preparation of this report. Concordia Communications, Inc., another Hill AFB contractor, conducted the community interviews that appear in **Appendix B**.

## 1.1 Purpose of Review

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 United States Code (USC) §9601 et seq. and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 Code of Federal Regulations (CFR) 300 et seq., call for five-year reviews of certain CERCLA remedial actions. The EPA also conducts five-year reviews of remedial actions in some other cases as a matter of policy. The statutory requirement to conduct a five-year review was added to CERCLA as part of the Superfund Amendments and Reauthorization Act of 1986 (SARA), Public Law 99-499. The EPA classifies each five-year review as either 'statutory' or 'policy' depending on whether it is required by statute or is conducted as a matter of policy. The 2008 five-year review for Hill AFB is a statutory review.

As specified by CERCLA and the NCP, statutory reviews are required for sites where—after remedial actions are complete—hazardous substances, pollutants, or contaminants will remain onsite at levels that will not allow for unrestricted use or unrestricted exposure. Statutory reviews are required at such sites if the record of decision (ROD) was signed on or after the effective date of SARA. CERCLA §121(c), as amended, 42 USC § 9621(c), 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 5 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."

The implementing provisions of the NCP, as set forth in the CFR, state at 40 CFR 300.430(f)(4)(ii):

> "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."

The five-year review for Hill AFB is required by statute because the RODs for Operable Units (OUs) 1 through 8 were signed after the effective date of SARA, and because materials remain onsite above levels that allow for unrestricted use and unrestricted exposure. The triggering action for the 2008 five-year review at Hill AFB is the completion date for the 2003 five-year review dated September 2003.

## 1.2 Site Description

Hill AFB is located in northern Utah, approximately 30 miles north of Salt Lake City and 5 miles south of Ogden. Hill AFB is located just west of the Wasatch mountain range and is surrounded by the incorporated towns of South Weber, Riverdale, Roy, Sunset, Clearfield, and Layton. Land use near Hill AFB includes residential, commercial, industrial, and agricultural (**URS, 2003**). The areas south and west of Hill AFB are urban and the area to the northeast is more rural**.** The location of Hill AFB is shown on **Figure 1-1.**

Hill AFB is within the Weber Delta Sub-district of the East Shore hydrologic region. The principle aquifers in the East Shore area include the Sunset (at 250 to 400 feet [ft] below ground surface [bgs]), and the Delta (at 500 to 700 ft bgs) (**URS, 2003**). As measured along the western boundary of Hill AFB, shallow groundwater is also encountered throughout the area. Many seeps and springs also exist at various locations within the areas and communities surrounding Hill AFB (**URS, 2003**).

Hill AFB, originally "Hill Field" in 1940, is part of the Air Force Materiel Command. The Ogden Air Logistics Center is also based at Hill AFB. The Ogden Air Logistics Center performs operational and support missions such as engineering and logistics management for various aircraft and intercontinental ballistic missiles. Dating back to World War II, Hill AFB has been the site for maintenance and repair activities for numerous types of aircraft (**URS, 2003**).

Activities at Hill AFB generate various wastes including chlorinated and non-chlorinated solvents and degreasers, fuels, other hydrocarbons, acids, bases, and metals. Waste products were historically disposed of at the Industrial Wastewater Treatment Plant (IWTP), in disposal pits and landfills on Hill AFB, or at other Air Force facilities. Waste disposal in

disposal pits and landfills ceased in 1980. Wastes are currently treated at the IWTP, recycled on Hill AFB, or sent to offsite treatment and disposal facilities (**URS, 2003**).

In July 1987, the EPA placed Hill AFB on the National Priorities List (NPL) under CERCLA. In April 1991, Hill AFB entered into a Federal Facility Agreement (FFA) with EPA Region VIII and the State of Utah Department of Health (now the Utah Department of Environmental Quality [UDEQ]). The FFA established the procedural framework and schedule for implementing CERCLA response actions at Hill AFB. The FFA originally defined seven OUs. There are currently 13 OUs at Hill AFB, several of which extend beyond the boundaries of Hill AFB (**URS, 2003** and **CH2M HILL, 2007b**). Each OU is comprised of one or more hazardous waste sites, known as Installation Restoration Program (IRP) sites. Forty-six IRP sites, managed in the 13 OUs, were evaluated as part of this review. The Basewide Indoor Air Program (IAP), which addresses vapor intrusion into homes from the groundwater plumes associated with several OUs, was also evaluated. Of the 46 IRP sites, 22 are considered "No Further Response Action Planned" (NFRAP). The location of each OU and the associated IRP sites are shown on **Figure 1-1**.

The OUs are in various stages of the CERCLA process, ranging from Site Inspection through Remedial Investigation/Feasibility Study (RI/FS), to ROD and Long-Term Monitoring (LTM). A brief description of each OU and associated IRP sites is provided in **Table 1-1**. The protectiveness determination for each OU provided in the 2003 five-year review report for Hill AFB is also included in **Table 1-1**. More detailed information for each OU is provided in **Section 7.0** of this report.

Hill AFB opened in 1920 and has over 85 years of operational history. Over approximately the last 25 years, remedial actions have been implemented at Hill AFB. Major events associated with the CERCLA process across Hill AFB are provided in **Table 1-2**.

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Table 1-1
Summary of Operable Units Reviewed During 2008 Five-Year Review, Associated IRP Sites, Management Stage, and Determinations from the 2003 Five-Year Review
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| OU | IRP Site ID | Site Name | 2003 Five-Year Review Protectiveness Determination* | 2003 Management Stage** | Next Five-Year Review (from 2003) | Current Management Stage** |
|---|---|---|---|---|---|---|
| **1** | **OU 1** | **OPERABLE UNIT 1** | **Protectiveness cannot be determined until further information is obtained** | **LTO/LTM** | **2008** | **LTO/LTM** |
| 1 | LF001 | LANDFILL NO 4 | Protective | LTO/LTM | 2008 | LTO/LTM |
| 1 | WP002 | CHEMICAL PITS 1 AND 2 | Protectiveness cannot be determined until further information is obtained | LTO/LTM | 2008 | LTO/LTM |
| 1 | LF003 | LANDFILL NO 3 | Protective | LTO/LTM | 2008 | LTO/LTM |
| 1 | FT009 | FIRE TRAINING AREA 1 | Not applicable | LTO/LTM | 2008 | LTO/LTM |
| 1 | OT014 | GOLF COURSE | Not applicable | NFRAP | None required | NFRAP |
| 1 | FT081 | FIRE TRAINING AREA 2 | Protectiveness cannot be determined until further information is obtained | NFRAP | None required | NFRAP |
| 1 | WP080 | WASTE PHENOL OIL PIT | Protectiveness cannot be determined until further information is obtained | LTO/LTM | 2008 | LTO/LTM |
| **2** | **OU 2** | **OPERABLE UNIT 2** | **Protectiveness cannot be determined until further information is obtained** | **LTO/LTM** | **2008** | **LTO/LTM** |
| 2 | WP007 | CHEMICAL PIT 3 | Protectiveness cannot be determined until further information is obtained | LTO/LTM | 2008 | LTO/LTM |
| 2 | SS021 | PERIMETER ROAD | Not applicable | NFRAP | None required | NFRAP |

Table 1-1
Summary of Operable Units Reviewed During 2008 Five-Year Review, Associated IRP Sites, Management Stage, and Determinations from the 2003 Five-Year Review
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| OU | IRP Site ID | Site Name | 2003 Five-Year Review Protectiveness Determination* | 2003 Management Stage** | Next Five-Year Review (from 2003) | Current Management Stage** |
|---|---|---|---|---|---|---|
| **3** | **OU 3** | **OPERABLE UNIT 3** | **Protective** | **LTO/LTM** | **2008** | **LTO/LTM** |
| 3 | ST004 | SODIUM HYDROXIDE SPILL | Protective | LTO/LTM | 2008 | LTO/LTM |
| 3 | WP005 | BERMAN POND | Protective | LTO/LTM | 2008 | LTO/LTM |
| 3 | WP006 | IWTP SLUDGE DRYING BEDS | Not applicable | NFRAP | None required | NFRAP |
| 3 | ST018 | BLDG 514 | Protective | NFRAP | None required | NFRAP |
| 3 | SD046 | POND 2 | Not applicable | NFRAP | None required | NFRAP |
| **4** | **OU 4** | **OPERABLE UNIT 4** | **Protective in the short term** | **LTO/LTM** | **2008** | **LTO/LTM** |
| 4 | LF011 | LANDFILL NO 1 | Protective in the short term | LTO/LTM | 2008 | LTO/LTM |
| 4 | LF012 | LANDFILL NO 2 | Not applicable | NFRAP | 2008 | NFRAP |
| 4 | OT020 | SPOIL PIT | Not applicable | NFRAP | None required | NFRAP |
| 4 | OT041 | NORTH GATE DUMP OP UNIT 4 | Not applicable | NFRAP | 2008 | NFRAP |
| 4 | OT042 | MUNITIONS DUMP OP UNIT 4 | Not applicable | NFRAP | None required | NFRAP |
| **5** | **OU 5** | **OPERABLE UNIT 5** | **Protective in the short term** | **RI/Early Action** | **2008** | **LTO/LTM** |
| 5 | SD016 | BAMBERGER POND | Not applicable | NFRAP | None required | NFRAP |
| 5 | SS017 | US ARMY TOOELE RAIL SHOP | Protective in the short term | RI/Early Action | 2008 | LTO/LTM |
| 5 | SS091 | BLDG 1607 - EVAPORATION POND | Not applicable | RI | 2008 | LTO/LTM |

Table 1-1
Summary of Operable Units Reviewed During 2008 Five-Year Review, Associated IRP Sites, Management Stage, and Determinations from the 2003 Five-Year Review
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| OU | IRP Site ID | Site Name | 2003 Five-Year Review Protectiveness Determination* | 2003 Management Stage** | Next Five-Year Review (from 2003) | Current Management Stage** |
|---|---|---|---|---|---|---|
| **6** | **OU 6** | **OPERABLE UNIT 6** | **Protectiveness cannot be determined until further information is obtained** | **LTO/LTM** | **2008** | **LTO/LTM** |
| 6 | ST022 | SUMP LEACH FIELD | Protective | LTO/LTM | 2008 | LTO/LTM |
| 6 | OT026 | ASPHALT PAD | Protectiveness cannot be determined until further information is obtained | LTO/LTM | 2008 | LTO/LTM |
| 6 | SD40B | BLDG. 1946 EVAPORATION POND | Not applicable | NFRAP | None required | NFRAP |
| **7** | **OU 7** | **OPERABLE UNIT 7** | **Protective** | **LTM** | **2008** | **LTM** |
| 7 | SS027 | BLDG 225 CR SPILL | Protective | LTM | 2008 | LTM |
| 7 | ST031 | B220 UNDERGROUND TANKS | Not applicable | NFRAP | None required | NFRAP |
| 7 | SS032 | BLDG 225 PCB | Not applicable | NFRAP | None required | NFRAP |
| 7 | SS028 | SILL PROPERTY, LAYTON | Not applicable | NFRAP | None required | NFRAP |
| 7 | OT029 | B-204 BE | Not applicable | NFRAP | None required | NFRAP |
| **8** | **OU 8** | **OPERABLE UNIT 8** | **Protectiveness cannot be determined until further information is obtained** | **IRA/PP** | **2008** | **LTO/LTM** |
| 8 | OT033 | TCE PLUME | Protectiveness cannot be determined until further information is obtained | IRA/PP | 2008 | LTO/LTM |

Table 1-1
Summary of Operable Units Reviewed During 2008 Five-Year Review, Associated IRP Sites, Management Stage, and Determinations from the 2003 Five-Year Review
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| OU | IRP Site ID | Site Name | 2003 Five-Year Review Protectiveness Determination* | 2003 Management Stage** | Next Five-Year Review (from 2003) | Current Management Stage** |
|---|---|---|---|---|---|---|
| **9** | **OU 9** | **OPERABLE UNIT 9** | **Will be protective once remedy is completed** | **RI** | **2008** | **PP** |
| 9 | SD023 | POND 3 | Not applicable | RI | 2008 | NFRAP |
| 9 | SD034 | POND 1 | Will be protective once remedy is completed | RA-C | 2008 | LTM |
| 9 | SS092 | BLDG 786 | Protective | NFRAP | None required | NFRAP |
| 9 | OT106 | DEFERRED AREAS*** | Not applicable | LTM | 2008 | SI |
| 9 | SD040 | POND 7 | Not applicable | RI | 2008 | NFRAP |
| 9 | PT093 | Transformer Storage Yard | Not included in 2003 Five-Year Review | NFRAP | Not included in 2003 Five-Year Review | NFRAP |
| 9 | SS094 | Building 2402 | Not included in 2003 Five-Year Review | NFRAP | Not included in 2003 Five-Year Review | NFRAP |
| 9 | SS095 | Building 2403 | Not included in 2003 Five-Year Review | NFRAP | Not included in 2003 Five-Year Review | NFRAP |
| 9 | SS089 | 1100 AREA | Not applicable | RI | 2008 | PP |
| 9 | SS090 | ZONE 7 GOLF COURSE | Not applicable | RI | 2008 | PP |
| 9 | SS108 | 800/900 WAREHOUSE AREA | Not applicable | RI | 2008 | PP |
| **10** | **OU 10** | **OPERABLE UNIT 10** | **Not applicable** | **RI** | **2008** | **RI** |
| 10 | SS109 | 1200 AREA | Not applicable | RI | 2008 | RI |
| **11** | **OU 11** | **OPERABLE UNIT 11** | **Not applicable** | **RI** | **2008** | **RI** |
| 11 | OT097 | GAS STATION (454) | Not applicable | RI | 2008 | RI |

Table 1-1
Summary of Operable Units Reviewed During 2008 Five-Year Review, Associated IRP Sites, Management Stage, and Determinations from the 2003 Five-Year Review
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| OU | IRP Site ID | Site Name | 2003 Five-Year Review Protectiveness Determination* | 2003 Management Stage** | Next Five-Year Review (from 2003) | Current Management Stage** |
|---|---|---|---|---|---|---|
| **12** | **OU 12** | **OPERABLE UNIT 12** | **Not protective** | **RI/TS-C** | **2008** | **PP/Early Action** |
| 12 | SS107 | ASPEN AVE. DISPOSAL AREA | Not protective | RI/TS-C | 2008 | PP/Early Action |
| **13** | **OU 13** | **OPERABLE UNIT 13** | **Not included in 2003 Five-Year Review** | **DESIGNATED IN 2007** | **Not included in 2003 Five-Year Review** | **RI/Early Action** |
| 13 | SS112 | Upper Area F Housing PCB Site | Not included in 2003 Five-Year Review | Designated in 2007 | Not included in 2003 Five-Year Review | RI/Early Action |

* The 2003 Five-Year Review stated that NFRAP sites did not require review in 2008. A protectiveness determination of 'not applicable' was therefore assigned for these sites. However, additional information available for any NFRAP site published during the period of the 2008 Five-Year Review (October 2002 – September 2007) was reviewed.

** Management Stages:
IRA = Interim Remedial Action, under Interim ROD
LTM = Long Term Monitoring
LTO = Long Term Operation
NFRAP = No Further Response Action Planned
PP = Proposed Plan
RA = Remedial Action in place, under ROD
RA-C = Remedial Action under Construction, under ROD
RI = Under Remedial Investigation
SI = Site Inspection
TS-C = Treatability Study under Construction

*** Deferred Sites have been removed from OU 9 and placed under Site Inspection status

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TABLE 1-2
Chronology of CERCLA-Related Events at Hill AFB
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Month | Year | Event | Comments | Reference |
|---|---|---|---|---|
| | 1981 | Phase I (Records Search) of the Air Force Installation Restoration Program (IRP) starts at Hill Air Force Base (AFB). | Part of nationwide IRP initiated by the Department of Defense in 1978. | Federal Facilities Agreement (FFA) under Comprehensive Response, Compensation, and Liability Act (CERCLA) Section 120 |
| Jan | 1982 | Results of Phase I IRP are published. | Identified 13 areas at Hill AFB where hazardous materials may have been used, stored, treated, or disposed. These areas are later grouped into Operable Units (OUs) 1 through 7. | FFA under CERCLA Section 120 |
| Sept | 1982 | Phase II (preliminary assessments [PA]/site inspections [SI]) of IRP begins. | Designed to identify and quantify contaminants and to evaluate extent, direction, and rate of contaminant migration. | FFA under CERCLA Section 120 |
| July | 1984 | Cease and Desist Order issued by Utah Department of Water Quality. | Order was issued for leachate discharged below Landfill No. 4 (now part of OU 1). | Record of Decision Operable Unit 1 IRP Sites LF001, WP002, LF003, FT009, FT081, and WP080 |
| Aug | 1984 | Construction begins on groundwater treatment facility at OU 1. Extraction wells U1-201, U1-202, and U1-205 were installed. | The facility construction is the first remedial action conducted at Hill AFB. | Comprehensive Remedial Investigation Report for Operable Unit 1 (IRP Site LF01, LF03, WP02, FT09, OT14, FT81, and WP80), Volume 1 |
| Sept | 1984 | Results of Phase II IRP are published. | Identified volatile organic compounds (VOCs) and heavy metal contaminants at Hill AFB. | FFA under CERCLA Section 120 |
| Oct | 1984 | The United States Environmental Protection Agency (EPA) proposes Hill AFB for inclusion on the National Priorities List (NPL). | | FFA under CERCLA Section 120 |
| | 1985 | Additional remedies installed at OU 1. | Remedies include low-permeability caps over source areas and a subsurface barrier. | Record of Decision Operable Unit 1 IRP Sites LF01, WP02, LF03, FT09, FT81, and WP80 |
| July | 1987 | Hill AFB is placed on the NPL by EPA. | | Federal Register Vol. 52, No. 140. |

TABLE 1-2
Chronology of CERCLA-Related Events at Hill AFB
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Month | Year | Event | Comments | Reference |
|---|---|---|---|---|
| Apr | 1991 | Hill AFB enters into an FFA with the Utah Department of Health (now the Utah Department of Environmental Quality [UDEQ]) and EPA. | Established the procedural framework and schedule for developing, implementing, and monitoring response actions at Hill AFB in accordance with existing regulations. Seven OUs were defined under the FFA. | FFA under CERCLA Section 120 |
| Aug | 1991 | Record of Decision (ROD) for Interim Action at OU 2 signed. | Pump-and-treat (P&T) system for removal and destruction of free-phase dense non-aqueous phase liquids (DNAPL) from groundwater is selected as the remedy for interim action. | Record of Decision for Interim Action at Operable Unit 2, Final |
| Sept | 1992 | ROD for Interim Action at OU 3 site ST004 signed. | Selected an asphalt cap as the interim remedial action at site ST004. | Record of Decision for Interim Action at Operable Unit 3 Site ST004 |
| | 1993 | OU 8 created. | Contaminated groundwater, previously considered part of OU 3 and OU 7, redesignated as OU 8. | Remedial Investigation Report for Operable Unit 8. |
| June | 1994 | ROD for OU 4 signed. | The selected remedy addresses contaminated groundwater, surface water, and landfill contents at OU 4, and air inside off-Base residences in plume area. | Record of Decision and Responsiveness Summary for Operable Unit 4 (IRP Sites LF11, LF12, OT20, OT41, OT42) |
| Jan | 1995 | Formation of Restoration Advisory Board (RAB). | Created to advise Hill AFB on community and interest group concerns regarding environmental investigation and cleanup. | Minutes, First RAB Meeting, January 12, 1995 |
| Sept | 1995 | ROD for OU 3 signed. | The selected remedy called for soil vapor extraction (SVE) at Site ST018, a cap at Site WP005, and cap maintenance at ST004. | Record of Decision for OU 3 |

TABLE 1-2
Chronology of CERCLA-Related Events at Hill AFB
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Month | Year | Event | Comments | Reference |
|---|---|---|---|---|
| Sept | 1995 | ROD for OU 7 signed. | Mandated groundwater monitoring upgradient, beneath, and downgradient of the area where contaminant concentrations in soils are above health-based risk levels. | Record of Decision for Operable Unit 7 |
| Mar | 1995 | OU 9 is formed. | OU 9 was developed based on the "North" and "South" area preliminary assessments conducted in 1993 and 1994. The first document in which it was referenced was published in December 1995. | South Area of Operable Unit 9 Site Inspection Work Plan, December 1995 |
| Sept | 1996 | ROD for OU 2 signed. | The selected remedy addresses contaminated groundwater, soil, and surface water at OU 2. | Record of Decision and Responsiveness Summary for Operable Unit 2 |
| May | 1997 | Interim ROD for OU 8 signed. | An Interim Remedial Action (installation of a hydraulic containment system at the Base boundary) was required. | Record of Decision for an Interim Remedial Action at Operable Unit 8 |
| Oct | 1997 | ROD for OU 6 signed. | Contaminated groundwater required active treatment by extraction and air stripping. | Record of Decision for Operable Unit 6 Sites ST022, OT026, SD40B |
| Sept | 1998 | First Five-Year Review of CERCLA Sites at Hill AFB completed. | Focused on OUs, not on individual IRP Sites. | Hill AFB Five-Year Review, September 1998 |
| Sept | 1998 | ROD for OU 1 signed. | ROD established Remedial Action Objectives (RAOs) for existing and planned actions at OU 1. | Record of Decision for Operable Unit 1 IRP Sites LF01, WP02, LF03, FT09, FT81, and WP80 |
| Sept | 2000 | OU 10 created. | Redesignation of groundwater contamination plumes identified during OU 9 investigations. SS109, the 1200 Area, redesignated as OU 10. | OU10 Remedial Investigation/Feasibility Study Operable Unit 10 Analytical Data Report, May 1 2001 – January 31, 2002 |
| Sept | 2000 | OU 11 created. | Former Building 454 (Site OT097), formerly part of OU 9, were redefined as OU 11. | Final Analytical Data Report (ADR) For Operable Unit 9 Investigation Areas 1 May through 10 October 2000. |

TABLE 1-2
Chronology of CERCLA-Related Events at Hill AFB
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Month | Year | Event | Comments | Reference |
|---|---|---|---|---|
| Oct | 2001 | OU 12 created. | The northern groundwater contamination plume within OU 5 is designated OU 12. | Final Operable Units 5 and 12 Historic Site and Source Area Review, March 2002. |
| Mar | 2002 | Site Management Plan for OU 9 Deferred Sites. | Provides the mechanism to track and inventory deferred sites. | Operable Unit 9 Calendar Year 2001 Deferred Sites Inventory Report, Hill Air Force Base, Utah. |
| Sept | 2003 | Second Five-Year Review of CERCLA Sites at Hill AFB completed. | Comprehensive Five-Year Review of CERCLA actions taken at the Base completed in accordance with current EPA guidance. | Final CERCLA Five-Year Review Report, Second Five-Year Review Report for Hill Air Force Base, Utah |
| Sept | 2003 | Action Memorandum for Time-Critical Removal Actions for Indoor Air signed. | Implemented use of mitigation systems in residences Basewide overlying groundwater plumes. | Action Memorandum for Time Critical Removal Actions for Indoor Air |
| Oct | 2004 | Action Memorandum for installation of a permeable reactive barrier (PRB) at OU 12 is signed. | Documented approval of the installation of the PRB at OU 12 as a non-time critical removal action. | Final Action Memorandum for Installation of a Permeable Reactive Barrier at Operable Unit 12 |
| Mar | 2005 | ROD for OU 8 is signed. | The selected remedy addresses contaminated groundwater on-Base and off-Base at OU 8. | Final Record of Decision for Operable Unit 8 |
| July | 2006 | Explanation of Significant Differences (ESD) to the ROD for OU 1 is signed. | Documents significant, but not fundamental, differences between the Remedial Action (RA) selected in the OU 1 ROD and the RA that was implemented. | Final Explanation of Significant Difference for OU 1 |
| July | 2006 | ESD to the ROD for OU 4 is signed. | Documents significant, but not fundamental, differences between the RA selected in the OU 4 ROD and the RA that was implemented. | Final Explanation of Significant Difference for OU 4 |
| July | 2006 | ROD for OU 5 is signed. | The selected remedy addresses contaminated groundwater on-Base and off-Base and soils on-Base at OU 5. | Final Record of Decision for Operable Unit 5 |

TABLE 1-2
Chronology of CERCLA-Related Events at Hill AFB
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Month | Year | Event | Comments | Reference |
|---|---|---|---|---|
| Dec | 2007 | OU 13 created. | OU 13 created after discovery of contaminated soils in the Base Housing Upper Area F. | Draft Action Memorandum for Polychlorinated Biphenyls Removal Action at Upper Area F of the Residential Military Housing |
| Sept | 2007 | ESD to the ROD for OU 6 is signed. | Documents significant, but not fundamental, differences between the RA selected in the OU 6 ROD and the RA that was implemented. | Final Explanation of Significant Difference for OU 6 |
| Sept | 2007 | Final action memorandum for time-critical removal action at OU 13 prepared. | Requests approval to perform time-critical soil removal action at OU 13. | Final Action Memorandum for Polychlorinated Biphenyls Removal Action at Upper Area F of the Residential Military Housing |

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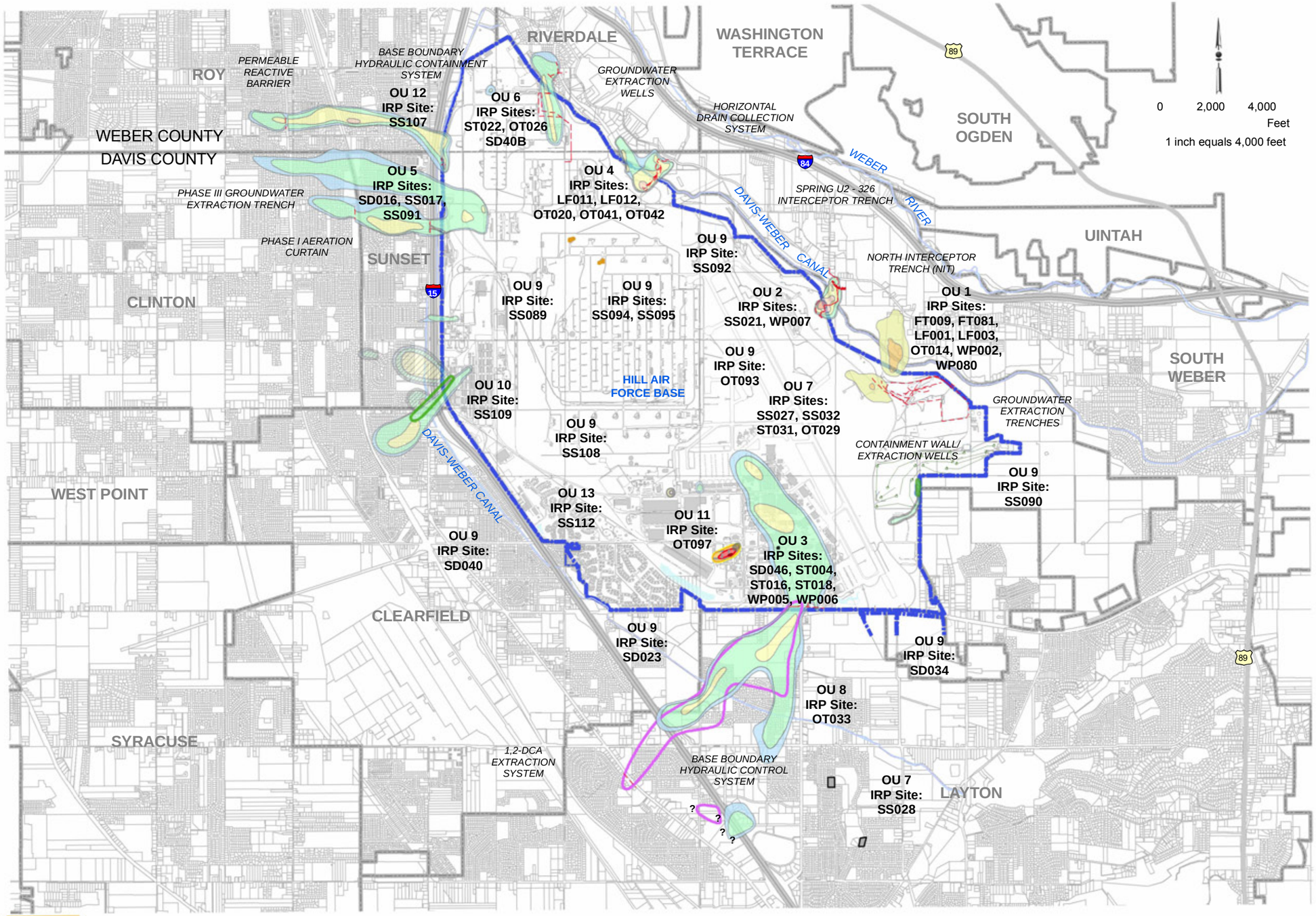
DFW \\CHUCKWAGON\GIS\NWOFILES\HILLAFB\MXD\SITE_MAP.MXD NBHATTAC 04/11/08




**LEGEND**

**HAFB BOUNDARY**

**DCA ISOCONCENTRATIONS (OU8)**

**< 5 µg/l**

**SURFACE WATER**

**ESTIMATED EXTENT OF BTEXN CONTAMINATION**

**5-10 µg/l**

**10-100 µg/l**

**100 - 1,000 µg/l**

**1,000 -10,000 µg/l**

**10,000 - 100,000 µg/l**

**ESTIMATED EXTENT OF CIS-1,2 DCE CONTAMINATION**

70 - 1000 µg/l

> 1000 µg/l

**ESTIMATED EXTENT OF MTBE CONCENTARTION**

20 -100 µg/l

100-1,000 µg/l

1,000-10,000 µg/l

10,000-100,000 µg/l

**ESTIMATED EXTENT OF TCE CONTAMINATION**

5-10 µg/l

10-100 µg/l

100 - 1,000 µg/l

1,000 -10,000 µg/l

10,000 - 100,000 µg/l

**PCE CONCENTRATION**

**5-10 µg/l**

**10-100 µg/l**

**DEEP PLUME TCE CONCENTRATION**

5-10 µg/l

10-100 µg/l

100 - 1,000 µg/l

**CTCL CONCENTRATION**

5-10 µg/l

10-100 µg/l


FIGURE 1-1
**SITE OVERVIEW MAP**
2008 FIVE-YEAR REVIEW
HILL AIR FORCE BASE, UTAH

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Section 2

# Description of Five-Year Review Process

This 2008 five-year review for Hill AFB was conducted in accordance with the EPA's *Comprehensive Five-Year Review Guidance* (**EPA, 2001**). For each OU and the IAP, relevant and applicable documents and data covering the period of the five-year review were evaluated; interviews were conducted with relevant parties; and a site inspection was conducted for each component of each OU. The IAP was addressed individually for this five-year review because it is in effect managed separately from each OU. For OUs where investigations were ongoing and no interim or RAs have been performed, the five-year review verified that known and potential exposures were being addressed. Community involvement and notification was also performed as part of the five-year review.

## 2.1 Five-Year Review Approach

Document reviews, interviews, and site inspections were performed to gather information necessary to answer the three technical assessment questions contained in the EPA guidance:

- Question A—Is the remedy functioning as intended by the decision documents?
- Question B—Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?
- Question C—Has any other information come to light that could call into question the protectiveness of the remedy?

The five-year review did not generate new data or significantly reevaluate existing data to assess previous conclusions regarding the data. In addition, the five-year review did not reevaluate the decisions made in the remedy selection process. Issues and recommendations identified as part of this five-year review are provided in **Section 3.0**. A summary for each OU, including the findings of the document and data review, interviews, site inspection, technical assessment, and OU specific issues and recommendations are provided in **Section 7.0**.

Management of CERCLA activities at Hill AFB has been historically structured on an OU basis, and much of the documentation and information is reported by OU. The 2008 five-year review was conducted primarily on an OU-wide basis. Where appropriate, individual IRP sites were assessed as part of the five-year review. The 2003 Five-Year Review stated that NFRAP sites did not require review in 2008. However, additional information available for any NFRAP site published during the period of the 2008 Five-Year Review (October 2002–September 2007) was reviewed.

Hill AFB initiated the 2008 five-year review. The review team was lead by Barbara Hall of Hill AFB/CEVR. The review team included staff from CH2M HILL, which was led by Margaret O'Hare. CH2M HILL was tasked to perform the technical components of the review and to prepare this 2008 Five-Year Review Report. Hill AFB project managers

worked in close coordination with the review team to provide documentation, interviews, and clarification throughout the process. Comments on previous draft versions of this Five-Year Review Report are provided in **Appendix A**.

## 2.2 Community Notification and Involvement

Hill AFB has made community involvement an important aspect of environmental management and CERCLA-related efforts. Hill AFB maintains professional and contract staff to address and manage community involvement issues. Community notification is also a requirement as part of the five-year review, and the EPA guidance recommends community involvement activities be performed, especially at high-profile sites or sites where there is public interest (**EPA, 2001**). Hill AFB tasked their community involvement contractor, Concordia Communications, to perform five-year review community involvement activities separate from the technical aspects of the five-year review.

Hill AFB published a public notice announcing initiation of the five-year review in the *Ogden Standard Examiner* (local daily newspaper) on December 11, 2007. Upon signature, the 2008 Five-Year Review Report will be placed in the Administrative Record for Hill AFB and a second public notice summarizing the findings of the review and announcing the availability of the report at the information repositories will be published in the *Ogden Standard Examiner* and the *Hilltop Times (base newspaper)*.

Members of the RAB were notified of the initiation of the five-year review at a meeting held on April 26, 2007. The RAB is a group of local people who represent the surrounding residents, municipalities, and interest groups. The group serves as a means for the public to be more involved in the environmental management activities at Hill AFB. The Hill AFB RAB was formed in 1995 and meets quarterly. The RAB was involved throughout the five-year review process and formed a Five-Year Review Work Group that worked with Hill AFB regarding this review. The RAB reviewed and commented on a draft copy of the 2008 Five-Year Review Report, and these comments are included in **Appendix A**.

Interviews were also conducted with public and private members of the community. Community interviews are further discussed in **Section 2.5**.

## 2.3 Five-Year Review Database

The data collection process included gathering data derived from document reviews, inspections, and interviews into forms suitable for uploading into a revised version of the 2003 five-year review Microsoft Access™ database developed for the site. In the database, relationships are established so that all information can be downloaded and distinguished by OU number and/or site identification, as well as other key fields. The 2008 five-year review database retains information presented in the 2003 five-year review database. This approach will allow for five-year review information, issues, and recommendations to be queried and summarized when necessary during the next five-year review period.

## 2.4 Document and Data Review

The 2008 five-year review included a review of relevant site documents and data related to the CERCLA process for each OU and remedial action. The types of documents reviewed included decision documents (RODs and ESDs), previous five-year review reports, action memorandums, performance standard verification plans (PSVPlans), performance standard verification reports (PSVReports), operations and maintenance (O&M) reports, O&M plans, LTM data, RA reports, sampling and investigation reports, and annual Land Use Controls Reports. With the exception of decision documents, the documents reviewed covered work performed at Hill AFB during the period from October 2002 through September 2007. Documents prepared after September 30, 2007, as well as draft documents, were not included as part of the document review unless specific information contained in such documents was identified as relevant to the 2008 five-year review. Examples of such documents would be the internal-draft Performance Standard Verification Report for OU 1 (a draft document) or the most recently updated Performance Standard Verification Plan for OU 8 (updated in December 2008). Additional information available for any NFRAP site published during the period of the 2008 Five-Year Review was also reviewed. The typical types of documents reviewed and types of information available are listed in **Table 2-1**. A list of all the documents reviewed for the 2008 five-year review is provided in **Appendix C**.

The document and data review was performed as part of the technical assessment to evaluate protectiveness for each OU. This information, along with the site inspections and interviews, was used to prepare the summaries for each OU provided in **Section 7.0**.

TABLE 2-1
Typical Documents Reviewed and Contents
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Document Type | Contents Pertinent to the Five-Year Review |
|---|---|
| Record of Decision | Background summary, nature and extent of contamination, contaminants, summary of risk assessments, RAOs and remediation goals, selected remedy, Applicable or Relevant and Appropriate Requirements (ARAR). |
| Explanation of Significant Differences | Documents and explains significant, but not fundamental, differences between the RA selected in the ROD and the RA that was implemented. |
| Action Memorandum | Background summary, nature and extent of contamination, contaminants, cleanup objectives and remediation goals, and selected remedy for removal actions. |
| 2003 Five-Year Review Report | Documents issues, recommendations, and findings of the 2003 five-year review. |
| Performance Standard Verification Plan | Provides conceptual site models, performance objectives for remedial systems, monitoring objectives, and how achievement of RAOs is to be demonstrated. Also includes sampling plan and performance metrics for remedial systems and remedies. |

TABLE 2-1
Typical Documents Reviewed and Contents
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Document Type | Contents Pertinent to the Five-Year Review |
|---|---|
| Performance Standard Verification Report | Presents updated conceptual site models, findings, and recommendations from work completed as defined in the PSVPlan. The PSVReport also evaluates the performance of RAs at a site, and contains an evaluation and recommends changes to the PSVPlan. |
| Operations and Maintenance Manuals | Defines how the systems will be operated, design parameters, what the system objectives are, how system operation will be monitored, and documents system construction and changes with time. |
| O&M Reports (monthly and annual) | Documents system operations, monitoring data, data trends, and interpretation of monitoring data. |
| Long-term Monitoring Data | Monitoring data, data trends, and interpretation of monitoring data. |
| Site Conceptual Model Reviews | Provides assessments of and updates to site conceptual models used to make site decisions and assess remedy performance. |
| Remedial Action Reports | Documents activities associated with construction and completion of an RA. |
| Sampling and Investigation Reports | Provides information related to nature and extent of contaminants present, updates to conceptual site models, and supplemental information. |
| Land Use Controls Reports | Includes an annual assessment of the institutional controls (land use controls, access restrictions, groundwater use controls) for Hill AFB. |

## 2.5 Interviews

Interviews with members of the community, Hill AFB OU and O&M managers, contractor staff, and regulatory authorities were conducted as part of the 2008 five-year review. Community interviews were conducted to receive input from the public regarding CERCLA-related activities at Hill AFB. Technical interviews were conducted with Hill AFB OU and O&M managers and contractor staff to obtain input regarding the technical activities at each OU and to obtain additional information and resolve questions identified during the document review. Interviews were conducted with the UDEQ and EPA managers responsible for Hill AFB to obtain their input as part of the five-year review. A list of the interviews conducted for the five-year review, the role or association of the interviewee, and the date of the interview is provided in **Table 2-2**.

TABLE 2-2
Interviews Conducted for the Five-Year Review
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| **Community Interviews** | | | |
|---|---|---|---|
| **Person Interviewed** | **Role or Association** | | **Date of Interview** |
| Agnes Bojanski | Roy City Resident | | December 21, 2007 |
| Chad Bangerter | Sunset City Council Member | | December 14, 2007 |
| Dale K. Searcy | Roy City RAB Representative | | December 11, 2007 |
| David Krieger | Layton City Resident | | December 20, 2007 |
| Dennis W. Cluff | Clinton City Manager | | December 12, 2007 |
| Gregg Benson | Clearfield City RAB Representative | | December 18, 2007 |
| Jeff and Cathy Burton | Roy City Residents | | December 28, 2007 |
| Lynn Moulding | Riverdale City and Community RAB Representative | | December 11, 2007 |
| Joe Gertge[1] | Mayor, South Weber City | | December 17, 2007 |
| Matt Dixon[1] | City Manager, South Weber City | | December 17, 2007 |
| Joe Ritchie | Mayor, Roy City | | December 17, 2007 |
| Mickey Hennessee | Sunset City RAB Representative | | December 12, 2007 |
| Pat Crezee | Riverdale City Resident | | December 13, 2007 |
| Brent Poll[2] | Executive Director, South Weber Landfill Coalition | | December 14, 2007 |
| **Technical Interviews** | | | |
| **Operable Unit** | **Person Interviewed (Association)** | **Role** | **Date of Interview** |
| OU 1 | Jason Dalpias (CEVR) | Site and O&M Manager | December 14, 2007 |
| | Ray Spencer (CEVR) | O&M Manager (landfill caps) | December 13, 2007 |
| | John Barlow (CH2M HILL) | O&M Contractor (Technician) | September 24, 2007 |
| | Mike Cox (CH2M HILL) | O&M Contractor (Project Manager, landfill caps) | January 14, 2008 |
| OU 2 | Kyle Gorder (CEVR) | Site Manager | December 13, 2007 |
| | Jason Dalpias (CEVR) | O&M Manager | December 14, 2007 |
| | John Barlow (CH2M HILL) | O&M Contractor (Technician) | September 24, 2007 |
| OU 3 | Barbara Hall (CEVR) | Site Manager | September 28, 2007 |
| | Ray Spencer (CEVR) | O&M Manager | December 13, 2007 |
| | Mike Cox (CH2M HILL) | O&M Contractor (Project Manager, landfill caps) | September 28, 2007 |

TABLE 2-2
Interviews Conducted for the Five-Year Review
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| **Technical Interviews (Continued)** | | | |
|---|---|---|---|
| **Operable Unit** | **Person Interviewed (Association)** | **Role** | **Date of Interview** |
| OU 4 | Jarrod Case (CEVR) | Site Manager | December 17, 2007 |
| | Oscar Torres (CEVR) | O&M Manager | September 25, 2007 |
| | Ray Spencer (CEVR) | O&M Manager (landfill caps) | December 13, 2007 |
| | Brad Thein (AEEC)[3] | O&M Contractor (Project Manager) | September 25, 2007 |
| | Steve Parkinson (AEEC)[3] | O&M Contractor (Technician) | September 25, 2007 |
| | Mike Cox (CH2M HILL) | O&M Contractor (Project Manager, landfill caps) | January 14, 2008 |
| OU 5 | Mark Roginske (CEVR) | Site Manager | September 26, 2007 |
| | Oscar Torres (CEVR)[4] | O&M Manager | September 26, 2007 |
| | Brad Thein (AEEC)[3] | O&M Contractor (Project Manager) | September 26, 2007 |
| | Steve Parkinson (AEEC)[3] | O&M Contractor (Technician) | September 26, 2007 |
| OU 6 | Mark Roginske (CEVR) | Site Manager | September 26, 2007 |
| | Oscar Torres (CEVR)[4] | O&M Manager | September 26, 2007 |
| | Brad Thein (AEEC)[3] | O&M Contractor (Project Manager) | September 26, 2007 |
| | Steve Parkinson (AEEC)[3] | O&M Contractor (Technician) | September 26, 2007 |
| OU 7 | Barbara Hall (CEVR) | Site Manager | September 28, 2007 |
| | Ray Spencer (CEVR) | O&M Manager | December 13, 2007 |
| | Mike Cox (CH2M HILL) | O&M Contractor (Project Manager, landfill caps) | September 28, 2007 |
| OU 8 | Barbara Hall (CEVR) | Site Manager | September 27, 2007 |
| | Jason Dalpias (CEVR) | O&M Manager | December 14, 2007 |
| | Aaron Pettley (MWH) | O&M Contractor (Technician) | September 27, 2007 |
| OU 9 | Shannon Smith (CEVR) | Site Manager | September 25, 2007 |
| OU 10 | Shannon Smith (CEVR) | Site Manager | September 25, 2007 |
| OU 11 | Shannon Smith (CEVR) | Site Manager | September 25, 2007 |

TABLE 2-2
Interviews Conducted for the Five-Year Review
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| **Technical Interviews (Continued)** | | | |
|---|---|---|---|
| **Operable Unit** | **Person Interviewed (Association)** | **Role** | **Date of Interview** |
| OU 12 | Mark Roginske (CEVR) | Site Manager | September 26, 2007 |
| | Oscar Torres (CEVR)[4] | O&M Manager | September 26, 2007 |
| | Brad Thein (AEEC)[3] | O&M Contractor (Project Manager) | September 26, 2007 |
| | Steve Parkinson (AEEC)[3] | O&M Contractor (Technician) | September 26, 2007 |
| | Hhan Olsen (MWH) | O&M Contractor for PRB (Project Manager) | September 26, 2007 |
| OU 13 | Ray Spencer (CEVR) | Site Manager | December 13, 2007 |
| Indoor Air Program | Jarrod Case (CEVR) | Program Manager | December 17, 2007 |
| **Regulatory Interviews** | | | |
| **Operable Unit** | **Person Interviewed (Association)** | **Role** | **Date of Interview** |
| All OUs | Mohammad Slam (UDEQ) | Regulatory – project manager for UDEQ | December 18, 2007 |
| All OUs | Sandra Bourgeois (EPA) | Regulatory – Remedial Program Manager for EPA | February 4, 2008 |

NOTES:

1 - Mayor Joe Gertge and Mr. Matt Dixon were interviewed at the same time; therefore, a single interview record form was completed for both.
2 - Mr. Brent Poll responded to the interview request through submission of a letter and attachments.
3 - Mr. Brad Thein and Mr. Steve Parkinson were interviewed at the same time; therefore, a single interview record form was completed for both.
4 - Mr. Oscar Torres provided input during the interview for Mr. Mark Roginske for OUs 5, 6, and 12; therefore, these responses are incorporated on the interview record form for Mr. Roginske.
AEEC - American Engineering and Environmental Consultants
MWH - MWH Americas, Inc.
PRB - Permeable Reactive Barrier

### 2.5.1 Community Interviews

Hill AFB has an active community involvement program that includes at least yearly updates to local city governments, public meetings, and mailings to residents and quarterly meetings with the Hill AFB RAB to discuss ongoing clean-up actions (**www.hillrab.org**). For the 2008 five-year review, community interviews were performed by Hill AFB's community involvement contractor. The interviews included local residents, city officials from the surrounding communities, and members of the RAB. Fourteen interview responses were received as part of the community interviews (**Table 2-2**). The following paragraphs summarize the community interviews. Responses to specific questions are provided on the

Interview Record Forms for the community interviews, which are provided in **Appendix B2**.

Mr. Brent Poll, Executive Director of the South Weber Landfill Coalition (recipient of a Technical Assistance Grant), responded to the interview request via letter. Mr. Poll's response highlighted several concerns related to the selection and success of the OU 1 remedy described by the ROD, the associated risks, availability of information about the contamination at Hill AFB, financial responsibility of the cleanup, and a perceived conflict of interest that Hill AFB serves as the lead agency under CERCLA.

Hill AFB has indicated that through its Technical Assistance Grant (TAG), the South Weber Landfill Coalition is provided all documents dealing with the OUs located in South Weber (OUs 1, 2, and 4). While not currently a member of the Hill AFB RAB, Mr. Poll is kept up to date with the RAB's workings and is provided copies of the materials provided to RAB members. Hill AFB project managers also work closely with Mr. Poll in order to understand his concerns and respond appropriately within the requirements of CERCLA and the guidance of Air Force Policy. His comments receive close attention and, where appropriate, are considered in site management and particularly monitoring decisions (**Fisher, 2008**).

Roy City resident Agnes Bojanski had a negative impression of the efforts associated with cleanup efforts at Hill AFB. This resident has a vapor mitigation system installed and participates in the IAP. This interviewee stated that people are concerned about potential health problems and had a negative impression of the IAP. The interviewee expressed that enough information was made available by Hill AFB. However, the interviewee also stated that Hill AFB could do a better job of informing the public.

The remaining community interviews provided an overall positive impression of the cleanup efforts at Hill AFB. Most of the responses indicated that the community interviewees felt Hill AFB was taking appropriate actions to address contaminants within their communities and to protect human health and the environment. The main concerns that were expressed related to potential health effects of groundwater and vapor contamination and the impacts of the contaminated areas on property values. The interviewees stated that people in their communities are concerned about the potential health effects of the contamination. Several community interviewees also stated that there are concerns regarding the ability to sell their homes and the potential impacts the contamination might have on their property value. Most of the interviewees responded that Hill AFB does a good job of keeping the public informed regarding the various sites. In addition, most interviewers stated that Hill AFB has provided adequate information to the public regarding contamination associated with Hill AFB. The main impacts to the community related to site operations were noted as construction, sampling, and drilling activities. When these activities are not occurring, the impression was that the impacts were negligible.

### 2.5.2 Technical Interviews

Technical interviews were conducted with Hill AFB site managers, O&M managers, and contractor personnel to obtain additional information regarding each OU. Interview questions were initially developed based on EPA guidance, but the questions were

expanded based on the initial document and data review to address questions and/or issues identified during that process for each site.

Forty technical interviews were conducted for the five-year review (**Table 2-2**) using various interview methods. Many interviews were conducted in person at the time of the five-year review site inspections (during the week of September 24 through 28, 2007). The remaining interviews were completed either through email or via telephone call. The technical interviews are further discussed with each OU in **Section 7.0**. Responses to specific questions are provided on the Interview Record Forms for the technical interviews, which are provided in **Appendix D**.

### 2.5.3 Regulatory Interviews

Two interviews were conducted with the site managers responsible for Hill AFB. Ms. Sandra Bourgeois of EPA Region VIII and Mr. Mohammad Slam of the UDEQ were interviewed to obtain their input as part of the five-year review. The following paragraphs summarize the regulatory interviews. Responses to specific questions are provided on the Interview Record Forms for the regulatory interviews, which are provided in **Appendix D**.

Ms. Sandra Bourgeois of EPA Region VIII indicated that the EPA has been impressed with the amount of work accomplished with the PSVPlans since the 2003 five-year review. She stated they have proven to be a great tool to work with, as they give an in-depth look at whether the systems are doing what they are supposed to be doing. She pointed out that Hill AFB took the initiative to institute this process, as these documents are not specifically required by EPA or UDEQ. Ms. Bourgeois indicated that another measure of great progress has been the completion of ESDs for those OUs where an adjustment in the remedy required documentation. In addition, EPA has been pleased with the use of interim actions during this FYR period to help facilitate the process toward ROD development and remedy completion. Ms. Bourgeois was also pleased with the IAP, indicating that Hill AFB took the initiative to dedicate funding to the program to address real potential risk in the community.

In terms of remedy implementation, Ms. Bourgeois did indicate that EPA is concerned with the remedies that include monitored natural attenuation. Some remedies were finalized before it was really understood how quickly the attenuation processes would proceed. EPA's goal is that the lines of evidence for natural attenuation be clearly understood before it is incorporated into future remedies and this is now in progress for OUs 9 and 12.

Mr. Mohammad Slam of the UDEQ indicated that all major components of the remedies selected in the RODs were in place, and that Hill AFB was making good progress on the pre-ROD OUs. He stated that he thought progress in response to the recommendations of the 2003 five-year review was a little slow at first, but that over the last few years momentum has been gained for addressing the 2003 five-year review recommendations. He further indicated that Hill AFB's contamination has impacted all the surrounding communities. However, Hill AFB had done a good job in working with the surrounding communities regarding the contamination. He did specifically mention that the South Weber Landfill Coalition continues to voice opposition to the actions taken by Hill AFB. The only concern raised was regarding funding levels and the potential impacts to completion of projects on schedule.

## 2.6 Site Inspections

A site inspection was conducted at each OU from September 24 through 28, 2007. During each inspection, a Site Inspection Checklist was completed for each OU. The checklist is comprehensive and covers various types of remedy components that may be present as part of a remedial system. Only applicable portions of the checklist were completed for each OU. Copies of the Site Inspection Checklists for each OU are provided in **Appendix E**.

Each site inspection focused on the remedy components present and not specifically on individual IRP sites. The OUs, associated active IRP sites, remedy components, and dates of inspection are listed in **Table 2-3**.

The site inspections indicate that the remedies in-place, along with associated infrastructure, treatment systems, and facilities are well maintained and in good working order. All operating treatment systems have O&M personnel onsite a minimum of once per week. This frequent onsite presence ensures that all systems are maintained appropriately and kept operational. When there are no personnel onsite, all systems and facilities are secured. No equipment was observed to be in disrepair during the inspections. There were no identified health and safety issues for O&M staff during the inspections. Although not all signage was observed during the site inspection, it was noted that signs are posted at many locations at the various OUs, and the annual land use controls evaluation is performed to address Institutional Controls (IC). Because of the large number of monitoring wells present, not all wells could be physically inspected due to time constraints. However, numerous monitoring wells were observed during the inspection, and with the exception of one monitoring well at OU 4, all monitoring wells observed were properly identified and maintained appropriately. One monitoring well at OU 4 had a broken lid on the aboveground completion and lacked a cap on the well riser. No significant issues were identified as part of the site inspections. The site inspections for each OU are further discussed in the summary for each OU in **Section 7.0**.

TABLE 2-3
Site Inspections Conducted for the Five-Year Review
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Description/IRP Site IDs | Components Inspected | Date of Inspection |
|---|---|---|---|
| OU 1 | Landfill No. 4 (LF001), Landfill No. 3 (LF003), Chemical Pits 1 and 2 (WP002), Fire Training Area 1 (FT009), Waste Phenol Oil Pit (WP080) | Landfill Caps and Pond 10 | September 28, 2007 |
| | | Springs U1-303 and U1-304 collection systems and arsenic contaminated soils and sediments area | September 25, 2007 |
| | | Groundwater extraction trench system and Central Facilities Building | September 24, 2007 |
| OU 2 | Chemical Pit 3 (WP007) | Source Recovery System, Air Stripper Treatment Plant, North Interceptor Trench, Griffith Pool (G-Pool) | September 24, 2007 |

TABLE 2-3
Site Inspections Conducted for the Five-Year Review
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Description/IRP Site IDs | Components Inspected | Date of Inspection |
|---|---|---|---|
| OU 3 | Sodium Hydroxide Spill Site (ST004) and Berman Pond (WP005) | Sodium hydroxide spill site cap and Berman Pond cap | September 28, 2007 |
| OU 4 | Landfill No. 1 (LF011) | Landfill Cap | September 28, 2007 |
| | | Horizontal Drain Upgrade System, Air Stripper Treatment Plant | September 25, 2007 |
| OU 5 | US Army Tooele Rail Shop (SS017) and Building 1607 – Evaporation Pond (SS091) | Phase I Aeration Curtain, Phase III Groundwater Extraction Trench System, area of arsenic contaminated soils<br>Building 1607 (SS091) – remedy is monitored natural attenuation; monitoring wells associated with the remedy were not specifically inspected | September 26, 2007 |
| OU 6 | Asphalt Pad (OT026) and Sump Leach Field (ST022) | On-Base pump and treat system and drain field, Off-Base (Craigdale) pump and treat, Cooley's Seep/Pond Treatment System<br>Sump Leach Field (ST022) – remedy is monitored natural attenuation; monitoring wells associated with the remedy were not specifically inspected | September 26, 2007 |
| OU 7 | Building 225 Chromium Spill Site (SS027) | Building 225 Chromium Spill Site Cap | September 28, 2007 |
| OU 8 | Trichloroethene Plume (groundwater only) (OT033) | Base Boundary Hydraulic Containment System, 1,2-Dichloroethane Extraction System | September 27, 2007 |
| OU 9 | 800/900 Warehouse Area (SS108), 1100 Area (SS089), Zone 7 Golf Course Area (SS090), Pond 1 (SD034) | Monitoring wells and source areas associated with groundwater plumes, soil cover at Pond 1 | September 25, 2007 |
| OU 10 | 1200 Area (SS109) | Monitoring wells and source areas associated with groundwater plume, areas of off-Base well installations in residential neighborhood | September 25, 2007 |
| OU 11 | Former Base Gas Station – Building 454 (OT097) | Building 454, Soil Vapor Extraction System expansion, monitoring wells associated with groundwater plumes | September 25, 2007 |

TABLE 2-3
Site Inspections Conducted for the Five-Year Review
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Description/IRP Site IDs | Components Inspected | Date of Inspection |
|---|---|---|---|
| OU 12 | Aspen Avenue Disposal Area (SS107) | Base Boundary Hydraulic Containment System, disposal area, PRB | September 26, 2007 |
| OU 13 | Upper Area F Military Housing Polychlorinated Biphenyl (PCB) Site (SS112) | Areas of soil excavation, soil consolidation cell | September 27, 2007 |

## 2.7 Technical Assessment

The five-year review must determine if the remedies at a site are protective of human health and the environment. The EPA guidance uses the three technical assessment questions, introduced in **Section 2.1**, to provide the framework for organizing and evaluating site data and information and to ensure that all relevant issues are considered when assessing the protectiveness of a remedy. The technical assessment was performed for the remedies at each OU based on the information obtained from the document and data review, interviews, and site inspections. The 2003 Five-Year Review stated that NFRAP sites did not require review in 2008. A protectiveness determination of 'not applicable' was therefore assigned for these sites. However, additional information available for any NFRAP site published during the period of the 2008 Five-Year Review (October 2002–September 2007) was reviewed. The technical assessment was completed to provide the answers to the three technical assessment questions. A detailed discussion and the results of the technical assessment for each OU are provided in **Section 7.0**.

**Question A—Is the remedy functioning as intended by the decision documents?**
Question A was evaluated and answered through comparison of data and information contained within inspection reports, PSVReports (when available), LTM reports, and O&M reports, against the RAOs specified in the RODs. Where a ROD is not in place (such as at OU 12), the RAOs specified in the PSVPlan or goals outlined in O&M documents were used for comparison. The purpose was to determine that in-place systems were performing as expected, were operating in compliance with the specified parameters, and that the RAOs were being met. Potential early indicators of remedy performance issues were identified and evaluated. Also, potential opportunities to optimize O&M and remedy sustainability were evaluated and discussed.

Institutional controls were also evaluated to ensure compliance with the requirements of the decision documents for each OU. The ICs that are in place at each OU were assessed to determine that the ICs provided the required protectiveness and met the RAOs. The evaluation examined types of ICs in place and the effects of any anticipated future land use changes on the ICs. The annual Land Use Controls Assessment reports prepared by Hill AFB were the primary source for evaluating implementation of ICs at the Base.

Institutional controls are generally defined as non-engineered instruments such as administrative and legal tools that do not involve construction or physically changing the site, and that help minimize the potential for human exposure to contamination and/or protect the integrity of a remedy by limiting land and/or resource use (**EPA, 2005**). Institutional controls can be used for many reasons including restriction of site use, modifying behavior, and providing information to people (**EPA, 2000**). Institutional controls may include deed notices, easements, covenants, restrictions, or other conditions on deeds, and/or groundwater and/or land use restriction documents (**EPA, 2001**). The following paragraphs describe ICs implemented at Hill AFB and how they are assessed annually.

Hill AFB performs an annual evaluation of the ICs in place for Hill AFB. This includes verification of orders, leases, groundwater use restrictions, and inspections of signage, fences, and monitoring wells. An annual land-use controls report is prepared documenting the results of this work.

The following Land Use Controls (LUC) are assessed at Hill AFB during the Annual LUC Assessment (**Hill AFB CEVR, 2007**); warning signs, fences/locks, leases/easements/ permits, continuing order (AFI 32-7020 HAFBSU P 1), Utah Division of Water Rights (UDWR) water rights restrictions, and the restricted use access map for Hill AFB and the Little Mountain Test Annex (LMTA). Each of these LUCs is described below:

- **UDWR Restrictions:** This LUC is based on water rights and well drilling restrictions for on-Base and off-Base areas with shallow groundwater contamination. These restrictions are administered by the UDWR. Hill AFB submits the Hill AFB Water Rights Restrictions and Areas of Groundwater Contamination map to the UDWR to ensure well drilling and water rights restrictions continue to be enforced in areas of groundwater contamination in the vicinity of Hill AFB. The groundwater contamination depicted on the Hill AFB Water Rights Restrictions and Areas of Groundwater Contamination map is limited to what Hill AFB calls the shallow aquifer. Beneath this aquifer are several thick sequences of silty clay that separate the Sunset and Delta aquifers (**Hill AFB CEVR, 2007**).
- **Hill AFB Restricted Use Access Map:** The Restricted Use Access Map identifies areas on-Base with land-use and development restrictions due to known and potentially contaminated soil and groundwater. Individual maps for contaminated and potentially contaminated areas at Hill AFB and the LMTA are updated and distributed annually to appropriate personnel at Hill AFB and posted on the Hill AFB Restoration Intranet website to provide Basewide access (**Hill AFB CEVR, 2007**).
- **Continuing Order (AFI 32-7020 HAFBSUP 1):** This LUC is established by AFI 32-7020 HAFBSUP 1, and restricts unauthorized development or construction in OUs at Hill AFB (**Hill AFB CEVR, 2007**).
- **Leases/Easements/Permits:** This LUC may be used to limit development and grant/maintain access for treatment/monitoring activities. Off-Base leases and easements are verified and determined to be current (**Hill AFB CEVR, 2007**).
- **Warning Signs:** Sign can be used to restrict unauthorized access, prevent unauthorized excavation and/or construction, and prevent potential exposure to contaminated areas. The warning signs also provide contact information if access to these areas is necessary (**Hill AFB CEVR, 2007**).

- **Fences/Locks:** This LUC may be used to restrict unauthorized access, excavation, and/or construction in potential exposure areas, construction areas, and treatment facilities (**Hill AFB CEVR, 2007**).

**Question B—Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?**
Several activities were performed to answer Question B. A risk review of the exposure assumptions, toxicity data, and cleanup levels presented in the RODs was performed to determine that they were still valid. A new risk assessment was not performed as part of the five-year review. The exposure assumptions were evaluated to determine that they were still valid. Toxicity data used to determine risks and cleanup levels were examined to determine if changes in published values existed. Tables providing the results of the risk review are provided in **Appendix F**. Changes were identified and evaluated to determine if the changes impact the overall protectiveness of the remedy and are further discussed for each OU in **Section 7.0**.

A draft technical memorandum was prepared by Hill AFB CEVR in November 2007 to re-evaluate the risk assessments and issues for OUs 1 through 8. This memorandum was prepared in response to the 2003 FYR recommendation that the risk analyses for OUs 1 through 8 be re-evaluated due to revised cleanup standards and more stringent toxicity factors. A list of recommended actions was provided for each OU (**Hill AFB CEVR and SES, 2007**). The OU-specific recommended actions are further discussed in **Section 7.0**. This assessment, along with the assessment of ICs (as discussed under Question A above), were used to confirm that no completed exposure pathways exist for each OU. Where ICs are in place and no complete exposure pathways are present, a short-term protectiveness determination was provided.

Changes to ARARs, as specified in the RODs for OUs 1 through 8, were also evaluated. The ARARs in place and specified at the time of the RODs were evaluated against current ARARs to determine if any significant changes to the ARARs that impact the protectiveness of the remedies had been promulgated. An example would be a revised, lower Maximum Contaminant Level (MCL) specified as a cleanup level in a ROD. Tables providing the ARARs evaluation are provided in **Appendix G**. Changes to ARARs that potentially impact the overall protectiveness of the remedies at each OU are further discussed in **Section 7.0**.

**Question C--Has any other information come to light that could call into question the protectiveness of the remedy?**
Examples of other information that might call into question the protectiveness of the remedy include potential future land use changes in the vicinity of the site, other expected or anticipated changes in site conditions, identification of new exposure pathways, and identification of new contaminants. Question C is used to determine if there are issues unrelated to O&M, ICs, the risk evaluation, cleanup standards, and ARARs that might affect the remedy's overall protectiveness. Information obtained during the document and data review, interviews, and site inspection was used to answer Question C.

The results of the technical assessment were used to develop yes/no answers to the three questions. The answers to these questions were then used to evaluate the overall protectiveness for each OU. The results of the technical assessment were also used to

identify issues for each OU and to provide recommendations to address the issues. The issues and recommendations are further discussed in **Section 3.0** and in **Section 7.0**.

## 2.8 Determination of Remedy Protectiveness

Based on the technical assessment, the protectiveness of the remedies for each OU was determined and categorized as:

- Protective
- Protective in the short-term
- Will be protective once remedy is complete
- Protectiveness cannot be determined until additional information is obtained
- Not protective
- Not applicable

Based on the determination of protectiveness, a protectiveness statement was prepared for each OU. An explanation of the reasoning for the protectiveness statement was also prepared. The protectiveness statements for each OU are provided in **Section 7.0** and further discussed in **Section 4.0**.

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Section 3

# 2008 Five-Year Review Recommendations

The following sections discuss the progress made at Hill AFB since the 2003 five-year review was completed in September 2003 in response to Basewide findings and recommendations. The issues and recommendations identified as part of this 2008 five-year review are also discussed.

## 3.1 Progress Since the 2003 Five-Year Review

The Basewide findings from the 2003 five-year review, the status of the Basewide recommendations, the results of the implemented actions, and the status of any other issues are described in the following sections. The status and results of OU specific findings and recommendations are provided in **Section 7.0**.

### 3.1.1 Protectiveness Statements from 2003 Five-Year Review

The 2003 five-year review of Hill AFB developed OU and IRP site-specific protectiveness determinations. A Basewide protectiveness statement was not developed because some OUs did not have remedies in place. The protectiveness determinations were categorized in the following manner:

- Protective
- Protectiveness cannot be determined until further information is obtained
- Protective in the short-term; however, for the remedy to be protective in the long-term, follow-up actions need to be taken
- Will be protective once the remedy is complete
- Not protective, unless the following actions are taken to ensure protectiveness
- Not applicable

A not applicable determination was given to IRP sites that had NFRAP status or sites that were undergoing RI/FS and a remedy was not in place.

In the 2003 five-year review, only OU 12 was determined to be not protective. This determination was based on concerns related to trichloroethene (TCE) in shallow groundwater impacting indoor air in residences (**URS, 2003**). **Table 3-1** summarizes the protectiveness determinations made in the 2003 five-year review of Hill AFB.

TABLE 3-1
Summary of Protectiveness Determinations from 2003 Five-Year Review
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Protectiveness Determination | Number of Installation Restoration Program Sites | Number of Operable Units | Operable Units |
|---|---|---|---|
| Protective | 8 | 2 | 3 and 7 |
| Protectiveness cannot be determined | 6 | 4 | 1, 2, 6, and 8 |
| Protective in the short-term | 2 | 2 | 4 and 5 |
| Will be protective once remedy complete | 1 | 1 | 9 |
| Not protective | 1 | 1 | 12 |
| Not applicable | 24 | 2 | 10 and 11 |

### 3.1.2 2003 Five-Year Review Recommendations and Follow-up Actions

The 2003 five-year review for Hill AFB identified Basewide- and OU-specific issues. In addition, the 2003 Five-Year Review Report contained recommendations and follow-up actions needed to address the identified issues. The identified Basewide recommendations and follow-up actions from the 2003 five-year review are provided in **Table 3-2**. Operable Unit-specific recommendations and follow-up actions are discussed in **Section 7.0**. The current status of the recommendations and follow-up actions is discussed in **Section 3.1.3**.

### 3.1.3 Status of Recommended Actions

Since completion of the 2003 five-year review, the IAP has been implemented Basewide to address indoor air exposures to residents in areas where groundwater contamination extends off-Base. The IAP includes indoor air sampling at residences in areas of identified off-Base groundwater contamination. Mitigation systems have been installed at residences where volatile organic compound concentrations exceed Mitigation Action Levels identified in the Basewide Air Sampling and Analysis Plan for Indoor Air. Resident participation in the IAP is voluntary (**MWH, 2004**). The IAP is discussed in more detail in **Section 7.0**.

The risk analysis for each OU was reevaluated by Hill AFB in 2007, and a draft technical memorandum has been prepared documenting the results of the evaluation. Operable Unit-specific conclusions and recommendations are discussed in **Section 7.0**. Basewide, the technical memorandum states that CEVR will continue to act on new information suggesting that completed exposure pathways exist. Specific actions include verifying that a newly identified exposure pathway(s) is indeed complete, performing risk screening or risk assessment related to the new exposure pathway(s), and risk management as necessary to address newly identified exposure pathways. The technical memorandum also states that CEVR will continue to track "emerging" contaminants to determine if additional actions are required. Emerging contaminants are identified as contaminants that may have been components of historic waste streams at Hill AFB, but were not previously considered chemicals of concern for a wide variety of reasons. The focus in tracking emerging

contaminants would be where completed exposure pathways are likely to exist, and the primary focus would be on whether any emerging contaminants exist in groundwater that could result in unacceptable risk through vapor migration into indoor air (**Hill AFB CEVR and SES, 2007**).

Remedy performance and effectiveness at Hill AFB is evaluated through the PSVPlan/PSVReport process, which occurs in 5-year cycles. The 2003 five-year review recommended that a periodic, integrated review of O&M and LTM data be performed to support remedy performance and protectiveness tracking. The 2003 Five-Year Review Report discussed the need to perform a less rigorous, but more frequent review of O&M and LTM data at each OU. The 2003 five-year review also recommended that each PSVPlan and update be reviewed to ensure the PSVPlan includes the parameters necessary to monitor the performance and the protectiveness of the selected remedy.

PSVReports and PSVPlan updates were prepared for OUs 1, 3, and 7 in 2007. A draft PSVReport and PSVPlan update for OU 2 was prepared in 2007 and is currently under revision. The PSVPlans were prepared or updated for OUs 5, 8, and 12 in 2007. Operable Unit 6 has undergone extensive assessment to correct remedy performance issues, and additional work is ongoing. A PSVPlan update for OU 6 is scheduled for 2008. The most recent PSVPlan for OU 4 was prepared in November 2001. Additional assessment work is being performed at OU 4 to further evaluate the source areas and remedy performance. The PSVPlan will be updated once this work is complete. The PSVPlan/PSVReport process is in place and is being carried out for each OU with a remedy in place. Periodic, integrated reviews of O&M and LTM data appear to be occurring as part of the ongoing site management activities. The results of these analyses are published in many documents: monthly and annual O&M reports, monthly system performance evaluations, task-specific letter reports and memoranda, PSVReports, etc. The analysis and reporting requirements for performance metrics are listed in PSVPlans and PSVReports for those OUs with completed PSVPlans and PSVReports.

The 2003 five-year review recommended that a check of O&M and LTM contracts be conducted to ensure that all PSVPlan-based items are being completed under one or the other. Contracts with O&M and LTM contractors were not assessed as part of this five-year review. The LTM and O&M Plans were assessed against the PSVPlans as part of the document review. Any identified OU specific issues are discussed in **Section 7.0**.

Landfill cap inspections are conducted annually as required by the current Basewide CERCLA Cap System Inspection, Operation, and Maintenance Plan (**CH2M HILL, 2007**). Ponding and damage to the caps are assessed and addressed as part of routine O&M.

The condition of gates, fences, and signage are assessed annually as part of the land-use controls assessment performed by Hill AFB (**Hill AFB CEVR, 2007**).

### 3.1.4 Restoration Timeframes For Operable Units

Restoration timeframes for each OU were collected through review of various documents. **Table 3-3** provides (1) the current estimates of restoration timeframes; (2) the decade in which RA operations, the response action as a whole, and LTM, will be completed; and (3) the references for this information.

TABLE 3-2
Progress Since 2003 Five-Year Review – Status of Basewide Recommendations and Follow-up Actions
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| 2003 Five-Year Review Basewide Recommendation/ Follow-up Action | Current Status | Carry Over Beyond 2008 Five-Year Review |
|---|---|---|
| Determine the potential for exposure to TCE vapors for residents near OUs with groundwater contamination that extends off-Base. | **Ongoing.** Residential indoor air sampling is now included as part of the Basewide Air Sampling and Analysis Program (BASAP) for Residential Indoor Air. The BASAP was prepared to standardize sample collection and analysis procedures for all Hill AFB indoor air sampling projects. The BASAP is an ongoing program at Hill AFB, and the collection of additional indoor air and water samples at residential locations is planned. Residences overlying contaminated groundwater or within the immediate vicinity of groundwater plumes have been contacted annually since 2003 for indoor air sampling (**MWH, 2004** and **MWH, 2006**). Because an appropriate process is now in place, this recommendation is not carried forward beyond the 2008 five-year review. | No |
| Reevaluate the risk analyses for OU 1 through OU 8 in view of new standards and more stringent toxicity factors. | **Ongoing.** Human health risks were re-evaluated in a recent draft technical memorandum (**Hill AFB CEVR and SES, 2007**). Specific conclusions regarding risk analyses at OU 1 through OU 8 were developed and presented in the technical memorandum. This document was reviewed as part of this 2008 five-year review and the approach described was found to be appropriate. Refer to **Section 7.0** for OU specific conclusions of this analysis. | Yes |

TABLE 3-2
Progress Since 2003 Five-Year Review – Status of Basewide Recommendations and Follow-up Actions
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| 2003 Five-Year Review Basewide Recommendation/ Follow-up Action | Current Status | Carry Over Beyond 2008 Five-Year Review |
|---|---|---|
| Conduct periodic, integrated review of O&M and LTM data to support remedy performance and protectiveness tracking. | **Ongoing.** OUs with remedies in place undergo the PSVPlan/PSVReport process every five years to rigorously assess remedy performance based on site LTO and LTM data. PSVReports and PSVPlan updates were prepared for OUs 1, 2, 3, and 7 in 2007. The PSVPlans were prepared or updated for OUs 5, 8, and 12 in 2007. OU 6 has undergone extensive assessment to correct remedy performance issues, and additional work is ongoing. A PSVPlan update for OU 6 is scheduled for 2008. The most recent PSVPlan for OU 4 was prepared in November 2001.<br><br>The 2003 five-year review findings discuss the need to perform a less rigorous (as compared to the PSVPlan/PSVReport process), but more frequent, review of LTO and LTM data, to allow for more regular changes to site O&M that might modify treatment, ensure protectiveness, and potentially reduce the time required to achieve site closure. This level of review appears to be occurring as part of the ongoing site management activities. However, based on the document review, this level of review may not be occurring for all OUs. | Yes |
| Conduct a check of O&M and LTM contracts to ensure that all PSVPlan-based items are being completed under one or the other. | **Complete.** The 2005 CEVR reorganization assigned responsibility for this recommendation to each Site Manager. O&M contracts for Operating Years beginning in April 2006 include specific requirements for O&M contractors (such as sampling, recording, ERPIMS submission). Site Managers are to ensure that all other performance-based measuring requirements are completed by either Basewide monitoring program or other approach. | No |

TABLE 3-2
Progress Since 2003 Five-Year Review – Status of Basewide Recommendations and Follow-up Actions
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| 2003 Five-Year Review Basewide Recommendation/ Follow-up Action | Current Status | Carry Over Beyond 2008 Five-Year Review |
|---|---|---|
| Review each PSVPlan and update if necessary to ensure the PSVPlan includes the parameters necessary to monitor the performance and the protectiveness of the selected remedy. | **Ongoing.** OUs with remedies in place undergo the PSVPlan/PSVReport process every five years to rigorously assess remedy performance based on site LTO and LTM data. PSVReports and PSVPlan updates were prepared for OUs 1, 2, 3, and 7 in 2007. The PSVPlans were prepared or updated for OUs 5, 8, and 12 in 2007. OU 6 has undergone extensive assessment to correct remedy performance issues, and additional work is ongoing. A PSVPlan update for OU 6 is scheduled for 2008. The most recent PSVPlan for OU 4 was prepared in November 2001 and has not been updated. Additional assessment work is being performed at OU 4 to further evaluate the source areas and remedy performance. The PSVPlan will be updated once this work is complete. | No |
| Assess the impact of ponding and damage on landfill caps and correct activities and repair accordingly. | **Ongoing.** Landfill cap inspections are being conducted and a Basewide CERCLA Cap System Inspection, Operation, and Maintenance Program was developed. Assessing ponding, landfill cap damage, and repair activities are included as part of the inspection and maintenance of the landfill caps. Inspections are reported in the annual Treatment System Operation Report and Inspection, Monitoring, and Maintenance Report (**CH2M HILL, 2007**). | No |
| Ensure that all gates are locked and adequate, descriptive signage is present where required. | **Complete.** Hill AFB performs an annual evaluation of the ICs in place for the Base. This includes verification of orders, leases, groundwater use restrictions, and inspections of signage, fences, and monitoring wells. An annual land-use controls report is prepared documenting the results of this work (**Hill AFB CEVR, 2007**). | No |

Notes:
ERPIMS – Environmental Restoration Program Information Management System

TABLE 3-3
Restoration Timeframes and Estimated Decades to Remedial Action Operations Complete, Remedial Action Complete, and End of Long-Term Monitoring
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Date of ROD | Date of ESD | Estimated Remedial Timeframes | | | | Comments | Reference |
|---|---|---|---|---|---|---|---|---|
| | | | Remedy Component | Remedial Action Operations (RA-O) Complete | Response Complete (RC) | End of Long-Term Monitoring (LTM) | | |
| OU 1 | September 1998 | July 2006 | Source Area | Indefinite, > 30 years | | | The ROD predicts that the Source Area remedy will have to operate for a period greater than 50 years. This remedy will have to operate to address the sources as long as they persist as sources. There are no reports available that update the ROD estimate, but the Source Area remedy will essentially operate indefinitely. | Hill AFB EMR, 1998. *Final Record of Decision and Responsiveness Summary for Operable Unit 1*. September. |
| | | | Landfill Caps | Indefinite, > 30 years | | | The landfill caps will have to remain in place and should be monitored as long as the groundwater Source Area remedy continues to operate. | |
| | | | Non-Source Area | NA | 2070's | 2070's | Updated MNA calculations indicate that the non-source area plume will attenuate over a period of 70 years. | Hill AFB CEVR, 2008. *Hill Air Force Base, Utah, Operable Unit 1, Phase I Remedial Action, Groundwater Extraction System, Performance Standard Verification Report.* Internal Draft. www.hafbdyndocs.com. Accessed: January 4, 2008. |

TABLE 3-3
Restoration Timeframes and Estimated Decades to Remedial Action Operations Complete, Remedial Action Complete, and End of Long-Term Monitoring
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Date of ROD | Date of ESD | Estimated Remedial Timeframes | | | | Comments | Reference |
|---|---|---|---|---|---|---|---|---|
| | | | Remedy Component | Remedial Action Operations (RA-O) Complete | Response Complete (RC) | End of Long-Term Monitoring (LTM) | | |
| OU 2 | September 1996 | Not applicable | Source Area | Indefinite, > 30 years | | | The ROD predicts that the Source Area remedy will have to operate for a period greater than 30 years. The remedy will have to operate to address the sources as long as they persist as sources. There are no reports available that updated the ROD estimate, but the Source Area remedy will essentially operate indefinitely. | CH2M HILL, 1996. *Final Record of Decision and Responsiveness Summary for Operable Unit 2*. September. |
| | | | Non-Source Area | 2030's | 2030's | 2030's | Toe of plume beyond the North Interceptor Trench should be at the remediation goals during the 2030's. The estimates are based on the draft PSVReport and may be revised. | URS, 2007. *Draft Operable Unit 2 Performance Standard Verification Report, Hill Air Force Base, Utah.* October. |
| | | | Springs | 2030's | 2030's | 2030's | Springs continue to discharge intermittently. It is assumed that the spring collection system and monitoring will continue for the same period as the non-source area remedy. | |
| | | | Soil Vapor Extraction | Not Yet Implemented | | | Action on this portion of the remedy was deferred at the time of the ROD. | CH2M HILL, 1996. *Final Record of Decision and Responsiveness Summary for Operable Unit 2*. September. |

TABLE 3-3
Restoration Timeframes and Estimated Decades to Remedial Action Operations Complete, Remedial Action Complete, and End of Long-Term Monitoring
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Date of ROD | Date of ESD | Estimated Remedial Timeframes | | | | Comments | Reference |
|---|---|---|---|---|---|---|---|---|
| | | | Remedy Component | Remedial Action Operations (RA-O) Complete | Response Complete (RC) | End of Long-Term Monitoring (LTM) | | |
| OU 3 | September 1995 | Not applicable | Refueling Vehicles Motor Facility | Complete | Complete | Complete | NFRAP Status | URS, 2003. *Final CERCLA Five-Year Review Report, Second Five-Year Review Report For Hill Air Force Base, Utah.* September. |
| | | | Sodium Hydroxide Tank Site | Complete | 2010's | 2010's | Hill AFB CEVR is currently considering NFRAP status for this site. | Hill AFB CEVR, 2007. *Performance Standard Verification Report for Operable Unit 3.* www.hafbdyndocs.com. Accessed: August 16, 2007. |
| | | | Berman Pond | Indefinite, > 30 years | | | Berman Pond is a continuing source of contamination to OU 8 groundwater near the Base Boundary. Monitoring the cap and ICs will continue indefinitely to ensure the integrity of the remedy. | |
| OU 4 | June 1994 | July 2006 | Groundwater | Indefinite, > 30 years | | | ROD indicates that the groundwater remedy will require greater than 30 years (2020's). | HAFB EMR, 1994. *Final Record of Decision and Responsiveness Summary for Operable Unit 4 (IRP Sites LF11, LF12, OT20, OT41, OT42).* June. |
| | | | Surface Water | Indefinite, > 30 years | | | ROD indicates that the surface water remedy will require greater than 30 years (2020's) due to the link between groundwater and surface water. | |
| | | | Landfill Cap | Indefinite, > 30 years | | | Monitoring of the landfill cap system will continue until the groundwater and surface water remedies are complete. | |

TABLE 3-3
Restoration Timeframes and Estimated Decades to Remedial Action Operations Complete, Remedial Action Complete, and End of Long-Term Monitoring
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Date of ROD | Date of ESD | Estimated Remedial Timeframes | | | | Comments | Reference |
|---|---|---|---|---|---|---|---|---|
| | | | Remedy Component | Remedial Action Operations (RA-O) Complete | Response Complete (RC) | End of Long-Term Monitoring (LTM) | | |
| OU 5 | July 2006 | Not applicable | TARS Plume | Indefinite, > 30 years | | | ROD estimates that the off-Base portion will be completed in 35 years (2040's), but the on-Base portion of the plume will remain indefinitely due to on-going sources. | MWH Americas, 2006. *Final Record of Decision for Operable Unit 5, Hill Air Force Base, Utah.* July. |
| | | | Zone 16 Plume | Not Applicable | 2050's | | ROD estimates that the off-Base portion will be completed in 35 years (2040's), and the on-Base portion of the plume will be completed in 50 years (2050's). | |
| | | | Soils | Complete | Complete | Indefinite, > 30 years | Arsenic contaminated soils are addressed through ICs. Monitoring will continue indefinitely to monitor enforcement of ICs. | |
| OU 6 | August 1997 | August 2007 | On-Base, East Plume | 2020's | 2020's | 2020's | ROD estimates the remediation timeframe between 20 and 30 years. | Radian, 1997. *Record of Decision for Operable Unit 6, Hill Air Force Base, Utah.* August. |
| | | | Off-Base, East Plume | 2020's | 2020's | 2020's | ROD estimates the remediation timeframe at between 2 and 3 years. This length has already been exceeded. Values adjusted to assume the off-Base system operates for the same period of time as the on-Base system. This assumption is considered conservative. | |
| | | | West Plume | Not Applicable | 2030's | 2030's | ROD estimates the remediation timeframe at between 28 and 35 years. | |

TABLE 3-3
Restoration Timeframes and Estimated Decades to Remedial Action Operations Complete, Remedial Action Complete, and End of Long-Term Monitoring
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Date of ROD | Date of ESD | Estimated Remedial Timeframes | | | | Comments | Reference |
|---|---|---|---|---|---|---|---|---|
| | | | Remedy Component | Remedial Action Operations (RA-O) Complete | Response Complete (RC) | End of Long-Term Monitoring (LTM) | | |
| OU 7 | September 1995 | Not applicable | Building 225 Former Metals Plating Shop | Indefinite, > 30 years | | | Remedy relies on cap and ICs. Monitoring will continue indefinitely, as indicated in the PSVPlan, to ensure the integrity of the cap and enforcement of ICs. | Hill AFB CEVR, 2007. *Operable Unit 7 Performance Standard Verification Report, Hill Air Force Base, Utah.* www.hafbdyndocs.com. Accessed: August 16, 2007. |
| OU 8 | March 2005 | Not applicable | On-Base Plume | 2080's | 2080's | 2080's | The 2007 natural attenuation evaluation indicates that MNA will achieve 99% cleanup of the on-Base TCE plume between 2080 and 2090. | MWH, 2007. *Evaluation of Natural Attenuation of Groundwater Contamination at Operable Unit 8, Hill Air Force Base, Utah.* November. |
| | | | Off-Base TCE and 1,2-DCA Plumes | 2130's | 2130's | 2130's | The 2007 natural attenuation evaluation indicates that MNA will achieve 99% cleanup of the off-Base TCE plume between 2050 and 2060 and the off-Base 1,2-DCA plume between 2130 and 2140. | |
| OU 9 | May 2010* | Not applicable | | | | | Restoration timeframe will depend on the remedy selected. | |
| OU 10 | April 2010* | Not applicable | | | | | Restoration timeframe will depend on the remedy selected. | |
| OU 11 | April 2010* | Not applicable | | | | | Restoration timeframe will depend on the remedy selected. | |

TABLE 3-3
Restoration Timeframes and Estimated Decades to Remedial Action Operations Complete, Remedial Action Complete, and End of Long-Term Monitoring
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Date of ROD | Date of ESD | Estimated Remedial Timeframes | | | | Comments | Reference |
|---|---|---|---|---|---|---|---|---|
| | | | Remedy Component | Remedial Action Operations (RA-O) Complete | Response Complete (RC) | End of Long-Term Monitoring (LTM) | | |
| OU 12 | ROD in progress | Not applicable | Off-Base Plume | 2040's | 2040's | 2040's | PSVPlan estimates the off-Base plume will require 30 to 40 years to achieve remediation goals. | Hill AFB CEVR, 2007. *Hill Air Force Base, Utah, Performance Standard Verification Plan for Operable Unit 12.* www.hafbdyndocs.com. Accessed: October 15, 2007. |
| | | | On-Base Plume | Indefinite, > 30 years | | | PSVPlan indicates that the on-Base plume will persist indefinitely due to continuing sources on-Base. | |
| | | | Soils | 2010's | 2010's | Indefinite, > 30 years | Proposed remedy for soils includes excavation of known source areas and implementation of ICs. Monitoring will continue indefinitely to monitor enforcement of ICs. | |
| OU 13 | Not Applicable | Not applicable | | | | | RI/FS scheduled to begin in 2008. Restoration timeframe will depend on the remedy selected. | |

Notes:

* Estimated future completion date of ROD.

## 3.2 Issues Identified in 2008 Five-Year Review

Comprehensive Environmental Response, Compensation, and Liability Act activities at Hill AFB are ongoing. These activities include LTM and LTO for interim and final remedies, and completion of the RI/FS and/or ROD at five OUs (9 through 13). Based on the results of the technical assessment, it appears that the selected remedies have been implemented as planned and are functioning as expected by the decision documents in the short term. The various groundwater remedies implemented at Hill AFB are anticipated to operate over long periods (decades – see **Table 3-3**). As a result, ICs are in place to prevent exposures to contaminants in on-Base and off-Base areas over the long term. The ICs also address exposures in areas of contaminated soils on-Base. All ICs are assessed annually to ensure that they remain protective and are effectively implemented. Risks associated with indoor air are addressed through the IAP.

To ensure continued protectiveness, four Basewide issues are identified as part of this 2008 five-year review for Hill AFB, as described in the following paragraphs. These issues are also summarized in **Table 3-4**. These issues do not currently affect the protectiveness of the remedies in place at Hill AFB, although they need to be addressed to ensure continued protectiveness.

1. **Changes to chemical specific cleanup levels and toxicity factors.** The 2003 five-year review recommended that the risk analyses for OUs 1 through 8 should be reevaluated to determine if revised contaminant action levels are warranted based on new standards and toxicity factors. Hill AFB completed an assessment of the risk analyses and made OU-specific recommendations (**Hill AFB CEVR and SES, 2007**). No action, beyond implementation of the ICs already in place, was recommended for each OU because site closure of the various OUs is not anticipated for many years. This approach was deemed appropriate as part of this 2008 five-year review. As part of the risk review for this 2008 five-year review, it was noted that several toxicity factors and cleanup standards have changed since the 2003 five-year review. Toxicity factors and cleanup standards are likely to change again in the future, prior to achievement of site closure.

2. **Periodic, integrated reviews of O&M and LTM data to support remedy performance and protectiveness tracking have not been documented outside of the PSVPlan/PSVReport process.** The 2003 five-year review recommended that a less rigorous (as compared to the PSVPlan/PSVReport process), but more frequent review of LTO and LTM data, be performed. Such a review allows for more regular changes to site O&M activities that might modify treatment, ensure protectiveness, and potentially reduce the time required to achieve site closure. This level of review appears to be occurring as part of the ongoing site management activities. However, based on the document review, this level of review may not be occurring for all OUs. In the PSVPlan for OU 8 issued in December 2007, a process for performing this review was developed. The OU 8 PSVPlan contains a schedule that specifies the type of data/analysis to be performed, the schedule or frequency for performing the evaluation, and the requirements for reporting (**MWH, 2007**).

3. **The IAP is currently managed as a separate program but covers multiple OUs.** The IAP is currently managed as a separate program at Hill AFB, although the program

addresses indoor air risks associated with multiple OUs. The IAP addresses indoor air risks associated with all off-Base groundwater plumes. Participation in the IAP is voluntary, and the risks to residents that do not participate are not known. The RODs for OUs 1, 2, 3, and 7 include RAOs that state the remedial actions will prevent human exposures through inhalation such that the additional risk to an individual from cancer is below $1 \times 10^{-6}$ and the non-cancer threshold is less than 1.0. However, only the ROD for OU 4 includes an RAO specifically to address risks associated with exposure in residential indoor air.

4. **The deferred sites have been returned to Site Inspection status, and have not yet been investigated.** There are currently 108 sites associated with IRP Site OT106. These sites were originally included as part of OU 9, but because remedy selection for these sites was being deferred, they were removed from OU 9 in 2007 and returned to Site Inspection Status for further evaluation and investigation. These sites are not therefore associated with a specific OU. The deferred sites are currently inventoried and evaluated annually to assess their current status and determine if further investigation is warranted and can be performed. A work plan to implement investigation of these sites is scheduled for 2008, with investigations to begin in 2009.

## 3.3 Basewide Recommendations and Follow-up Actions for 2008 Five-Year Review

As described in **Section 3.2**, four Basewide issues were identified during the 2008 five-year review for Hill AFB. To address these issues, the following recommendations and follow-up actions have been identified. These recommendations and follow-up actions are also included in **Table 3-4**.

1. **Continue to assess site risks and exposure pathways in response to revised toxicity factors and cleanup standards.** While remedy modifications based on revised toxicity values or cleanup standards are not currently recommended because current ICs ensure protectiveness, some standards have changed, and if circumstances also change and exposure pathways become complete, risk and cleanup goals will need to be reevaluated at that time. Future five-year reviews should continue to assess revised toxicity factors and cleanup standards relative to site risks and exposure pathways. Prior to site closure at each OU, the risk analysis should be evaluated based on the currently existing toxicity factors and cleanup standards to ensure that the completed remedy is protective at that time.

2. **Perform periodic, integrated reviews of O&M and LTM data to support remedy performance and protectiveness tracking and document results.** Currently, O&M data are evaluated and reported annually by O&M contractors in Cost and Performance Reports, and LTM data, such as groundwater monitoring results, are reported separately in quarterly and annual reports. Remedy performance is evaluated rigorously through the PSVPlan/PSVReport process on a five-year basis. A more frequent integrated assessment of O&M and LTM data should be more formally documented. The process described in the OU 8 PSVPlan would facilitate such documentation if applied to all OUs.

3. **Create a separate OU for management of the IAP.** Hill AFB is currently considering creating a separate OU for the IAP. Hill AFB should move forward with this process and get concurrence from the regulatory agencies to manage offsite residential indoor air issues on an integrated basis under a single OU. The IAP should proceed through the RI/FS process, and a ROD should be signed documenting the remedies, O&M, and LTM activities performed under the IAP.
4. **Investigation of the deferred sites should proceed.** Hill AFB should evaluate and describe the priority for investigation of each site in the deferred sites work plan scheduled for 2008. The process of evaluating the deferred sites to determine if an RI/FS, NFRAP status, or other appropriate action is required should proceed.

## 3.4 OU Specific Issues and Recommendations/Follow-Up Actions

This 2008 five-year review has identified issues and recommendations/follow-up actions specific to each OU that need to be addressed to ensure long-term protectiveness. The OU-specific issues and recommendations/follow-up actions are discussed in **Section 7.0**.

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TABLE 3-4
2008 Five-Year Review Basewide Issues and Recommendations
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Issue | Recommendation | Potentially Affects Protectiveness | |
|---|---|---|---|
| | | Current | Future |
| **Changes to chemical specific clean-up levels and toxicity factors.** The 2003 five-year review recommended that the risk analyses for OUs 1 through 8 should be re-evaluated to determine if revised contaminant action levels are warranted based on new standards and toxicity factors. Hill AFB completed an assessment of the risk analyses and made OU specific recommendations (**Hill AFB CEVR and SES, 2007**). No action, beyond implementation of the ICs already in place, was recommended for each OU, because site closure of the various OUs is not anticipated for many years. As part of the risk review for the 2008 five-year review, it was noted that several toxicity factors and cleanup standards have changed since the 2003 five-year review. Toxicity factors and cleanup standards are likely to change again in the future, prior to achievement of site closure. | **Continue to assess site risks and exposure pathways in response to revised toxicity factors and clean-up standards.** While remedy modifications based on revised toxicity values or clean-up standards are not currently recommended because current ICs ensure protectiveness, if circumstances change and exposure pathways become complete, risk and clean-up goals will need to be reevaluated at that time. Future five-year reviews should continue to assess revised toxicity factors and cleanup standards relative to site risks and exposure pathways. Prior to site closure at each OU, the risk analysis should be evaluated based on the currently existing toxicity factors and clean-up standards to ensure that the completed remedy is protective at that time. | No | Yes |

TABLE 3-4
2008 Five-Year Review Basewide Issues and Recommendations
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Issue | Recommendation | Potentially Affects Protectiveness | |
|---|---|---|---|
| | | Current | Future |
| **Periodic, integrated reviews of O&M and LTM data to support remedy performance and protectiveness tracking have not been documented outside of the PSVPlan/PSVReport process.** The 2003 five-year review recommended that a less rigorous (as compared to the PSVPlan/PSVReport process), but more frequent review of LTO and LTM data, be performed. Such a review allows for more regular changes to site O&M activities that might modify treatment, ensure protectiveness, and potentially reduce the time required to achieve site closure. This level of review appears to be occurring as part of the ongoing site management activities. However, based on the document review, this level of review may not be occurring for all OUs. In the PSVPlan for OU 8 issued in December 2007, a process for performing this review was developed. The OU 8 PSVPlan contains a schedule that specifies the type of data/analysis to be performed, the schedule or frequency for performing the evaluation, and the requirements for reporting (**MWH, 2007**). | **Perform periodic, integrated reviews of O&M and LTM data to support remedy performance and protectiveness tracking and document results.** Currently, O&M data are evaluated and reported annually by O&M contractors in Cost and Performance Reports, and LTM data, such as groundwater monitoring results, are reported separately in quarterly and annual reports. Remedy performance is evaluated rigorously through the PSVPlan/PSVReport process on a five-year basis. A more frequent integrated assessment of O&M and LTM data should be more formally documented. The process described in the OU 8 PSVPlan would facilitate such documentation if applied to all OUs. | No | Yes |

TABLE 3-4
2008 Five-Year Review Basewide Issues and Recommendations
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Issue | Recommendation | Potentially Affects Protectiveness | |
|---|---|---|---|
| | | Current | Future |
| **The IAP is currently managed as a separate program but covers multiple OUs.** The IAP is currently managed as a separate program at Hill AFB, but the program addresses indoor air risks associated with multiple OUs. The IAP addresses indoor air risks associated with all off-Base groundwater plumes. The RODs for OUs 1, 2, 3, 4, and 7 include RAOs related to risks associated with inhalation of vapors. However, only the ROD for OU 4 specifically includes RAOs associated with residential indoor air risks. | **Create a separate OU for management of the Indoor Air Program (IAP).** Hill AFB is currently considering creating a separate OU for the IAP. Hill AFB should move forward with this process and get concurrence from the regulatory agencies to manage offsite residential indoor air issues on an integrated basis under a single OU. The IAP should proceed through the RI/FS process, and a ROD should be signed documenting the remedies, O&M, and LTM activities performed under the IAP. | No | Yes |
| **The deferred sites have been returned to Site Inspection status, and have not yet been investigated.** There are currently 108 sites associated with IRP Site OT106. These sites were originally included as part of OU 9, but because remedy selection for these sites was being deferred, they were removed from OU 9 in 2007 and returned to Site Inspection Status for further evaluation and investigation. These sites are not therefore associated with a specific OU. The deferred sites are currently inventoried and evaluated annually to assess their current status and determine if further investigation is warranted and can be performed. A work plan to implement investigation of these sites is scheduled for 2008, with investigations to begin in 2009. | **Investigation of the deferred sites should proceed.** Hill AFB should evaluate and describe the priority for investigation of each site in the deferred sites work plan scheduled for 2008. The process of evaluating the deferred sites to determine if an RI/FS, NFRAP status, or other appropriate action is required should proceed. | No | Yes |

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Section 4

# Protectiveness Statements

Protectiveness statements have been developed for each OU and the IAP as part of this 2008 five-year review. The protectiveness statements and the basis for these statements are provided in the OU summaries in **Section 7.0**. A summary of the protectiveness determinations for Hill AFB is provided in **Table 4-1**. A not applicable determination was made for IRP Sites with NFRAP status and for OUs where the RI/FS is being conducted and a remedy has not been selected or completed. For OUs 4, 6, and 8, where the protectiveness could not be determined, this determination is based on the need for additional information to be obtained. Enforcement of ICs provides short-term protectiveness at these OUs, pending further assessment of the remedies. A protectiveness determination was made for OUs 12 and 13 because they have interim remedies in place, although they do not yet have a ROD. Although not a separate OU, the IAP was reviewed and a protectiveness determination made as part of this 2008 five-year review. The IAP was reviewed because it is an integral part of addressing risks associated with several OUs at Hill AFB. The interim remedies and enforcement of ICs are considered protective in the short-term, pending selection of a final remedy at these OUs.

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TABLE 4-1
Summary of Protectiveness Determinations
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Associated IRP Sites | Protectiveness Determination | Change from Protectiveness Statement in 2003 Five-Year Review |
|---|---|---|---|
| OU 1 | Landfill No. 4 (LF001) | Protective in the short-term. | The 2003 FYR indicated that the protectiveness of the OU 1 remedies could not be determined until further information was obtained. The additional analyses discussed in the 2003 FYR have been performed and preparation of a final PSVReport is in progress to document the results. Because institutional controls (ICs) are in place on-Base and off-Base to prevent exposures to contaminated groundwater and landfill contents, and the ICs and land-use controls are assessed annually, the determination has been changed to protective in the short-term. |
| | Chemical Pits 1 and 2 (WP002) | | |
| | Landfill No. 3 (LF003) | | |
| | Fire Training Area 1 (FT009) | | |
| | Golf Course (OT014) – NFRAP | | |
| | Fire Training Area 2 (FT081) - NFRAP | | |
| | Waste Phenol Oil Pit (WP080) | | |
| OU 2 | Chemical Pit 3 (WP007) | Protective in the short-term. | The 2003 FYR indicated that the protectiveness of the OU 2 remedies could not be determined until further information was obtained. Preparation of a final PSVReport is in progress to document the status of evaluations conducted based on the 2003 FYR recommendations. Because water-use restrictions and land-use controls are in place and assessed annually, the groundwater plume is well defined and stable, and there are no completed exposure pathways present at OU 2, the protectiveness determination has been changed to protective in the short-term. |
| | Perimeter Road (SS021) - NFRAP | | |
| OU 3 | Sodium Hydroxide Tank Site (ST004) | Protective. | No change. |
| | Berman Pond (WP005) | | |
| | Industrial Wastewater Treatment Plant Sludge Drying Beds (WP006) – NFRAP | | |
| | Building 514 (ST018) – NFRAP | | |
| | Pond 2 (SD046) – NFRAP | | |

TABLE 4-1
Summary of Protectiveness Determinations
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Associated IRP Sites | Protectiveness Determination | Change from Protectiveness Statement in 2003 Five-Year Review |
|---|---|---|---|
| OU 4 | Landfill No. 1 (LF011) | Protectiveness cannot be determined until additional information is obtained. | The 2003 FYR indicated that the OU 4 remedies were protective in the short-term. The current well network does not provide an adequate definition of the horizontal and vertical extent of TCE contamination in groundwater. Because the extent of the TCE plume is not completely defined, capture of TCE contamination cannot be determined with certainty. The North Gate Dump and Landfill 2 have been identified as potential source areas for the OU 4 plume. |
| | Landfill No. 2 (LF012) – NFRAP | | |
| | Spoils Pit (OT020) – NFRAP | | |
| | North Gate Dump (OT041) – NFRAP | | |
| | Munitions Dump (OT042) - NFRAP | | |
| OU 5 | US Army Tooele Rail Shop (SS017) | Protective. | The 2003 FYR indicated that the OU 5 remedies were protective in the short-term. The Phase III Groundwater Containment System is containing contaminated groundwater and preventing it from moving further into the City of Clinton, and the aeration curtain is operating effectively as expected. Exposure to contaminants in indoor air is addressed through the IAP, and ICs to restrict groundwater use are currently in place. ICs and land-use controls are assessed annually. Monitoring indicates that the Zone 16 groundwater plume is naturally attenuating. |
| | Building 1607 Evaporation Pond (SS091) | | |
| | Bamberger Pond (SD016) - NFRAP | | |
| OU 6 | Sump Leach Field (ST022) | Protectiveness cannot be determined until additional information is obtained. | No change. |
| | Asphalt Pad (OT026) | | |
| | Building 1946 Evaporation Pond (SD40B) - NFRAP | | |
| OU 7 | Building 225 Chromium Spill (SS027) | Protective. | No change. |
| | Building 220 Underground Tanks (ST031) – NFRAP | | |
| | Building 225 PCB (SS032) – NFRAP | | |
| | Sill Property, Layton (SS028) - NFRAP | | |
| | Building 204 Beryllium Underground Waste Tank (OT029) – NFRAP | | |

TABLE 4-1
Summary of Protectiveness Determinations
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Associated IRP Sites | Protectiveness Determination | Change from Protectiveness Statement in 2003 Five-Year Review |
|---|---|---|---|
| OU 8 | TCE Plume (OT033) | Protectiveness cannot be determined until additional information is obtained. | No change. |
| OU 9 | 1100 Area (SS089) | Protective in the short-term. | The 2003 FYR indicated that the OU 9 remedies would be protective once completed. Remedial actions implemented at Pond 1 and Pond 3 are considered to be protective of human health and the environment. The soil and groundwater at the Pond 7 Area were determined to pose no unacceptable risk to human health or the environment. ICs have already been implemented at OU 9. ICs and land-use controls are assessed annually. Enforcement of ICs at OU 9 provides protectiveness in the short-term pending remedy selection. |
| | Zone 7 Golf Course (SS090) | | |
| | 800/900 Warehouse Area (SS108) | | |
| | Deferred Areas (OT106)* | | |
| | Pond 3 (SD023) | | |
| | Pond 1 (SD034) | | |
| | Building 786 (SS092) - NFRAP | | |
| | Pond 7 Area (SD040) - NFRAP | | |
| | Transformer Storage Yard (PT093) - NFRAP | | |
| | Building 2402 (SS094) - NFRAP | | |
| | Building 2403 (SS095) - NFRAP | | |
| OU 10 | 1200 Area (SS109) | Not applicable. | No change. |
| OU 11 | Building 454 (OT097) | Not applicable. | No change. |

TABLE 4-1
Summary of Protectiveness Determinations
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Associated IRP Sites | Protectiveness Determination | Change from Protectiveness Statement in 2003 Five-Year Review |
|---|---|---|---|
| OU 12 | Aspen Avenue Disposal Area (SS107) | Protective in the short-term. | The 2003 FYR indicated that the OU 12 remedies were not protective. The interim action at OU 12 associated with the Base Boundary Hydraulic Containment System is currently achieving the performance objectives as specified in the Performance Standard Verification Plan. However, the removal action associated with the Permeable Reactive Barrier is not performing as expected. The Permeable Reactive Barrier is currently meeting the Remedial Action Objectives as specified in the Action Memorandum, but it is not achieving the performance goal of reducing TCE concentrations downgradient to less than the Maximum Contaminant Level as specified in the Performance Standard Verification Plan. ICs are currently in place to limit human exposure to potential groundwater contamination. ICs and land-use controls are assessed annually. Vapor intrusion issues identified in the 2003 FYR are currently being addressed through the IAP. |
| OU 13 | Upper Area F Housing PCB Site (SS112) | Will be protective once the removal action is completed. | Not evaluated in 2003. |
| Indoor Air Program | The Indoor Air Program is associated with multiple OUs and IRP Sites | Protective in the short-term. | Not evaluated in 2003. |

Notes:
* Deferred Sites have been removed from OU 9 and placed under Site Inspection status
FYR – Five-Year Review
IAP – Indoor Air Program
ICs – Institutional Controls
IRP – Installation Restoration Program
OU – Operable Unit
PCB – Polychlorinated Biphenyls
TCE – Trichloroethene

Section 5

# Next Five-Year Review

Five-year reviews are required by statute for Hill AFB, as stated in **Section 1.1**. The next five-year review, the fourth for Hill AFB, should be completed during or before December 2013 (5 years from the completion date of this report). The next five-year review should cover site activities that occur during the period from October 2007 through September 2012. The next five-year review should assess all 13 OUs and any new OUs designated during the five-year review period. The status of the deferred sites (IRP site OT106) and the IAP should be included in this review.

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Section 6

# References for Sections 1 Through 5


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Section 7

# Detailed Five-Year Review for each Operable Unit

Detailed information for the five-year review of each OU is provided in this section. The background, remedial action summary, progress since the 2003 five-year review, interviews, site inspection, data and document review, and results of the technical assessment are provided for each OU and the IAP. A set of issues, recommendations, and a protectiveness statement are also provided for each OU and the IAP.

The deferred sites (IRP site OT106) have been removed from OU 9. The status of the deferred sites is further described in **Section 8.0**.

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Table OU 1-1
# Operable Unit 1
# Background Information

Reviewer: Victor Martinez

**Introduction**

Operable Unit 1 is located along the eastern boundary of Hill AFB. Operable Unit 1 is divided into eight Source Areas and two non-Source Areas. The Installation Restoration Program Sites that compose the Source Areas include: Landfill Nos. 3 and 4, Fire Training Area Nos. 1 and 2, Chemical Disposal Pit Nos. 1 and 2, and the Waste Phenol/Oil Pit (see **Figure OU 1-1**). Also cited as a Source Area is the Waste Oil Storage Tanks site, which does not have an IRP Site designation. The OU 1 Source Area consists of subsurface accumulation of LNAPL. The non-Source Areas are groundwater plumes of dissolved-phase cis-1,2-dichloroethene (cis-1,2-DCE) and other dissolved contaminants as depicted in **Figure OU 1-1**. The selected remedy at OU 1 addresses on-Base and off-Base contamination for both Source and non-Source Areas. The remedies include: (1) groundwater extraction trenches; (2) landfill cap repair and maintenance; (3) spring collection and treatment system; (4) monitored natural attenuation; and (5) institutional controls (**URS, 2003**).

A list of the documents reviewed for OU 1 as part of the 2008 five-year review is provided in **Appendix C**.

| IRP Identification | IRP Site Name | Status |
|---|---|---|
| LF001 | Landfill No. 4 | Remediation ongoing |
| WP002 | Chemical Pits 1 and 2 | Remediation ongoing |
| LF003 | Landfill No. 3 | Remediation ongoing |
| FT009 | Fire Training Area 1 | Remediation ongoing |
| OT014 | Golf Course | NFRAP |
| FT081 | Fire Training Area 2 | NFRAP |
| WP080 | Waste Phenol Oil Pit | Remediation ongoing |
| Not applicable | Waste Oil Storage Tanks | Remediation ongoing |

**Site Chronology**

Provided separately. See **Table OU 1-2**

**Background**

**Physical Characteristics.** The on-Base portion of OU 1 sits upon relatively flat lying ground that drops steeply to the northeast, towards the City of South Weber (**HILL AFB EMR, 1998**). The off-Base portion of the site includes steep hill slopes that dip into the Weber River Valley. The major geologic units at OU 1 consist of landslide debris, terrace deposits, the Provo Formation, the Alpine Formation, an unnamed formation, and the groundwater aquifer. Shallow groundwater at OU 1 exists under unconfined and semi-confined conditions. Groundwater occurs in two stratigraphic units: the sand and gravel fluvial deposits of the Provo Formation, and the underlying, finer-grained deltaic deposits of the Alpine Formation. Analysis of borehole data from the site indicates that these units contain multiple hydraulically interconnected water-bearing zones. The interconnections between the water-bearing zones are complex, particularly within the Alpine Formation, as a consequence of the heterogeneous character of the interbedded lacustrine and deltaic sediments (**HILL AFB CEVR, 2008**). OU 1 is located at the northeastern margin of flat and westward sloping terrace above the Weber River floodplain and

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| | is separated from the river valley below by a steep, north to northeast facing escarpment with a relief of approximately 300 feet. The steep topography is a major influence on groundwater movement at OU 1 (**URS, 2005**). Most of the shallow groundwater beneath OU 1 flows laterally along the interface of the Provo and Alpine formations. Shallow groundwater flow within the Provo Formation is mostly to the east and west along groundwater channels eroded into the Alpine Formation. Groundwater flow in the Alpine Formation is to the north (**HILL AFB EMR, 1998**). Because of the nature of the outcrops of alluvial sediments and the vertical hydraulic gradient caused by the topography at OU 1, the escarpment leading from the Base to the Weber River floodplain is probably a seepage face for the shallow Provo/Alpine aquifer system. As a result, numerous springs and seeps occur along the escarpment (**URS, 2005**). |
| | **Land and Resource Use.** Historically, land use on-Base at OU 1 has been for military and industrial use while off-Base is a combination of agricultural and rural-residential in the community of South Weber. In 1998, when the ROD was signed, there were no hospitals, retirement/nursing homes, schools, nurseries, or daycare centers located within the foot print of the off-Base portions of the OU 1 groundwater contaminant plume. The nearest daycare/school was located approximately 0.3 miles east of the contamination associated with OU 1. Off-Base land use just north of OU 1 consists mostly of residential homes and areas used for livestock grazing. The Davis-Weber Canal is located off-Base and is situated about two-thirds of the way down the escarpment. It is a privately-owned irrigation canal that supplies water for irrigation diverted from the Weber River from mid-April to mid-October. Shallow groundwater is not used as a source of drinking water in the area. Municipal water is supplied by the Weber Basin Water Conservancy District to the City of South Weber. The district provides water from wells that tap the Delta aquifer that is 500 to 700 ft bgs and is unaffected by contaminants associated with OU 1. There is one groundwater well located within the foot print of the OU 1 off-Base groundwater plume (South Weber Well No. 2). The well is located approximately 1,500 feet from the OU 1 Source Areas. This well was used sporadically over the years during peak demand periods. However, oil was observed floating on the surface of the water in the well, and the well was not operational due to the dissolved contamination in the well water from the oil. Investigations have shown that Hill AFB is not the source of the oil or associated contamination in the well water (**HILL AFB EMR, 1998**). No land use changes were observed on-Base or off-Base during the 2008 five-year review. Site inspection (**CH2M HILL, 2007b**). |
| | **History of Contamination.** Since the 1940s, Hill AFB has housed a diverse number of industrial facilities dedicated to the management and maintenance of a variety of aircraft and missiles. Operational activities at these facilities included the use of numerous chemicals, plating solutions, degreasing materials, and hydrocarbon fuel products. Fire training areas were set up on-Base to conduct fire training drills to manage and extinguish hydrocarbon fuel fires. The types of waste products disposed at the Source Areas and periods of operations varied by location. Disposal of industrial liquid took place at Chemical Disposal Pits 1 and 2 from 1952 through 1973. Landfill 3 was an industrial liquid and solid waste disposal site where dumping and burning operations occurred from 1940 through 1967. Landfill 4 was a sanitary refuse landfill in operations from 1967 through 1973. Fire Training Area 1 was a practice area to extinguish simulated aircraft fires and was used by Hill AFB from mid-1950s through 1973. Activities at Fire Training Area 2 were the same as Fire Training Area 1 and operated from 1973 through 1995. Waste oil and phenol were disposed and burned at the Waste Phenol Oil Pit from 1954 through 1965. Four aboveground storage tanks with storage capacity ranging from 20,000 to 25,000 gallons were used to store wastes from fuel oil, jet fuel, and hydraulic oil. The four tanks were removed in 1985 (**HILL AFB EMR, 1998**). |
| | **Initial Response.** In 1985 and 1986, in response to a cease and desist order from the Utah Water Pollution Control Board (currently the Utah Division of Water Quality) Hill AFB initiated and implemented several remedial actions to prevent and restrain the mobility of contaminants at OU 1. These remedial actions took place prior to the Superfund Amendments and Reauthorization Act (SARA) in November 1986. Remedial actions implemented at OU 1 in |

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| | 1985 and 1986 included: (1) the installation of low-permeability caps to reduce infiltration of precipitation at Landfill 3 and 4, and Chemical Disposal Pits 1 and 2; (2) installation of a subsurface physical barrier located upgradient of the Source Areas to reduce groundwater recharge; (3) collection and treatment of contaminated surface water from off-Base springs located downgradient of the Source Areas; and (4) extraction and treatment of contaminated groundwater from the on-Base Source Area (**URS, 2003**). |
| | **Basis for Taking Action.** The purpose of the response actions conducted at OU 1 was to protect public health and welfare and the environment from releases or threatened releases of hazardous substances from the OU 1. Remedial actions taken at OU 1 were deemed necessary based on the results of the Human Health Risk Assessment and the Ecological Risk Assessment conducted as part of the Comprehensive Remedial Investigation Report for OU 1 (**HILL AFB EMR, 1998**). Future potential exposure pathways that could become significant involve on-Base and off-Base domestic use of contaminated groundwater from the shallow unconfined water-bearing zone, exposure of construction workers and future residents to on-Base soil contaminants, and exposure to contaminated soil gas if it migrates into the basements of houses. Actual or threatened releases of hazardous substances from this site may present an imminent and substantial endangerment to public health, welfare, or the environment if not addressed by the response actions selected by the ROD. The primary threats that OU 1 posed to public health were potential domestic groundwater use by ingestion, inhalation, and dermal pathways (**HILL AFB EMR, 1998**). |
| **Remedial Actions** | **Remedy Selection (i.e. ROD/ ESDs).** For the Source Areas, the ROD describes the remedy as: (1) dewatering of the Source Area with extraction trenches; (2) recovery of LNAPL from the extraction trenches followed by disposal of the LNAPL; (3) groundwater treatment at the OU 2 Air Stripper Treatment Plant (ASTP) or the Hill AFB Industrial Wastewater Treatment Plant (IWTP) and discharge to a Publicly-Owned Treatment Works (POTW) for final treatment; and (4) repair, as well as operation and maintenance of the landfill caps and passive gas vent system. For the non-Source Areas, the selected remedy is: (1) upgrade of the spring collection system and treatment of the collected surface water at the OU 2 ASTP, a new remote treatment plant, or the IWTP; (2) excavation of arsenic-contaminated spring sediments and off site disposal at an appropriate disposal facility; (3) monitored natural attenuation of contaminants in groundwater of the non-Source Area, which depends on effective interception of contaminants in the Source Area. The ROD indicates that other remedies will be implemented if concentrations do not attenuate in a reasonable time frame. Components of the selected remedy that apply to both the Source and non-Source Areas are: (1) environmental monitoring; (2) institutional and engineering controls designed to prevent potential unacceptable risk to human health and the environment; and (3) designation of a Corrective Action Management Unit (CAMU) to facilitate remedial actions (**HILL AFB EMR, 1998**). Dilution (advection and dispersion) and adsorption were considered to be the most significant processes affecting contaminants in groundwater in the non-Source Area at OU l. Because the degree of biodegradation rates were not known at the time the ROD was signed, biodegradation was not included in estimates of the time to achieve remedial goals. The restoration time frame for groundwater was estimated to be greater than 50 years for the Source Area and 12 years for the non-Source Area (**HILL AFB EMR, 1998**).<br><br>The ROD stated that extracted groundwater from OU 1 was to be pre-treated at the Hill AFB IWTP or the OU 2 ASTP and then sent on to a POTW for final treatment. In August 2000, a permit change in total VOC limits in the Central Weber Sewer Improvement District (CWSID) allowed for concentrations up to 2,130 µg/L total VOCs in effluent discharged to the CWSID. Based on favorable results from studies performed and discussions with the CWSID, modifications were made to the OU 1 effluent piping network during 2004 to allow the discharge of OU 1 groundwater directly to the CWSID. On February 28, 2005, permission was granted by the CWSID to allow the groundwater effluent from OU 1 was re-routed from the Hill AFB IWTP to CWSID. An ESD describing this change was prepared and signed on September, 2006 (**Hill AFB CEVR, 2006**). |

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| | **Remediation Goals.** Remedial action objectives and remediation goals were established to address potential future unacceptable risk scenarios. The RAOs associated with each medium of concern at OU 1 are presented below (**HILL AFB EMR, 1998**).<br><br>**Soils RAOs.** The RAOs for soils are to prevent human exposure through contact, ingestion, or inhalation to contaminated soil that presents an unacceptable risk and to prevent migration of contaminants that cause an unacceptable risk in groundwater.<br><br>**Groundwater RAOs**. The RAOs for groundwater are to prevent human exposure through contact, ingestion, or inhalation to contaminated groundwater and restore groundwater to beneficial use. Institutional and engineering controls will prevent use of the water and contain contaminants in the Source Area. Contaminated groundwater from the Source Area will be treated as part of the dewatering process. Monitored natural attenuation is expected to meet these goals in the non-Source Area.<br><br>**Surface Water RAOs**. The RAOs for surface water are to prevent human exposure through contact, ingestion, or inhalation to contaminated seep or spring water by the collection and treatment of the contaminated water.<br><br>**Sediment RAOs**. The RAOs for sediments at springs are to prevent human exposure through contact, ingestion, or inhalation to sediments that exceed 11 milligrams per kilogram (mg/kg) of arsenic.<br><br>**Source Area RAOs**. The RAOs for the Source Area are to prevent contaminants in excess of MCLs from migrating away from the Source Area so that the non-Source Area can be effectively remediated and to restore Source Area groundwater to MCLs.<br><br>**LNAPL Plume RAOs**. The RAOs for the LNAPL plume are to remove the LNAPL that can be practicably removed and to prevent contaminant migration from the Source Area to groundwater at levels that impair water quality and/or represent a potential threat to human health and the environment.<br><br>**Landfill RAOs**. The RAOs for the landfill contents and landfill gas are to prevent human exposure to the contents and the gas, minimize infiltration (thus reducing additional groundwater contamination), and prevent landfill gas concentrations from reaching dangerous (i.e., explosive) levels. |
| | **Remedy Implementation.** Remedial actions implemented at OU 1 addresses both on-Base and off-Base contamination. Remedies implemented at OU 1 included: (1) groundwater extraction trenches in the Source Area; (2) landfill cap repair and maintenance for the Source Area; (3) spring collection and treatment system for the non-Source Area; (4) Monitored Natural Attenuation for the non-Source Area; and (5) institutional and engineering controls for both the Source and non-Source Areas. Current remedial treatment system and actions include operation of a system of groundwater extraction trenches and associated process facilities to inhibit the off-Base movement of contaminated groundwater; inspection and maintenance of the landfill caps to prevent ponding; implementation of institutional controls to prevent exposure of human and animal receptors to contamination; implementation of a long-term monitoring program for contamination and treatment systems performance to define the necessary data requirements and analytical methodologies to evaluate whether the remedial systems in place at OU 1 are mitigating environmental contamination; monitoring natural attenuation for groundwater in the non-Source Area; spring collection and treatment; and five-year reviews to verify that the remedy continues to provide adequate protection of human health and the environment (**URS, 2005**). Because contaminated water at the springs and the contaminated soils surrounding the springs are located at and just below the ground surface, the potential for exposure to receptors is significantly greater than exposure to subsurface contamination; consequently, remediation of the springs has been a high priority at OU 1 (**HILL AFB CEVR, 2008**). However, operation of the groundwater extraction trenches has ceased the majority of spring flow. Since 2001 the |

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|---|---|
| | entire hillside has been inspected annually during the spring season and no new seeps or springs have been identified (**URS, 2005**). |
| | **Operations and Maintenance.** During the current review period, O&M of the treatment systems was conducted by URS through March 2006. On April 2006, CH2M HILL took over O&M at OU 1 and is the current O&M contractor. General tasks conducted during O&M activities at OU 1 consist of: (1) system operational data collection; (2) system performance evaluation and reporting; (3) system operation tasks; (4) system maintenance tasks; and (5) answer of system alarms (**Hill AFB CEVR, 2007c**). Current O&M activities at OU 1 include maintenance of the extraction trenches and associated sumps and piping, long-term monitoring of the site groundwater, inspection and maintenance of the landfill caps and fencing, and O&M of the spring collection systems, conveyance systems, and the Central Facilities Building. Based on the site inspection performed at OU 1 during September 2007, proper inspection and maintenance procedures are in place and being implemented to ensure the integrity of the landfill caps and to ensure the enforcement of ICs (groundwater use restrictions, land use restrictions onsite, integrity of fencing, and signage) (**CH2M HILL, 2007b**). Fouling in process lines, pumps, and wells is a recurring performance issue identified with the system at OU 1. Air surging procedures have been implemented to remove fouling from the lines. Upgrades were also made to the collection sumps, which eliminated the necessity to perform confined space entry for maintenance activities, and procedures to clean out process lines to remove biofouling, Overall, the upgrades and procedures implemented to the system have improved the performance of the collection system from an operations standpoint. The CEVR managers and their contractors continue to work to develop methods to deal with the fouling issues, which potentially can impact costs to operate their systems. The current O&M manual and as-built drawings are maintained through CEVR's Dynamic Documents system. All changes are managed and updated electronically through this system (**CH2M HILL, 2007c**). |
| | **Progress Since Initiation of Remedial Action.** All remedial activities specified in the ROD have been implemented except for remedial actions concerning the removal of arsenic-contaminated sediments from the springs.<br><br>**Groundwater Extraction System:** From 2001 through 2005, the total gallons of water removed from Trench A are approximately 14,546,392. The total mass of dissolved COCs removed by the trench from this same period is approximately 196 pounds. A list of the COCs for OU 1 is presented in **Table OU 1-5**. At Trench B, the total gallons of water removed from 2001 through 2005, are approximately 26,371,758 gallons, which yields a total removal mass of approximately 175 pounds of dissolved COCs. From 2001 through 2005, the total gallons of water removed from Trench C are approximately 1,539,559 gallons. This constitutes approximately 9 pounds of aqueous COCs removed from this trench. At Trench D, the total gallons of water removed from 2001 through 2005, are approximately 28,217,796 gallons, which yields a total removal mass of approximately 116 pounds of dissolved COCs (**HILL AFB CEVR, 2008)**. Between June 2001 and March 2007, 16,707 gallons of LNAPL have been recovered (**CH2M HILL, 2007a**). Monitoring and data analysis has been conducted at OU 1 as specified in the 2001 PSVPlan. An overall review of the monitoring data and the remedies at OU 1 began in 2006 and continues to date (**CH2M HILL, 2007d**). |
| **Progress Since Last FYR** | Six issues were identified during the 2003 five-year review that could affect the protectiveness of the selected remedies at OU 1. Fourteen recommendations to address these issues were included in the 2003 five-year review. Recommendations and follow up actions for OU 1 are presented in **Table OU 1-3** along with the current status of each recommendation.<br><br>Current Status:<br><br>All remedial actions outlined in the ROD have been implemented except for remedial actions concerning the removal of arsenic-contaminated sediments from the springs. Characterization and assessment of remedial options for the arsenic-contaminated soils has recently been completed. Removal of the arsenic-contaminated sediments is currently scheduled to occur in |

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| | the Summer or Fall of 2008. However, this is contingent upon obtaining a real estate agreement with the affected landowner. Hill AFB will not be able to complete this remedial action until a real estate agreement is reached with the landowner (**CH2M HILL, 2007d**). Operation and maintenance of in-place systems and monitoring is ongoing. Fouling problems and pump maintenance are the most significant O&M issues in the operation of the trenches, however, upgrades to the sump pumps and air surging procedures implemented to remove fouling has improved the performance of the collection system. The internal draft version of the PSVReport for OU 1 was prepared in 2006. This report formally documents an evaluation of how the OU 1 remedial systems performed up until 2006. The PSVReport also addresses issues about system performance identified in the 2003 five-year review (**HILL AFB CEVR, 2008**). The OU 1 PSVReport is a dynamic document that is continually updated as new data is received and more knowledge about the OU 1 site is obtained (**CH2M HILL, 2007d**). Currently, the PSVReport is being modified to address issues identified in the internal draft version of the report.<br><br>Overall the remedies implemented at OU 1 appear to be functioning as expected relative to the RAOs. However, there have been performance issues identified during this five-year review period associated with the Source Area remedy. The performance issues are due in part to fouling of the process lines and to periods of high groundwater levels that result in contaminant mass escape. These issues are being addressed by implementing new O&M procedures and system upgrades. The effectiveness that these modifications have had on the system performance is documented in monthly reports and will continue to be documented in annual treatment system cost and performance reports. Hill AFB will address the sewer line fouling issues, most likely associated with OU 1, in the combined OU 1 and OU 2 sewer line as needed.<br><br>The data collected since the 2003 five-year review indicate progress toward achieving remedial goals. The Source Area remedial system has removed significant quantities of LNAPL and appears to be containing the Source Area. Although the off-Base dissolved volatile organic compound plume appears to be shrinking in most areas, the internal draft version of the PSVReport identified that concentrations at off-Base monitoring well U1-1602 are elevated and this needs to be investigated further (**CH2M HILL, 2007d**) In addition, the report indicated that the groundwater restoration time frame projections that MCLs in the off-Base plume would be reached after 12 years through natural attenuation are optimistic. The internal draft version of the PSVReport is being updated to address issues identified in the development of the estimated plume mass and natural attenuation time frames used to evaluate attenuation of the non-Source Area plume. |

Table OU 1-2

# Chronology of Site Events OU1

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 1 | OU1 | 7 | 1984 | Enforcement Action | Cease and Desist Order issued by UDWQ for leachate discharge below LF 4 observed at monitor wells U1-303 and U1-304. | Record of Decision Operable Unit 1 IRP Sites LF01, WP02, LF03, FT09, FT81, and WP80 |
| 1 | OU1 | 8 | 1984 | Interim Action | Began construction of an on-site groundwater extraction and treatment facility. Extraction wells U1-201 and U1-202 were completed near CDPs, and extraction well U1-205 was completed north of LF4 | Comprehensive Remedial Investigative Report for Operable Unit 1 (IRP Sites LF01, LF03, WP02, FT09, OT14, FT81, and WP80) Volume 1 |
| 1 | OU1 | 12 | 1985 | Interim Action | U1-206, U1-207, and U1-208 were installed east of LF4, and U1-209 was installed west of LF4. A 1,500 feet extraction trench with two sumps (U1-203 and U1-204) was completed south of FTA-2, and a facility was constructed to treat extracted groundwater which included an aeration tank and a skid-mounted dual tank groundwater processor. Effluent is discharged via an underground pipeline to an airfield sprinkler system. Pumping systems U1-303 and U1-304 were installed at springs northeast of LF4. | Comprehensive Remedial Investigative Report for Operable Unit 1 (IRP Site LF01, LF03, WP02, FT09, OT14, FT81, and WP80) Volume 1 |
| 1 | OU1 | | 1985 | Interim Action | Low-permeability caps installed over Landfills 3 and 4. Designed to reduce infiltration of precipitation. | Record of Decision Operable Unit 1 IRP Sites LF01, WP02, LF03, FT09, FT81, and WP80 |
| 1 | OU1 | | 1985 | Interim Action | Soil/bentonite slurry cut-off wall was designed and installed to reduce groundwater recharge to the source areas at OU 1. | Record of Decision Operable Unit 1 IRP Sites LF01, WP02, LF03, FT09, FT81, and WP80 |
| 1 | OU1 | | 1986 | Interim Action | Air strippers were installed to treat all pumped groundwater from extraction wells. | Comprehensive Remedial Investigative Report for Operable Unit 1 (IRP Site LF01, LF03, WP02, FT09, OT14, FT81, and WP80) Volume 1 |
| 1 | | | 1987 | Hill AFB placed on the National Priorities List (NPL) | The U.S. EPA placed HAFB on the NPL under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). | Record of Decision Operable Unit 1 IRP Sites LF01, WP02, LF03, FT09, FT81, and WP80 |
| 1 | OU1 | 1 | 1988 | Interim Action | A 3-mile waste water line was installed to transport effluent to the IWTP. At this point, the treatment system was disassembled. | Comprehensive Remedial Investigative Report for Operable Unit 1 (IRP Site LF01, LF03, |
| 1 | OU1 | | 1989 | Interim Action | A pumping system was installed at Pond 10 to pump excess water out of the pond and send it to Pond 9. This was designed to keep a constant elevation head in the pond by removing water above a set elevation. | Final Remedial Action Report Pond 10 Pumping Facility Construction at OU 1 |
| 1 | OU1 | | 1990 | Groundwater Monitoring | Groundwater and surface water monitoring implemented. Monitoring was implemented to establish baseline data for site groundwater and surface water. | Record of Decision Operable Unit 1 IRP Sites LF01, WP02, LF03, FT09, FT81, and WP80 |
| 1 | OU1 | 4 | 1991 | FFA | Entered Federal Facilities Agreement with UDEQ and EPA. The FFA Establish a framework and schedule for developing, implementing, and monitoring appropriate response actions at the site in accordance with existing regulations | Record of Decision Operable Unit 1 IRP Sites LF01, WP02, LF03, FT09, FT81, and WP80 |
| 1 | OU1 | 9 | 1993 | Interim Action | Pump transfer building constructed (BLDG 753). Building constructed to transfer effluent from OU 1 and OU 2 to a 250,000 gallon holding tank at the IWTP | Comprehensive Remedial Investigative Report for Operable Unit 1 (IRP Site LF01, LF03, WP02, FT09, OT14, FT81, and WP80) Volume 1 |
| 1 | OU1 | 1 | 1995 | Interim Action | Pumping station installed at U1-307 on hillside north of the OU 1 Source Areas. On-site holding pond was removed and filled. | Comprehensive Remedial Investigative Report for Operable Unit 1 (IRP Site LF01, LF03, WP02, FT09, OT14, FT81, and WP80) Volume 1 |

Table OU 1-2

## Chronology of Site Events OU1

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 1 | OU1 | 12 | 1995 | Remedial Investigation (RI) | The RI was completed. The RI determined the nature and extent of contamination. Free-phase LNAPL and LNAPL in residual saturation in the sand and gravel aquifer material act as the primary continuing sources of contaminants in the groundwater at OU 1. The risk to human health was low at the time of the RI, but could increase due to shallow groundwater being used for domestic purposes or if housing were built over areas with free or residual phase LNAPL. | Comprehensive Remedial Investigative Report for Operable Unit 1 (IRP Site LF01, LF03, WP02, FT09, OT14, FT81, and WP80) Volume 1 |
| 1 | OU1 | 1 | 1998 | Feasibility Study (FS) | The FS determined RAOs for soil, groundwater, surface water, LNAPL, and landfill caps and contents. Preliminary remediation goals were outlined for each RAO with technology evaluations and alternatives included as well. Treatability Study technologies were found not to be viable remediation options. | Final Feasibility Study Report for Operable Unit 1 (IRP Sites LF01, LF03, WP02, FT09, OT14, FT81, and WP80), Hill Air Force Base, Utah |
| 1 | OU1 | 9 | 1998 | First Five Year Review | The first Five-Year Review for OU 1 stated that the remedies selected for the site remain protective of human health and the environment. | Five-Year Review Report, First Five-Year Review Report for Hill Air Force Base, Utah. |
| 1 | OU1 | 10 | 1998 | Record of Decision | The ROD for OU 1 was signed. The ROD established RAOs and remedial action goals for the OU 1 site and selected the remedy for OU 1. | Record of Decision Operable Unit 1 IRP Sites LF01, WP02, LF03, FT09, FT81, and WP80 |
| 1 | OU1 | 5 | 2000 | Remedial Action | Construction of trench extraction system expansion started for extension of the source area containment system. | 2001 Cost & Performance Report, Operable Unit 1, Hill AFB, UT |
| 1 | OU1 | | 2000 | Remedial Action | Modification of the pumping system at Pond 10 occurs. The pumping system at Pond 10 was modified to drain the pond completely. | Final Remedial Action Report Pond 10 Pumping Facility Construction at OU 1 |
| 1 | OU1 | 6 | 2001 | Remedial Action | Construction of trench extraction system expansion completed. Four trenches installed with associated drains/sumps to capture contaminated groundwater from the Source Areas. Piezometers installed for monitoring. Water and LNAPL extraction pumps installed in sumps. Oil water separator constructed to remove LNAPL prior to pumping effluent to the IWTP. Landfill cap repair on LF4 and cap addition over CDPs were completed. | 2001 Cost & Performance Report, Operable Unit 1, Hill AFB, UT |
| 1 | OU1 | 6 | 2001 | Operation of groundwater extraction system began | URS operated the OU 1 system as the O&M contractor, and CH2M Hill selected as the long term monitoring contractor. | 2001 Cost & Performance Report, Operable Unit 1, Hill AFB, UT |
| 1 | OU1 | 8 | 2003 | Post-ROD Study | A Source Zone Delineation Project was completed. This report was prepared to: (1) significantly improve the conceptual site model (geosystems model) by developing a better estimate of the volume and extent of the LNAPL in the source zone, (2) provide information helpful in optimizing the operation and maintenance (O&M) of the existing remedial system, and (3) provide a quantitative basis for formulating future remedial strategies for OU 1. | Operable Unit 1 Final Report Source Zone Delineation Project |
| 1 | OU1 | 9 | 2003 | Five-Year Review | The second Five-Year Review stated that a protectiveness determination of the remedial actions implemented at OU 1 could not be made until additional information was available. | Final CERCLA Five-Year Review Report, Second Five-Year Review Report for Hill Air Force Base, Utah. |
| 1 | OU1 | | 2004 | Operations and Maintenance | Modifications to the OU 1effluent piping network were made during fall 2004. The OU 1 effluent was redirected to discharge directly to the CWSID. This decision was made based on the potential for fouling of the air stripper trays due to the relatively high iron content in the OU 1 effluent water and the fact that additional treatment was not necessary to meet the CWSID permit requirements. | Cost & Performance Report OU 1, Hill AFB, UTAH January - December 2004 |
| 1 | OU1 | 2 | 2005 | Operations and Maintenance | On February 28, 2005, permission was granted by the CWSID and the groundwater effluent from OU 1 was re-routed from the Hill AFB IWTP to the CWSID. | Cost & Performance Report OU 1, Hill AFB, UTAH January - December 2005 |

Table OU 1-2

## Chronology of Site Events OU1

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 1 | OU1 | 6 | 2005 | Operations and Maintenance | Fencing upgrades at springs U1-301, U1-303, U1-304, and U1-305 were preformed during summer 2005 to restrict access to the springs. | Cost & Performance Report OU 1, Hill AFB, UTAH January - December 2005 |
| 1 | OU1 | 6 | 2005 | Operations and Maintenance | Landfill 3 and4 included in the Hill AFB Landfill Cap Inspection Program. | Cost & Performance Report OU 1, Hill AFB, UTAH January - December 2005 |
| 1 | OU1 | 1 | 2006 | Explanation of Significant Differences | An Explanation of Significant Differences (ESD) signed for OU 1. The ROD stated that extracted groundwater from OU 1 was to be pre-treated at the Hill AFB IWTP and then sent on to a Publicly-Owned Treatment Works (POTW) for final treatment. In August 2000, a permit change in VOCs limit in the Central Weber Sewer Improvement District (CWSID) allowed for concentrations up to 2,130 µg/L total VOCs in effluent discharged to the CWSID. Based on favorable results from studies performed and discussions with the CWSID, modifications were made to the OU 1 effluent piping network during 2004 to allow the discharge of OU 1 groundwater to CWSID. The ESD incorporated these changes into the remedy for OU 1. | Final Explanation of Significant Difference for Operable Unit 1, July 2006. |
| 1 | OU1 | 10 | 2006 | Post-ROD Study | Data gap evaluation of existing spring data of arsenic contaminated sediment performed. Evaluation performed to provide an overview of previous sampling performed in areas affected by the OU 1 springs and to identify data gaps that would required addressing prior to development of the Removal Action Work Plan. | Project B Arsenic-Contaminated Sediment Removal Support, Data Gap Evaluation of Existing OU 1 Spring Data |
| 1 | OU1 | 8 | 2007 | Post-ROD Study | Characterization and remedial action assessment of arsenic impacted springs performed. The purpose of this sampling event was to screen and collect sediment samples at Springs U1-303, U1-304, U1-305, and U1-318 to address data gaps identified in previously collected data. | Characterization and Remedial Action Assessment Report for the Operable Unit 1 Arsenic-Impacted Springs |
| 1 | FT009 | 7 | 1989 | No Further Response Action Planned (NFRAP) | Due to the lack of evidence of fire-training related contamination at FTA-1, coupled with the relative "sealing off" of surface water infiltration, it has been concluded that no further IRP action is necessary at FTA-1. During the sampling in the referenced decision document, there was no evidence of soil contamination at FTA-1. It is possible that any contaminated materials were removed during interim construction activities at LF3 and LF4. FTA-1 was also covered by the LF clay cap and asphalt during construction activities. Groundwater contamination was found at MW-49 but is attributed to CDP1 and CDP2. | Final Decision Document for Fire Training Area 1, U.S. Air Force Installation Restoration Program, Hill Air Force Base, Utah, July 1989 |
| 1 | FT081 | 4 | 1994 | Treatability Study | A Bioventing study was conducted at FTA081 an reduced TPH-DRO concentrations in soil to below the Tier 1 Screening level of 5,000 mg/kg. The study lasted approximately one year. | Operable Unit 1 Fire Training Area 2 No Further Response Action Planned (NFRAP) Decision Document, IRP Site FT081, Leaking Underground Storage Tank Site EIIK, Hill Air Force Base, |
| 1 | FT081 | | 2001 | No Further Response Action Planned (NFRAP) | FTA-2 was recommended and accepted for NFRAP status. | Operable Unit 1 Fire Training Area 2 NFRAP Decision Document, IRP Site FT081, Leaking Underground Storage Tank Site EIIK, Hill Air Force Base, Utah |
| 1 | OT014 | 5 | 1991 | NFRAP | There is no record use of the golf course as a disposal site. The golf course was investigated only to determine the influence of irrigation on groundwater flow at the known disposal sites at OU 1 and OU 3. Effects of recharge from all sources will be addressed in the RI/FS reports for each operable unit. | Final Decision Document for Site OT14 - Golf Course, Hill Air Force Base, Utah |

Table OU 1-2

## Chronology of Site Events OU1

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 1 | WP002 | | 1995 | Treatability Study | The Ethanol flushing treatability study was performed to assess innovative technology effectiveness for the OU 1 site remediation. | Innovative Subsurface Remediation: Field Testing of Physical, Chemical, and Characterization Technologies. |
| 1 | WP002 | | 1996 | Treatability Study | Air Sparging/Soil Vapor Extraction Treatability Study performed. The study determined that contaminant removal rates by volatilization due to air sparging were higher than what could be achieved with a conventional pump and treat system. The addition of oxygen to the soils and groundwater appeared to enhance contaminant removal. The elevated carbon dioxide levels suggest that aerobic biodegradation was significant. | Innovative Subsurface Remediation: Field Testing of Physical, Chemical, and Characterization Technologies. American Chemical Society Symposium Series 725 |
| 1 | WP002 | | 1996 | Treatability Study | In-Well Aeration/Vertical Co-solvent Solubilization Treatability Study performed. | Hill AFB Environmental Restoration Management Action Plan - 2001 |
| 1 | WP002 | | 1996 | Treatability Study | Co-solvent Mobilization Treatability Study performed. Both flushing methods (single phase microemulsion study and co-solvent mobilization study) removed approximately 90% of the mass based on soil cores and constituent removal in extraction wells and approximately 80% based on partitioning tracers. | Innovative Subsurface Remediation: Field Testing of Physical, Chemical, and Characterization Technologies. American Chemical Society Symposium Series 725 |
| 1 | WP002 | | 1996 | Treatability Study | Complexing Sugar Flush Treatability Study performed. The technology was successful in enhancing remediation of the contaminated site. As an enhanced solubilization technology, it is not as aggressive as mobilization-based flushing technologies, but more efficient than water flushing. | Innovative Subsurface Remediation: Field Testing of Physical, Chemical, and Characterization Technologies. American Chemical Society Symposium Series 725 |
| 1 | WP002 | | 1996 | Treatability Study | Surfactant solubilization treatability study performed. The mobilization mechanism was more effective than the solubilization mechanism in terms of contaminant removal for approximately the same amount of contaminant mass.<br>The results show that that there is significant potential for surfactant systems to expedite pump and treat remediation of residual oil and encourage the continued development and implementation of these systems. | Innovative Subsurface Remediation: Field Testing of Physical, Chemical, and Characterization Technologies. American Chemical Society Symposium Series 725 |
| 1 | WP002 | | 1996 | Treatability Study | Surfactant Middle Phase Microemulsion Treatability Study performed. | Hill AFB Environmental Restoration Management Action Plan - 2001 |
| 1 | WP002 | | 1996 | Treatability Study | Steam Injection Treatability Study performed. | Hill AFB Environmental Restoration Management Action Plan - 2001 |

**Notes**

| | |
|---|---|
| CDP | Chemical Disposal Pit |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CWSID | Central Weber Sewer Improvement District |
| FS | Feasibility Study |
| FTA-1 | Fire Training Area 1 |
| FTA-2 | Fire Training Area 2 |
| IWTP | Industrial Wastewater Treatment Plant |
| LF3 | Landfill 3 |
| LF4 | Landfill 4 |
| LNAPLs | Light Non Aqueous Phase Liquids |
| mg/kg | milligrams per kilograms |
| NPL | National Priority List |
| O& M | Operations and Maintenance |
| OU 1 | Operable Unit 1 |
| RAO | Remedial Action Objectives |
| RI | Remedial Investigation |
| ROD | Record of Decision |
| TPH-GRO | Total Petroleum Hydrocarbons - Gasoline Range Organics |
| U.S. EPA | United States Environmental Protection Agency |
| UDEQ | Utah Department of Environmental Quality |
| UDWQ | Utah Division of Water Quality |
| VOC | volatile organic compound |
| WP080 | Waste Phenol Oil Pit |
| µg/l | microgram per liter |

Table OU 1-3

## Progress Since Last Five Year Review - Status of Recommendations and Follow-Up Actions at OU 1

*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Site | 2003 Five-Year Review Recommendations | Current Status | Carry over to next FYR |
|---|---|---|---|
| OU1 | Re-evaluate the non-source area monitored natural attenuation remedial action to determine if it is still applicable in all non-source areas (specifically in the area of measurable hydrocarbon concentrations outside Trench D). | **In Progress.** An evaluation of the non-source area was completed and results presented in the internal draft version of the PSVReport. The PSVReport indicates that the non-source area plume will likely not naturally attenuate in the 12 years estimated in the OU 1 ROD (**Hill AFB CEVR, 2008**). In addition, although the off-Base dissolved VOC plume appears to be shrinking in most areas, the PSVR indicated that elevated concentrations at monitoring well U1-1602 need to be investigated further (**Hill AFB CEVR, 2008**). The natural attenuation calculations are being reevaluated to incorporate more refined depth constraints on estimates of MNA timeframe, and to establish bounds on the timeframe. | Yes |
| OU1 | Modify ERPIMS to indicate springs and seeps that are dry during a sampling event. | **Complete**. A metric was included in the PSVReport to report spring and spring collection system flow measurements. Reports are prepared annually and include a discussion of spring flow and spring collection flow behavior during the year. The ERPIMS were modified to indicate springs and seeps that are dry during sampling events (**Hill AFB CEVR, 2008**). | No |
| OU1 | Review the long term monitoring sampling and analysis plan to ensure that locations where the hydrocarbon concentrations were located during the Source Zone Area Delineation project (Intera, 2001) are sampled. | **Complete**. The long term monitoring plan was updated to include locations where the hydrocarbon concentrations were located during the Source Zone Area Delineation project. The sample locations are presented in the OU 1 PSVReport (**Hill AFB CEVR, 2008**). | No |
| OU1 | Proceed with the delineation and excavation of the arsenic contaminated soils at the springs. | **In Progress**. Soil sampling events to screen and collect sediment samples at several springs has been performed to address data gaps identified in previously spring collected data. Based on the results of sediment sampling events performed at OU 1 the areas of arsenic-impacted sediment have been delineated (**CH2M HILL, 2007e**). The OU 1 CEVR Site & O&M Manager, reported in the FYR interview that removal of arsenic contaminated soil is tentatively scheduled to occur in 2008. However, the removal is contingent upon obtaining a real estate agreement with the affected landowner (**CH2M HILL, 2007d**). | Yes |
| OU1 | Determine if the trenches are containing/capturing the contamination in the source area by evaluating the gradient around the trenches. Additional monitoring points may be necessary to confirm that the prescribed water levels in the sumps are adequate to maintain containment. | **Complete**. Based on the findings reported in the OU 1 PSVReport, the groundwater extraction trenches are effectively capturing most of the dissolved contaminant mass the majority of the time. However, despite the effectiveness of the trenches, contaminant mass continues to escape from the source area. The escaped mass appears to be less than the assimilative capacity of the plume. The escape occurs in two ways: (1) ongoing, continuous escape by groundwater flowing across and underneath the trenches; and (2) episodic escape when water levels are above the Provo/Alpine contact in exterior Trench D, and in particular the segment associated with sump U1-221 (**Hill AFB CEVR, 2008**). | No |

Table OU 1-3

Progress Since Last Five Year Review - Status of Recommendations and Follow-Up Actions at OU 1

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Site | 2003 Five-Year Review Recommendations | Current Status | Carry over to next FYR |
|---|---|---|---|
| OU1 | Re-evaluate the risk analysis for OU 1 to determine if revised contaminant action levels are warranted based on new standards and toxicity factors, as explained in the Technical Assessment in the 2003 five-year review. | **Ongoing**. Human health risks were re-evaluated in a recent draft technical memorandum (**Hill AFB CEVR and SES, 2007**). Conclusions for OU 1 stated that because the calculated non-carcinogenic risk changed significantly for Fire Training Area 2, a revised risk assessment should be conducted prior to allowing construction work involving subsurface soils in this area. Action: This area is already identified on the Contamination Summary Map Hill Air Force Base Utah (The Restricted Use Access Map). The AF 332 work order review process implementing Air Force Instruction (AFI) 32-7020 Hill AFB Supplement 1 (AFI 32-7020 HAFBS1, 18 February 2004) requires CEVR review and coordination on any planned construction projects. In the event that construction activities are proposed, contaminant concentrations in the soil will be compared to the then current risk screening concentrations (i.e., EPA Region 3 Risk-Based Concentrations) to determine what, if any, action is required to protect construction workers from unacceptable exposure.<br>Additionally, the review identified changes to the PRGs for soil associated with OU 1. Because site closure is not anticipated for many years and additional changes to risk-based cleanup goals are likely, no action is currently recommended. | No |
| OU1 | Re-evaluate the RI data on indoor air and determine if the new action level for TCE (0.43 ppb) in indoor air warrants additional mitigation measures in off-Base residential areas. | **Complete**. Residential indoor air sampling is included as part of the Basewide Indoor Residential Air Sampling Program BASAP. The BASAP was prepared to standardize sample collection and analysis procedures for all Hill AFB indoor air sampling projects. The BASAP is an ongoing program at Hill AFB and the collection of additional indoor air and water samples at residential locations is planned. Residences overlying contaminated groundwater or within the immediate vicinity of groundwater plumes have been contacted annually since 2003 for indoor air sampling (**MWH, 2004**). This issue is further addressed under the Indoor Air Program. | No |
| OU1 | Address drainage and ponding issues on Landfills No. 3 and No. 4 as soon as they are identified to ensure the landfill cap integrity. | **Complete**. Landfill cap inspections are being conducted and a Basewide CERCLA Cap System Inspection, Operation, and Maintenance Program was developed. Inspections are reported on the annual Treatment System Operation Report and Inspection, Monitoring, and Maintenance Report (**CH2M HILL, 2007f**). | No |
| OU1 | Ensure that all gates and fences are locked in accordance with the ROD-specified institutional controls. | **Complete**. Hill AFB performs an annual evaluation of the ICs in place for the Base. This includes verification of orders, leases, groundwater use restrictions, and inspections of signage, fences, and monitor wells. An annual land-use controls report is prepared documenting the results of this work (**Hill AFB CEVR, 2007b**). | No |
| OU1 | Determine if the plume mean concentrations are decreasing, using the described locations and monitoring frequency outlined in the PSVPlan and the results of the PSVReport, scheduled for 2006. This recommendation was based on the issue that with the years of data available, plume concentration trends can be evaluated. | **Complete**. The PSVReport provides an evaluation of plume concentration trends. The report states that based on data collected from 2001 through 2005, it appears that the dissolved-phase cis-1,2-DCE plume is stable or shrinking. Other contaminants of concern (COCs) present in groundwater generally follow the pathway of the cis-1,2-DCE plume at the OU 1 site. However, although the off-Base dissolved VOC plume appears to be shrinking in most areas, the PSVR identified that concentrations at monitoring well U1-1602 appear to be rising. | No |

Table OU 1-3

## Progress Since Last Five Year Review - Status of Recommendations and Follow-Up Actions at OU 1

*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Site | 2003 Five-Year Review Recommendations | Current Status | Carry over to next FYR |
|---|---|---|---|
| OU1 | Ensure that the method detection limits (MDLs) are low enough to detect a contaminant of concern. | **Complete**. A Basewide Quality Assurance Project Plan (BQAPP) was prepared in December 2003 to standardize analytical data collection, reporting, and validation activities (to the extent practicable) and to maximize data consistency and comparability between programs (**MWH, 2003**). A cross-check of the PRGs and MCLs listed in the OU 1 PSVPlan against the Reporting Limits (RL) of the BQAPP indicates that in all cases except Fluoride, the RLs required were less than or equal to the PRGs and MCLs. For fluoride analysis, the BQAPP states that the RLs must be established on an individual contract basis. An ERPIMS check of OU 1 Fluoride data showed that the MDLs achieved are well below the PRG and MCL for fluoride. | No |
| OU1 | Collect samples from all locations described in the PSVPlan and ensure that the results are entered in ERPIMS. [Related to the following issue: "Analytical data were not available for review. This could be as a result that a well might have been dry." In order to facilitate data review, additional well conditions during sampling events (i.e., "well is dry") should be included in ERPIMS.] | **Complete**. A Basewide Monitoring and Maintenance Work Plan was prepared to document sampling, monitoring, and maintenance activities, last updated on July 2007. Upon completion of the data validation, the sampling data is submitted to the ERPIMS database (**CH2M HILL. 2007g**). | No |
| OU1 | Continue to perform landfill cap inspections. | **Complete**. The CERCLA Cap System Inspection, Operation, and Maintenance Plan was developed and landfill cap inspections are being conducted at OUs 1, 3, 4, and 7 as part of the maintenance plan (**CH2M HILL. 2007f**). | No |
| OU1 | Ensure that regulatory approval is granted before the CAMU is used for any future remedial actions. [Related to the following issue: "The ROD established a CAMU according to the rule in place in 1993. The CAMU was established to facilitate remedial actions. Movement of soil or landfill materials to appropriate location within the boundaries of the CAMU complied with RCRA land disposal restrictions. Changes to the materials in, or usage of, the CAMU may not comply with rule changes."] | **Ongoing**. CEVR has indicated that interactions with regulators will be ongoing and approval of any future remedial actions will be obtained prior to initiation of such events. According to the CEVR, this issue was discussed at an RPM meeting in 2004. | No |

**Notes:**
FYR - Five-Year Review
ROD - Record of Decision
PSV - Performance Standard Verification
BASAP - Basewide Air Sampling and Analysis Plan for Indoor Residential Air Sampling.

Table OU 1-4
# Operable Unit 1
# Five-Year Review Process

Reviewer: Victor Martinez

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|---|---|
| **Introduction** | This 2008 five-year review for Hill AFB has been conducted in accordance with EPA Comprehensive Five-Year Review Guidance dated June 2001 (**EPA, 2001**). Administrative and community involvement components of the five-year review are described in **Section 2.0** of this report for the 2008 five-year review. Interviews and site inspections were conducted specific to each OU. In addition, relevant site documents and applicable data covering the period of the five-year review were evaluated. The interviews, site inspection, and data review for OU 1 are discussed in the following sections. Documents reviewed for OU 1 as part of the 2008 five-year review are provided in **Appendix C**. |
| **Interviews** | Interviews for OU 1 were conducted with Jason Dalpias/ Environmental Management/CEVR, Site and O&M manager, Ray Spencer/75 CEG/CEVR O&M Manager for Landfill Caps, and John Barlow/O&M contractor for CH2M HILL. Copies of the Interview Record Forms are provided in **Appendix D**.<br><br>Mr. Dalpias provided responses via electronic mail on December 14, 2007. He indicated that Hill AFB has conducted considerable amount of work to evaluate and optimize the OU 1 groundwater and LNAPL extraction system. He mentioned that Hill AFB has collected monitoring data and performed analysis as specified in the 2001 PSVPlan and that an overall review of the monitoring data and the remedies at OU 1 was initiated in 2006 and continues to date. With regards to remediation of the non-Source Area, Mr. Dalpias mentioned that data collected since the 2003 five-year review indicate the plume is degrading, however, the internal draft version of the PSVReport identified that concentrations at Monitoring Well U1-1602 appear to be rising and this issue needs further investigation. He stated that U1-1602 is located on the hillside adjacent to the OU 1 Source Area, it is downgradient of the remedial system, and it was unknown at the time of the interview whether or not unknown contamination downgradient of our Source Area is the cause of the high concentrations at U1-1602. Mr. Dalpias also indicated that removal of arsenic-contaminated sediments from springs is scheduled for the Summer/Fall of 2008. However, this removal action is contingent upon obtaining a real estate agreement with the affected landowner. Hill AFB will not be able to complete this remedial action until a real estate agreement is reached with the landowner.<br><br>Mr. Barlow was interviewed on September 24, 2007. He indicated that operations at OU 1 were constantly getting better as changes in procedures and operations have been developed and overall he was impressed with the work performed at OU 1 since 2002. He also stated that the amount of LNAPL recovered has continued to decrease and that the system was successful at capturing the plume effectively. Mr. Barlow stipulated that the LNAPL volume removed fluctuates depending on the amount of rainfall received over the year. He stated that operations have worked to adjust pumping zones by turning off or reducing pumping at some sumps to increase water levels in some areas and push LNAPL towards other sumps. Mr. Barlow stated that the two most significant O&M issues were fouling problems and pump maintenance. The sumps were upgraded to remove the need to perform a confined space entry to perform maintenance on the pumps. Air surging procedures have been implemented to remove fouling from the lines. Also, all sumps and influent lines from the trenches were recently cleaned, which has improved the performance of the collection system. In addition, there was a fouling issue reported in the sewer lines that are commingled from OU 1 and OU 2. The sewer lines were cleaned to remove fouling, most likely associated with OU 1. Mr. Barlow stated that lightning strikes have occurred that have knocked out programmable logic controller boards. Also, a high-pressure fire hydrant line ruptured and flooded the exterior trench, but he stated that they were still able to maintain capture in the trench. |

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|---|---|
| | Mr. Spencer was interviewed via telephone on December 13, 2007. He stated that he manages the Inspection, Monitoring, and Maintenance Reporting contract for the landfill cap, which includes annual inspections, repairs, and reporting for the caps at OU 1. Mr. Spencer indicates that repairs have been relatively minor, involving repairs to fences and gates, replacing signs, cleaning culverts, and repairing animal burrows and that there are no issues with ponding on the landfill caps. Mr. Spencer believes the caps were effective at limiting the infiltration of rainfall and snowmelt and they should limit the movement of contaminants to the groundwater. He further stated that no activities are allowed on the landfill caps, and there were therefore no direct human exposure to the landfill contents.<br><br>Based on interviews from Mr. Dalpias and Mr. Barlow, both agree that remedial operations at the site have resulted in large amounts of LNAPL and groundwater contaminated with dissolved VOCs being removed from the OU 1 Source Areas. Data collected since the 2003 five-year review indicate that progress toward achieving remedial goals is being made.<br><br>Mr. Dalpias and Mr. Spencer were aware of concerns from one resident in South Weber who resides at the base of the hill below OU 1. Mr. Spencer stated that this resident does not believe the landfill contents have been sufficiently characterized and that the resident is concerned with the affect the landfills might have to his family and property. The resident formed the South Weber Landfill Coalition, which was awarded a Technical Assistance Grant (TAG) by the EPA.<br><br>Interviews with members of the community were performed by Hill AFB's community involvement contractor. The interviews included local residents, city officials from the surrounding communities, and members of the RAB. Interviews were conducted with Mr. Joe Gertge/South Weber City Mayor and Mr. Matt Dixon/ South Weber City Manager. A copy of the Interview Record Form is provided in **Appendix B**.<br><br>Mayor Gertge said that it appears the Base has taken a multi-faceted approach to clean up a widespread problem. The Base has been forthcoming and anxiously engaged with the city and values the city's advice. The Base has also been willing to work with the community and explain things at a non-technical level for the layman. He also said he is very comfortable with the information mechanism. The Base is very open and provides reports to the city and the RAB representatives, Mr. Joel Workman and Ms. Jan Ukena. He also feels that over the last 5 years, the Base has improved both the dissemination of information and the quality of the information distributed, though he did note that some of the cancer studies are difficult to understand.<br><br>Mr. Dixon said that has been impressed with Hill AFB's technical people in the restoration program. He said he has met with Mr. Jason Dalpias and Mr. Bob Elliott and they have explained the cleanup process to him. Hill AFB's people are accessible, responsive, and willing to supply charts or maps if requested. He suggested that the base educate the newly elected officials at the first of the year, and perhaps offer a tour of the cleanup sites.<br><br>Both Mayor Gertge and Mr. Dixon indicated that development has been slowed due to concerns associated with the contamination and community concerns are focused on impacts to property values.<br><br>Mr. Brent Poll, Executive Director of the South Weber Landfill Coalition, responded to the interview request via letter. Copies of the interview responses are provided in **Appendix B**. Mr. Poll's response highlighted several concerns related to the selection and success of the OU 1 remedy described by the ROD, the associated risks, availability of information about the contamination at the Base, financial responsibility of the cleanup, and a perceived conflict of interest that the Base serves as the lead agency under CERCLA. |

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| **Site Inspection** | The site inspection for OU 1 was conducted on September 24 and 28, 2007. The completed site inspection checklist is provided in **Appendix E**.<br><br>Based on the site inspection, it appears that OU 1 is well maintained, O&M staff are onsite daily and equipment is kept in working condition. Due to the large number of wells present at OU 1, not all wells were inspected. However, those wells that were inspected were in good condition. Currently, all water is discharged directly (without treatment) to the CWSID under a discharge permit. Discharge limits are set by permit, which is updated every three years or as determined necessary by CWSID. Compliance sampling is performed and reported under a separate contract. Data is collected and reported quarterly to the CWSID. Groundwater sampling is performed and reported under a separate Basewide contract. Data is reported quarterly and an annual report is prepared for the Basewide sampling. Visual inspections for differential settlement are noted in the yearly inspections.<br><br>Access and ICs are currently in place at OU 1. Fences appeared to be in good condition. Minor fence damage has been noted in the past and repaired as needed. Gates do not serve to prevent pedestrian access to landfill caps, but they do serve to keep vehicle traffic off the caps. Signs are posted at landfill gates, along the fences, and on OU 1 site buildings. Signs appeared in good condition. Signs note contact information and many note restrictions and/or presence of contamination. Hill AFB performs an annual evaluation of the ICs in place for the Base. This includes verification of orders, leases, groundwater use restrictions, and inspections of signage, fences, and monitoring wells. An annual land-use controls report is prepared documenting the results of this work.<br><br>Landfill inspection indicates that they are being properly maintained. Some previous settlement has occurred along old landfill trenches at Landfill No.4, but currently no new settlement has occurred. Minor cracks were observed in cap for Landfill No. 4, but no significant cracks were observed at Landfill No. 3. Animal burrows were present across both landfills; however, there are no signs that the burrows penetrated the bentonite mat underneath the soil cover. No wet areas or areas of ponding were observed. Landfills are inspected after rainfall to inspect the caps for ponding and water damage. All surface water from landfills flows into Pond 10, where it is allowed to be pumped to the sewer after precipitation events. There are collection sumps located at several off-base seeps/springs. The springs and seeps no longer flow and these structures were not operating. LNAPL is removed by collection systems and by an OWS and shipped off-site for disposal. Water is discharged to CWSID for treatment.<br><br>The site inspection checklist addressed four discussion topics. These discussion topics are presented below, followed by responses and general observations based on the site inspection.<br><br>(1) Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).<br><br>The OU 1 remedy was to achieve 12 goals as presented in **Table OU 1-1**. Landfill caps were constructed over Landfills No. 3 and 4 to prevent exposure to the landfill contents and minimize the infiltration of water through the landfill contents to the underlying groundwater. Areas of contaminated soil are also covered by the caps. The landfill passive vents are monitored to verify that gas concentrations do not reach explosive levels.<br><br>Institutional controls are in place to prevent exposure to contaminated groundwater at OU 1. The non-Source Area groundwater plume is being addressed through monitored natural attenuation.<br><br>A series of collection trenches have been installed around the OU 1 Source Areas to collect and contain contaminated groundwater in this area. These trenches also recover LNAPL. The extracted groundwater and LNAPL is piped to the Central Facilities Building, where an OWS removes the LNAPL from the water. The LNAPL is shipped offsite for disposal. The water is then piped directly to the CWSID for treatment under permit. |

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| | Collection systems are in place at several springs at OU 1 to collect contaminated water. However, due to the success of the Source Area extraction trenches, the springs and seeps currently do not flow. Hill AFB is currently in the process of preparing to remove the arsenic contaminated sediments identified with many of the springs and seeps as a result.<br><br>Based on the site inspection, all components of the remedy appear to be functioning as designed.<br><br>(2) Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.<br><br>Operation and maintenance at the site includes maintenance of the extraction trenches and associated sumps and piping, long-term monitoring of the site groundwater, maintenance of the landfill caps and fencing, and O&M of the spring collection systems, conveyance systems, and the Central Facilities Building. Site monitoring data demonstrates that inward hydraulic gradients are regularly maintained by the extraction system, as is also evidenced by the lack of flow in the springs and seeps. The effluent is monitored to ensure that the treatment and discharge criteria are met. A few exceedences of the discharge limits for pentachlorophenol have occurred. Proper inspection and maintenance procedures are in place and implemented to ensure the integrity of the landfill caps and to ensure the enforcement of ICs (groundwater use restrictions, land use restrictions on-site, integrity of fencing, and signage).<br><br>(3) Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.<br><br>There are no issues related to the O&M procedures (cost or scope) that would indicate the protectiveness of the remedy may be compromised in the future. The design of the system and the nature of the NAPL are such that a constant O&M presence onsite will be required for the foreseeable future.<br><br>(4) Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.<br><br>An internal draft version of the PSVReport was completed for OU 1 in late 2006. The internal draft version of the PSVReport recommended changes to the PSVPlan for OU 1. Operation and maintenance contractors make recommendations to optimize performance and/or reduce costs. No optimization opportunities were identified as part of the site inspection. With all operating systems at the site, the CEVR staff and O&M contractors expressed that there is a constant issue with fouling in process lines, pumps, and wells. The CEVR staff and their contractors continue to work to develop methods to deal with the fouling issues, which potentially can impact costs to operate their systems. |
| **Data Review** | The data reviewed as part of the 2008 five-year review included groundwater samples, effluent discharge samples, surface water samples from seeps and springs, spring interceptor trenches, groundwater elevations, slope stability data, LNAPL recovery data, and system flow data. Groundwater data were collected on a biennial, annual, semiannual, or quarterly basis during the current review period. All sump water elevations are currently measured manually on a monthly basis, and several sumps are monitored continuously using pressure transducers. Sump flow monitoring occurs weekly, and consists of manual reading of the totalizing flow meter (in gallons) from each of the sumps located at OU 1. Instantaneous flow measurements are recorded from the sump flow meters electronically. Slope inclinometers are measured on a yearly basis.<br><br>The ROD established remediation goals for groundwater, surface water, soils, sediments, LNDAPL plume, and Landfills at OU 1. For groundwater seeps and springs, the remediation goals were set at the MCLs established under the SDWA and the UDEQ. Effluent is discharged from OU 1 to the CWSID under permit number HAFB/OU 1246, which is valid through September 1, 2010 and requires quarterly submittal of a report documenting analytical results |

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| | and the quantity of effluent discharged. Combined groundwater from OUs 1 and 2 is discharged into the sanitary sewer without further treatment. All OU 1 effluent discharge samples from 2004 through 2006 were within the permitted limits as presented in **Table OU 1-6**. Remediation goals and effluent discharge limits are presented in **Tables OU 1-5** and **OU 1-6**.<br><br>Metrics evaluated as indicators of system performance of the groundwater trenches included groundwater elevation in trench piezometers, water elevation in trench sumps, and the volume of groundwater extracted from the sumps. Groundwater elevation measurement in the Source Area is a system indicator criteria for monitoring the performance of the groundwater extraction trenches. The data review suggests that the trenches have performed adequately with respect to dewatering the Source Area, and that groundwater levels measured in trench piezometers are reliable indicators of groundwater elevation both within the Source Area and immediately downgradient from it.<br><br>The water level in a sump is an indicator of whether groundwater is being intercepted and removed by the corresponding groundwater extraction trench, and thus whether the system is operating successfully. A preventative maintenance program was introduced during 2004 that included regular pump cleaning and bimonthly hydroxyacetic acid treatment to inhibit fouling in the pumps and process piping at U1-219. Design water elevations were exceeded in sumps U1-214, U1-215, U1-216, U1-217, U1-218, U1-219, U1-220, U1-221, and U1-224 during the reviewing period despite the maintenance program. Trench point water elevation measurements are a system indicator criteria for monitoring the performance of the groundwater extraction trenches. Some dissolved contaminant mass escape has occurred from the Source Area via groundwater flowing under the trenches, but it represents a small fraction of the mass captured by the trenches. However, if the trenches are also allowed to overflow there is a threat of contamination leaving the site. The internal draft version of the PSVReport states that the majority of the mass escape from the Source Area occurs at trench D. An analysis of historical data indicated that the water level in Trench D rose above the Provo/Alpine contact 21 percent of the time between May 2001 and December 2005, occurring mostly in 2005. During these episodes of high groundwater, approximately 56 to 65 pounds of total COCs and 50 to 59 pounds of total VOCs escaped through Trench D in the Provo Formation. The internal draft version of the PSVReport indicated that more than 75 percent of the total COC and total VOC mass that escaped Trench D in the Provo Formation was lost through the trench segment associated with sump U1-221, and about 24 percent of the COC mass lost was through the trench segment associated with sump U1-224 (**Hill AFB CEVR, 2008**). The groundwater trench system was designed to contain contamination, and therefore it is important to maintain control of groundwater elevation levels within each of the trenches. During elevated groundwater conditions, an increase in sump flow is to be anticipated. During such periods, high flow should not necessarily be a concern; however, if sump flows are low during periods of elevated groundwater conditions, it might be an indication suggesting a blockage of the trench piping or need for pump maintenance (**Hill AFB CEVR, 2008**).<br><br>In addition, the volume of LNAPL recovered is a measure of ongoing trench performance and a future indicator of when a change of remediation strategies might be appropriate (**Hill AFB CEVR, 2008**). The annual volume of LNAPL recovered from sumps U1-216, U1-217, and U1-220 remained fairly stable during the period from 2002 through 2005. This represents a median annual volume recovered of approximately 3,304 gallons from the period of 2001 to 2005. However, during 2006, the annual volume of LNAPL recovered from the sumps U1-216, U1-217, and U1-220 decreased significantly to 426 gallons. The annual volume of LNAPL recovered from sump U1-221 appears to be declining. The volume of LNAPL recovered at U1-221 has decrease from 266 gallons in 2002 to 52 gallons in 2006. The recovery of LNAPL has continued longer than anticipated by the trench system design, and is expected to continue into the foreseeable future. As of February 2007, the total amount of LNAPL recovered from OU 1 trenches is 16,707 gallons.<br><br>Inclinometers were installed at OU 1 to monitor slope movement and assess the effects of groundwater remediation systems on slope stability. Slope stability is used as an indicator of system performance. Slope inspections and inclinometer measurements made during the period |

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| | from 2002 through 2005 (after trench construction) suggest that the escarpment slope is stable. No visual evidence of slope instability was observed during the period. An apparent movement was detected during the reviewing period in each of U1-762, U1-859, and U1-861, but the movement was ultimately credited to causes other than slope movement (**Hill AFB CEVR, 2008**).<br><br>Spring collection system flow and surface spring flow and are the primary metrics for monitoring the springs and the spring collection systems. In addition, monitoring of water concentrations is the metric for the surface water and spring collection system because receptors are exposed to a potential risk if groundwater with elevated contaminant concentrations. Data review of the annual inspections of the springs and surface waters located off-Base and north of the Source Area showed that the majority of the springs were dry at the time of the inspection from 2001 through 2005. Spring U1-309 was the exception, having observed a flow of 25.1 gpm at the time of the 2004 inspection. None of the water samples collected during the annual inspections had measured concentrations in excess of the preliminary remediation goals (PRG) for the OU 1 COCs. Spring collection systems installed to intercept groundwater before it surfaces at springs U1-303 and U1-304 reported no or very low levels of flow during the period from 2001 through 2005. Measured flow in each system has been below 0.1 gpm throughout the majority of this period although U1-304 had a flow of 0.4 gpm during June 2005, an event which coincided with a period of elevated sump water levels in U1-224. During the period from 2001 through 2005, the measured flow in spring collection system U1-307 ranged from 0 to 9.4 gpm. In each sample collected from 2002 through 2005, cis-1,2-DCE has been detected at concentrations above the PRG from collection system U1-307. Vinyl chloride was detected in U1-307 above the PRG in 2002, but has not been above the PRG since that sampling event. At U1-307, arsenic has not been detected in samples at concentrations above the PRG of 10 micrograms per liter (µg/L) from 2001 through 2005. Vinyl chloride was detected above its PRG in water samples from U1-304, in 2005. No other VOC COCs have been detected above PRGs in samples from collection systems U1-303 and U1-304 during the period from 2001 through 2005. Arsenic was detected above the PRG of 10 µg/L in water samples collected in 2005 from U1-303 and U1-304 at 26.8 µg/L and 159 µg/L, respectively (**Hill AFB CEVR, 2008**). In late 2006, Hill AFB conducted an Arsenic-Impacted Sediment Sampling Event to screen and collect sediment samples at Springs U1-303, U1-304, U1-305, and U1-318 to address data gaps identified in previously collected data. Review of the sediment sample analytical results indicate that the aerial extent of arsenic impacted sediment has been identified at Springs U1-303, U1-304, U1-305, and U1-318. However, due to difficulty in deeper sample collection, the vertical extent of contamination is not well defined (**CH2M HILL, 2007e**).<br><br>The metric for Landfill Cap Inspection is to verify that annual landfill inspections are being performed and that the cap successfully inhibits infiltration of precipitation and runoff. The annual *Operable Unit 1 CERCLA Caps Inspection, Operation, and Maintenance Program, Final Report, Treatment System Operation Report (TSOR) and Inspection, Monitoring, and Maintenance Report (IMMR)* documents the inspections. The annual OU 1 IMMR for calendar years 2003 through 2006 were reviewed to verify that the annual inspections were conducted as required by the monitoring plan. The 2006 IMMR concluded that the caps are in good condition with only minor defects that do not affect the performance of the caps (**CH2M HILL, 2007f**). However, since the mid-1990s Battelle Pacific Northwest Laboratory (PNL) has performed sporadic but ongoing research at OU 1 focused on the effectiveness of the landfill caps with respect to infiltration (**Hill AFB CEVR, 2008**).<br><br>Monitor Natural Attenuation was the selected remedy for the non-Source Area groundwater plume. The remedy requires long-term groundwater monitoring to determine if the RAOs are being met. Collection of groundwater concentration data is a metric required to monitor groundwater conditions in and around the contaminant plume. Temporal change in plume mass is a metric that provides an indication of the assimilation capacity of the aquifer. This metric is used to monitor plume behavior and the progress toward restoring groundwater to beneficial use. The apparent attenuation rates are used to estimate the remedial timeframe of the non-Source Area plume. The plume center of mass, also referred to as the centroid, is a metric that |

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| | can be used to track spatial movement of the plume over time, and thus to determine whether it is advancing, retreating, or stationary. The internal draft of the PSVReport indicates that cis-1,2-DCE at monitoring well U1-1602 from the period of June 2003 through November 2006, appear to be stable. Concentrations in monitoring points located downgradient of the groundwater trenches did exhibit a period of increasing concentration immediately after trench construction; however, temporary perturbations in groundwater concentrations are expected based on the amount of subsurface disturbance that occurred during construction activities. Based on the period from about June 2003 through November 2006, the dissolved mass of cis-1,2-DCE appears to be decreasing in the west plume. In addition, review of analytical data from monitoring points located outside of the baseline plume boundaries indicates that contamination has not been found at these points. Currently, the internal draft version of the PSVReport is being updated to address issues identified in the development of the Thiessen polygon method used to evaluate natural attenuation of the non-Source Area plume at OU 1 (**Hill AFB CEVR, 2008**).<br><br>Based on the data review, remedies implemented at OU 1 appear to be achieving remedial action objectives established in the ROD. However, the internal draft version of the PSVReport points out that elevated cis-1,2-DCE concentrations at Monitoring Well U1-1602 have a significant impact on estimating remedial timeframes. Review of the cis-1,2-DCE concentration within the non-Source Area plume indicates that the plume appears to be stable and not increasing in size. The ROD specified that dilution (advection and dispersion) and adsorption were considered to be the most significant processes affecting contaminants in groundwater in the Non-Source Area of OU l. In addition, the ROD stated that the degree of biodegradation in the off-Base plume was unknown, at the time when the ROD was signed, but it was not likely that the off-Base DCE plume in the alluvium would undergo significant biodegradation. The internal draft version of the PSVReport recommends a reduction in the monitoring well network and sampling frequency of MNA wells for the Non-Source Area to obtain an adequate collection of data and evaluate plume dynamics. The internal draft version of the PSVReport is being updated to address issues identified in the development of the estimated plume mass and natural attenuation time frames used to evaluate attenuation of the non-Source Area plume. Once the internal draft version of the PSVReport is updated, it is expected to provide better estimates of the nature and rates of the natural attenuation processes occurring in the Non-Source Area. |

Table OU 1-5

## Chemicals of Concern and Remediation Goals at OU 1

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Media | Chemical of Concern | Remediation Goal | Revised Goal** | Units |
|---|---|---|---|---|
| Groundwater/ Surface Water Seeps and Springs | 1,1,1-Trichloroethane (1,1,1-TCA) | 200 | | ug/L |
| | 1,1-Dichloroethane (1,1-DCA)* | 790 | | ug/L |
| | 1,1-Dichloroethene (1,1-DCE) | 7 | | ug/L |
| | 1,2,4-Trichlorobenzene (1,2,4-TCB) | 70 | | ug/L |
| | 1,2-Dichlorobenzene | 600 | | ug/L |
| | cis 1,2-Dichloroethene (cis 1,2-DCE) | 70 | | ug/L |
| | 1,4-Dichlorobenzene | 75 | | ug/L |
| | 2,4-Dimethylphenol* | 600 | | ug/L |
| | 4-Methylphenol (p-cresol)* | 750 | | ug/L |
| | Arsenic | 10 | Yes | ug/L |
| | Barium | 1000 | | ug/L |
| | Benzene | 5 | | ug/L |
| | Chlorobenzene | 100 | | ug/L |
| | Fluoride | 2400 | | ug/L |
| | Naphthalene* | 1200 | | ug/L |
| | Tetrachloroethylene (Perchloroethylene, PCE) | 5 | | ug/L |
| | Toluene | 1000 | | ug/L |
| | Trichloroethene (TCE) | 5 | | ug/L |
| Soil and Sediment | 1,1,1-Trichloroethane (1,1,1-TCA) | 10 | | mg/kg |
| | 1,1-Dichloroethane (1,1-DCA)* | 13 | | mg/kg |
| | 1,1-Dichloroethene (1,1-DCE) | 0.03 | | mg/kg |
| | 1,2,4-Trichlorobenzene (1,2,4-TCB) | 17 | | mg/kg |
| | 1,2-Dichlorobenzene | 60 | | mg/kg |
| | 1,2-Dichloroethane (1,2-DCA) | 0.1 | | mg/kg |
| | cis 1,2-Dichloroethene (cis 1,2-DCE) | 1.1 | | mg/kg |
| | 1,4-Dichlorobenzene | 5.8 | | mg/kg |
| | 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (2,3,7,8-TCDD) | 0.004 | | mg/kg |
| | 2,4-Dimethylphenol* | 8 | | mg/kg |
| | 4-Methylphenol (p-cresol) | 3.7 | | mg/kg |
| | Benzene | 0.12 | | mg/kg |
| | Benzo(a)pyrene | 21 | | mg/kg |
| | Chlorobenzene | 2.4 | | mg/kg |
| | Ethylbenzene | 11 | | mg/kg |
| | Naphthalene* | 22.5 | | mg/kg |
| | PCB | 10.1 | | mg/kg |
| | Tetrachloroethylene (Perchloroethylene, PCE) | 0.52 | | mg/kg |
| | Toluene | 43 | | mg/kg |
| | Trichloroethene (TCE) | 0.17 | | mg/kg |
| | Vinyl Chloride | 0.03 | | mg/kg |
| | xylenes (total) | 1000 | | mg/kg |

Notes:

* Remediation goals for these chemicals are risk-based levels

** - Remediation goal revised to reflect change to the MCL (see Appendix F)

Unless otherwise specified, the concentrations for ground and surface water are maximum contaminant levels (MCLs) established under the Safe Drinking Water Act and/or Utah Primary Drinking Water Standards

ug/L = micrograms per liter

mg/kg = milligrams per kilogram

Table OU 1-6

## OU 1 System Effluent Discharge Limits for Discharge to the Central Weber Sewer Improvement District

*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Analyte | Discharge Limit | Units |
|---|---|---|
| Total VOCs[1] | 2.13 | mg/L |
| Arsenic | None | |
| Nickel | 4.1 | mg/L |
| Lead | 1.14 | mg/L |
| Zinc | 4.57 | mg/L |
| pH | 5.0-11.0 | |
| Temperature | <140 | °F |

Notes:
mg/L milligrams per liter.
VOCs = volatile organic compounds.
Permit Dates: August 16, 2003 through September 1, 2006 and September 1, 2006 through September 1, 2010.
[1] VOCs Based on Method E624.

Table OU 1-7
# Operable Unit 1
# Five-Year Review Technical Assessment

Reviewer: Victor Martinez

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| **Introduction** | The five-year review must determine whether the remedy at a site is protective of human health and the environment. The EPA guidance describes three questions used to provide a framework for organizing and evaluating data and information and to ensure all relevant issues are considered when determining the protectiveness of a remedy (**EPA, 2001**). These questions are assessed for OU 1 in the following sections. The implementation of ICs is also described. At the end of this table is a summary of the technical assessment. |
| **Question A.** | **Is the remedy functioning as intended by the decision documents?**<br>Yes. The documents that detail the remedial decisions for OU 1 are the 1998 *Record Of Decision* (**Hill AFB EMR, 1998**) and the 2006 *Final Explanation of Significant Difference for OU 1*(**Hill AFB CEVR, 2006**).<br>During 2000 and 2001, the remedial systems, previously installed in response to a Cease and Desist Order issued by the Utah Water Pollution Control Board (currently the UDWQ) on July 23, 1984 at OU 1 were enhanced in response to the selected remedy prescribed in the OU 1 ROD (**Hill AFB EMR, 1998**). A system of groundwater extraction trenches and associated process facilities were constructed to inhibit the off-Base movement of contaminated groundwater. The new trench system incorporated the spring collection systems and the Pond 10 dewatering trench, but other components of the existing system were abandoned. In addition to the trench system, the enhancements included: repairing the landfill caps to prevent ponding; implementing ICs to prevent exposure of human and animal receptors to contamination; establishing a long-term monitoring program for contamination and treatment systems performance; monitoring natural attenuation for groundwater in the non-Source Area; spring collection and treatment; and five-year reviews after commencement of the remedial action to ensure the remedy continues to provide adequate protection of human health and the environment. Monitored natural attenuation is the selected remedy for the off-Base groundwater plume (**Hill AFB EMR, 1998**).<br>The primary goal of the OU 1 remedies is to dewater the Source Area and prevent groundwater contamination of the Non-Source Areas. As of December 2006, the groundwater extraction system has extracted 38,583,486 gallons of groundwater. As of February 2007 and the total amount of LNAPL recovered from OU 1 trenches is 16,707 gallons (**CH2M HILL, 2007a**). Designed water elevations in sumps U1-214, U1-215, U1-216, U1-217, U1-218, U1-219, U1-220, U1-221, and U1-224 have not been maintained below the trench pipe entry elevation. The majority of the springs off-Base and north of the OU-1 Source Area have been dry during 2002 through 2006, and this condition is expected to continue. Flow in the remaining springs has generally been below 3 gpm, although flow of approximately 25 gpm was measured in U1-309 during the 2004 inspection of the escarpment springs.<br>Spatial and temporal changes in the off-base plume due to naturally occurring processes were evaluated in the internal draft version of the PSVReport for OU 1. The OU 1 ROD specified that dilution (advection and dispersion) and adsorption were considered to be the most significant processes affecting contaminants in groundwater in the non-Source Area of OU l. Currently, the internal draft version of the PSVReport is being updated to address issues identified in the development of the estimated plume mass and natural attenuation time frames used to evaluate attenuation of the non-Source Area plume.<br>Remedial actions outlined in the OU 1 ROD have been implemented except for removal of arsenic contaminated soils from the springs. As stated in the ROD, the flow from the springs must first cease in order for the excavation and disposal of the contaminated sediment to be conducted. The operation of the groundwater extraction trenches has caused the majority of |

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| | spring flow to cease, thereby reducing the deposition of arsenic and the potential exposure of receptors to hazardous groundwater and sediments. Removal of the arsenic-contaminated sediments is currently scheduled to occur in the Summer or Fall of 2008. However, this is contingent upon obtaining a real estate agreement with the affected landowner. Hill AFB will not be able to complete this remedial action until a real-estate agreement is reached with the landowner.<br><br>The ROD stated that extracted groundwater from OU 1 was to be pre-treated at the Hill AFB IWTP or the OU 2 ASTP and then sent on to a POTW for final treatment. In August 2000, a permit change in VOCs limits in the CWSID allowed for concentrations up to 2,130 µg/L total VOCs in effluent discharged to the CWSID. Based on favorable results from studies performed and discussions with the CWSID, modifications were made to the OU 1 effluent piping network during 2004 to allow the discharge of OU 1 groundwater directly to the CWSID. On February 28, 2005, permission was granted by the CWSID and the groundwater effluent from OU 1 was re-routed from the Hill AFB IWTP to CWSID. An ESD describing this change was prepared and signed in September 2006 (**HAFB CEVR, 2006**).<br><br><u>Opportunities for Optimization:</u><br><br>The internal draft version of a PSVReport was completed for OU 1 in late 2006. The internal draft version of the PSVReport recommended changes to the PSVPlan for OU 1. URS began operating, maintaining, and upgrading the groundwater extraction system at OU 1 in 2001; CH2M HILL took over O&M in 2006. Operation and maintenance contractors make recommendations to optimize performance and/or reduce costs. No optimization opportunities were identified as part of the site inspection. With all operating systems at the site, the CEVR staff and O&M contractors expressed that there is a constant issue with fouling in process lines, pumps, and wells. CEVR staff and their contractors continue to work to develop methods to deal with the fouling issues, which potentially can impact costs to operate their systems. In addition, there was a fouling issue reported in the sewer lines that are commingled from OU 1 and OU 2. The sewer lines were cleaned to remove fouling, most likely associated with OU 1(CH2M HILL 2007c). Hill AFB will address the sewer line fouling issues as needed.<br><br><u>Early Indicators of Potential Remedy Problems:</u><br><br>Performance issues have been documented at some of the trenches due mainly to fouling of the process lines and to periods of high groundwater levels that resulted in mass escape of COCs. Several efforts have been conducted in order to address these issues, including system upgrades and implementation of additional O&M procedures. The system performance appears to be improving as a result of these upgrades and procedures. However, since these modifications were implemented in the system, the annual precipitation has been lower than in previous years and the effectiveness of the modifications has not been completely evaluated. |
| **Question B.** | **Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?**<br><br><u>Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics:</u><br><br>No, some of the toxicity values used to develop cleanup levels for COCs have become more stringent since the signing of the ROD. The oral reference doses (RfDo) for Toluene has become more stringent. The inhalation reference dose (RfDi) for Benzene, Chlorobenzene, 1,1,-Dichloroethene, TCE have become more stringent. Inhalation slope factor (SFi) for Benzene and TCE have become more stringent.<br><br><u>Changes in Applicable or Relevant and Appropriate Requirements:</u><br><br>The five-year review for OU 1 included identification of and evaluation of changes in the ROD-specified ARARs and To Be Considered to determine whether such changes may affect the protectiveness of the selected remedy. Chemical-specific and action-specific ARARs were reviewed and were all determined to still be applicable, relevant and appropriate, or To Be Considered as presented in **Appendix G**. |

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| **Question C.** | **Has any other information come to light that could call into question the protectiveness of the remedy?**<br>Examples of other information that might call into question the protectiveness of the remedy include potential future land use changes in the vicinity of the site or other expected changes in site conditions or exposure pathways.<br>Yes. The 2003 five-year review indicated that hydrocarbon concentrations were measurable downgradient and to the west of the exterior trench (Trench D) and recommended that and evaluation was to be conducted to determine whether Monitor Natural Attenuation was applicable to this contamination. The evaluation has not taken place because of limited data, only one well (U1-065), is available for monitoring groundwater quality in the area of this LNAPL accumulation, and the historical record of sampling in this well does not extend beyond 2000. This could be an indication that contaminated groundwater from the Source Area is not being captured by either the interior or exterior trenches or that there is an additional source of contamination off-site. |
| **Institutional Controls** | Institutional controls are generally defined as non-engineered instruments such as administrative and legal tools that do not involve construction or physically changing the site, and that help minimize the potential for human exposure to contamination and/or protect the integrity of a remedy by limiting land and/or resource use (**EPA, 2005**). Institutional controls can be used for many reasons including restriction of site use, modifying behavior, and providing information to people (**EPA, 2000**). Institutional controls may include deed notices, easements, covenants, restrictions, or other conditions on deeds, and/or groundwater and/or land use restriction documents (**EPA, 2001**). The following paragraphs describe ICs implemented at OU1, the potential affect of future land use plans on ICs, and any plans for changes to site contamination status.<br><u>Types of ICs in Place at the Site:</u><br>Access and ICs are currently in place at OU 1. Fences appeared to be in good condition. Minor fence damage has been noted in the past and repaired as needed. Gates do not serve to prevent pedestrian access to landfill caps, but they do serve to keep vehicle traffic off the caps. Signs are posted at landfill gates, along the fences, and on OU 1 site buildings. Signs appeared in good condition. Signs note contact information and many note restrictions and/or presence of contamination. Hill AFB performs an annual evaluation of the ICs in place for the Base. This includes verification of orders, leases, groundwater use restrictions, and inspections of signage, fences, and monitoring wells. An Annual Land-Use Controls report is prepared documenting the results of this work. Detailed information from the annual Land Use Controls Assessment report is described in **Section 2.7**. Based on review of the most recent Land Use Controls Assessment report, three recommendations were made for OU 1, including repair to the southwest corner of fence at Landfill 4, repair to the west side of the fence at Landfill 3, and replacement of the existing warning sign with a new warning sign that provides current contact information at Chemical Pits 1 and 2 (**Hill AFB CEVR, 2007b**)<br><br><u>Effects of Future Land Use Plans on ICs:</u><br>No effects on ICs due to future land use were identified during this five-year review.<br><u>Plans for Changes to Site Contamination Status:</u><br>No changes to site contaminant status at OU 1 are anticipated in the near future. |
| **Summary of the Technical Assessment** | The technical assessment, based on the data review, site inspection, technical evaluation, and interviews indicates that the remedial actions selected for OU 1 generally appears to have been implemented and are functioning as intended by the ROD and ESDs with the exception of removal of arsenic contaminated sediments from the springs. The assumptions used at the time of remedy selection are still valid. The amount of LNAPL recovered has decreased since 2006. As of February 2007, the total amount of LNAPL recovered from OU 1 trenches is 16,707 gallons. A total of 3,823 gallons of LNAPL were recovered in 2005 compared to only 478 gallons in 2006. The efficiency of continuing LNAPL recovery efforts should be assessed. Based on data and document review, it appears that the groundwater collection trenches are |

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| | capturing most of the plume. There have been some performance issues in previous years due to fouling of the process lines and due to periods of high groundwater levels that resulted in mass escape of COCs. System upgrades and additional O&M procedures have been implemented in order to address these issues. The system performance appears to be improving as a result of these upgrades and procedures. However, since these modifications were implemented in the system, the annual precipitation has been lower than in previous years and thus, the effectiveness of the modifications has not been fully evaluated. Currently, all water is discharged directly (without treatment) to the CWSID under a discharge permit. Design water elevations were exceeded in sumps U1-214, U1-215, U1-216, U1-217, U1-218, U1-219, U1-220, U1-221, and U1-224 during the current reviewing period despite of changes in procedures and operations developed to address fouling in the system. Collection systems are in place at several springs at OU 1 to collect contaminated water. However, due to the success of the Source Area extraction trenches, the springs and seeps currently do not flow. As a result of the diminished flows, Hill AFB is currently in the process of preparing to remove the arsenic contaminated sediments identified with many of the springs and seeps.<br><br>Evaluation of MNA data in the internal draft version of the PSVReport indicates that PCE concentrations in the off-base plume may have reached clean-up goals and that the dissolved masses of TCE and vinyl chloride have decreased. The internal draft version of the PSVReport also indicates that elevated cis-1,2-DCE concentrations at Monitoring Well U1-1602 have a significant impact on remedial timeframe estimates. Review of the cis-1,2-DCE concentration within the Non-Source Area plume indicates that the plume appears to be stable and not increasing in size. In addition, review of analytical data from monitoring points located outside of the baseline plume boundaries indicates that contamination has not been found at these points. Currently the internal draft version of the PSVReport is being updated to address issues identified in the development of the Thiessen polygon method used to evaluate natural attenuation of the non-Source Area plume at OU 1.<br><br>Landfill caps were constructed over Landfills No. 3 and 4 to prevent exposure to the landfill contents and minimize the infiltration of water through the landfill contents to the underlying groundwater. Areas of contaminated soil are also covered by the caps. The landfill passive vents are monitored to verify that gas concentrations do not reach explosive levels. Document review and site inspection concluded that the caps are in good condition with only minor defects that do not affect the performance of the caps. |

Table OU 1-8
# Operable Unit 1
# Technical Assessment Summary for OU 1

Reviewer: Victor Martinez

| Site ID | Remedy Description | Technical Assessment | | | Protectiveness | Next Five-Year Review |
|---|---|---|---|---|---|---|
| | | Question A* | Question B* | Question C* | | |
| FT009, WP002, WP080 | Groundwater Extraction Trenches, Spring Remediation, Landfill Cap, Monitored Natural Attenuation, Institutional Controls | Yes | No | Yes | The remedy is protective in the short term. | 2013 |
| LF001, LF003 | Landfill Cap, Institutional Controls | Yes | Yes | Yes | Protective | 2013 |
| FT081 | NA | NA | NA | NA | NA | NA |
| OT014 | NA | NA | NA | NA | NA | NA |
| OU 1 | Groundwater Extraction Trenches, Spring Remediation, Landfill Cap, Monitored Natural Attenuation, Institutional Controls | Yes | No | Yes | The remedy is protective in the short term. | 2013 |

*Question A: Is the remedy functioning as intended by the decision documents?
Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objective (RAO) used at the time of the remedy still valid?
Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
NA = Not Applicable

Table OU 1-9
## Operable Unit 1
## Five-Year Review Issues, Recommendations and Follow-Up Actions, and Protectiveness Statement

Reviewer: Victor Martinez

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| **Issues** | Operation and maintenance activities are ongoing at OU 1. Based on the document review, data review, site inspection, interviews, and the technical assessment, it appears the remedy has been implemented as planned and is functioning as intended by the decision documents in the short-term. To ensure continued protectiveness, three issues are identified in the 2008 five-year review for OU 1, as described below. These issues do not currently affect the protectiveness of the remedy, although they need to be addressed to ensure continued protectiveness.<br><br>The issues are:<br><br>1) The 2003 five-year review recommended to proceed with delineation and excavation of arsenic-contaminated soil and sediments near springs at OU 1. Sampling events to screen and collect sediment samples at several springs have been performed to address data gaps identified in previously collected data. Based on the results of sediment sampling events performed at OU 1, the areas of arsenic-impacted sediment have been delineated (**CH2M HILL, 2007e**). The OU 1CEVR Site and O&M manager Jason Dalpias reported in the 2008 five-year review interview that removal of arsenic-contaminated soil and sediments at OU 1 springs is scheduled to occur in 2008. The removal is contingent upon obtaining a real estate agreement with the affected landowner (**CH2M HILL, 2007d**).<br><br>2) The internal draft version of the PSVReport states that results of the MNA analysis indicate that the remediation will likely take longer than the 12 year timeframe estimated in the OU 1 ROD. The report also points out that elevated cis-1,2-DCE concentrations at Monitoring Well U1-1602, located in the non-Source Area, have a significant impact on estimating remedial timeframes. In the 2008 five-year review interview, the OU 1 site manager stated that it is not known at this time if contamination downgradient of the Source Area is the cause of the elevated concentrations at U1-1602. The PSVReport is being updated to address issues identified in the development of the estimated plume mass and natural attenuation time frames used to evaluate attenuation of the Non-Source Area plume and further clarify to what extent, natural attenuation is occurring in the Non-Source Area.<br><br>3) The RAO for the Source Area is to prevent contaminants in excess of MCLs from migrating away from the Source Area so that the Non-Source Area can be effectively remediated and to restore Source Area groundwater to MCLs. Based on the findings from the internal draft version of the PSVReport, the groundwater extraction trenches are effectively capturing most of the dissolved contaminant mass the majority of the time from the OU 1 Source Area. A small fraction of contaminant mass escapes past the extraction trenches. |

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| **Recommendations and Follow-Up Actions** | As described in the previous section, three issues were identified in the 2008 five-year review for OU 1. To address these issues, the following recommendations and followup actions have been defined.<br>1) Complete negotiations with the affected landowner and schedule the removal of arsenic contaminated soils and sediments at the springs currently scheduled for 2008.<br>2) Complete the reevaluation of the natural attenuation calculations and update the PSVReport as appropriate. Also, the elevated concentrations at well U1-1602 should be further investigated to determine whether or not contamination downgradient of the Source Area is the cause of the elevated concentrations at this well.<br>3) Upon completion of the review of the natural attenuation calculations, the PSVReport should be updated to incorporate the results. The need to reevaluate the significance of mass escape from the extraction trenches relative to the ability to meet the RAOs should be documented in the revised PSVReport based on the results of the review of natural attenuation in the non-Source Area. The revised PSV Report should include a timeframe for when this re-evaluation will be completed, if deemed necessary based on the review of natural attenuation in the non-Source Area. |
| **Remedial Timeframe** | **Table 3-3** in **Section 3.1.4** presents the remedial timeframe estimates for OU 1. The remedial timeframe for the Source Area and landfill cap is indefinite. Remediation associated with the non-Source Area is estimated to be complete sometime during 2070's. |
| **Protectiveness Statement** | **The remedial actions performed at OU 1 are considered protective of human health and the environment in the short-term.** The extent of contamination is defined and institutional controls are in place on-Base and off-Base to prevent exposures to contaminated groundwater and landfill contents. ICs and land-use controls are assessed annually. The selected remedy will continue to be protective if the recommendations and follow-up items identified in this five-year review are addressed. |
| **Next Five-Year Review** | Remedial actions at OU 1 will be reviewed in the next five-year review for Hill AFB to be completed during or before September 2013. |

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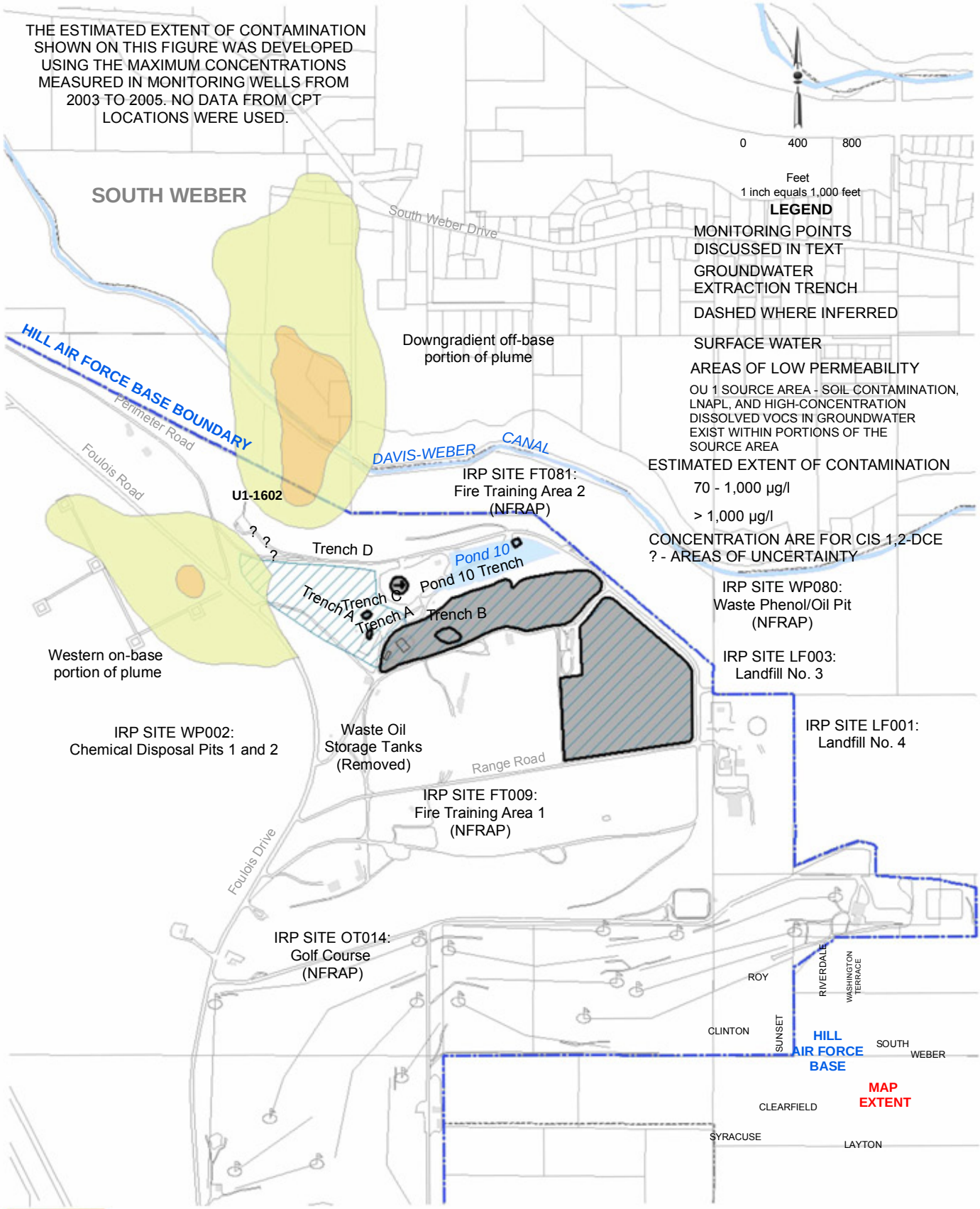


75th AIR BASE WING

FIGURE OU 1 - 1

**SITE FEATURES OF OPERABLE UNIT 1**

2008 FIVE-YEAR REVIEW

IRP SITES: FT081, WP080, LF003, LF001, FT009, OT014, WP002

HILL AIR FORCE BASE, UTAH

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Table OU 2-1
# Operable Unit 2
# Background Information

Reviewer: Kelly Taylor

**Introduction**

Operable Unit 2 is located near the northeast boundary of Hill AFB and consists of two IRP sites, Chemical Pit 3 (WP007) and the Perimeter Road (SS021). Installation Restoration Program Site WP007 consists of two unlined trenches used to dispose of unknown quantities of TCE waste from solvent recovery units, sludge from vapor degreasers, and possibly plating tank bottoms. As a result of this disposal practice, waste solvents migrated through the vadose zone and into the shallow aquifer and accumulated as mobile DNAPLs. Contaminated soils and DNAPL are the source of shallow groundwater contamination which extends approximately 1,500 feet downgradient, and beyond the Hill AFB boundary. Remedial actions to address this contamination include both source and non-source remedies that are in place and operating with long-term monitoring. Installation Restoration Program Site SS021 was reportedly the location of waste solvent dumping prior to 1979. Based on the 1996 *Record of Decision*, SS021 is free of contamination with the exception of a few areas being evaluated as part of other OUs and this site was recommended for no further remedial action (**URS, 2003a**).

A list of the documents reviewed for OU 2 as part of the 2008 five-year review is provided in **Appendix C**.

| IRP Identification | IRP Site Name | Status |
|---|---|---|
| WP007 | Chemical Pit 3 | Remediation ongoing |
| SS021 | Perimeter Road | NFRAP |

**Site Chronology**

Provided separately. See **Table OU 2-2**.

**Background**

**Physical Characteristics.** The on-Base portion of OU 2 sits upon relatively flat lying ground, while the off-Base portion of the site consists of a steep, terraced, north-facing escarpment that is the south wall of the Weber River Valley. There is about 300 feet of relief between Hill AFB and the valley below. Parts of this hillside are unstable and are known as the Weber Landslide Complex. Numerous seeps and springs occur along the hillside. Depending on water table elevation and the season, the springs and seeps discharge water from the shallow groundwater system. Depth to groundwater in the shallow system is generally less than 10 feet bgs in the off-Base area and 20 feet bgs in the on-Base area. The depth to the hillside groundwater ranges from 35 to 70 feet bgs. Along the hillside escarpment and just outside of the northeastern Base boundary is the Davis-Weber Canal, a privately owned concrete-lined irrigation canal. The canal is located outside the base boundary and parallels the northeast boundary along most of the base adjacent to the Weber River Valley. The canal provides water from the Weber River for irrigation in the surrounding areas (**CH2M HILL, 1996**).

**Land and Resource Use.** There are no hospitals, retirement or nursing homes, schools, nurseries, or day care centers, currently located in the vicinity of OU 2. Except for the air stripper treatment plant, the main process building for the Source Recovery System (SRS), the solvent storage tank building, two office trailers, the G-Pool trailer, the bioventing connex, and Perimeter Road, there are no buildings or man-made structures in the on-Base portion of OU 2. Land within OU 2 is not located within the 100-year floodplain. There are no jurisdictional wetlands, as regulated by the United States Army Corps of Engineers within OU 2. There are no uses or known occurrences of commercially valuable natural resources within OU 2 area. Shallow groundwater is not currently used as a source of drinking water in the area, but was used for irrigation and cattle in the past. Land use in the off-Base part of OU 2 is mostly agricultural and rural-residential in the community of South Weber. Agricultural use is for crops (alfalfa) and livestock grazing (mostly sheep and horses) (**CH2M HILL, 1996**).

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| | **History of Contamination.** From approximately 1967 to 1975, WP007 (former Chemical Disposal Pit 3) was used for disposing unknown quantifies of TCE wastes from solvent recovery units, sludge from vapor degreasers, and possibly plating tank bottoms. As a result of disposal practices at WP007, waste solvents migrated through the vadose zone and into the shallow aquifer and accumulated as mobile DNAPLs. Contaminated soils and DNAPL are the source of shallow groundwater contamination which extends approximately 1500 feet downgradient, and beyond the Hill AFB boundary. SS021 provides access to most of the waste disposal areas along the northern part of the Base. Most of these waste disposal areas were active in the 1960s and 1970s. Investigative activities along Perimeter Road revealed no evidence of spills or dumping except in areas already being investigated at part of this or other OUs on Hill AFB (**URS, 2003a**, and **CH2M HILL, 1996**). |
| | **Initial Response.** Initial efforts to prevent exposure to contaminated groundwater associated with OU 2 included: (1) providing municipal water connections to five homes known to have been affected by contamination at OU 2; (2) collecting and treating contaminated water flowing from springs and seeps and discharging the treated water to the original spring drainage; (3) installing fences around springs and seeps with contaminated water to prevent livestock access; and (4) constructing, as an IRA, the SRS to remove DNAPL and treat contaminated groundwater from the area near WP007. The interim ROD for this action was signed September 30, 1991 (**CH2M HILL, 1991**, and **CH2M HILL, 1996**). |
| | **Basis for Taking Action.** In 1986, high levels of VOCs were confirmed in groundwater near OU 2 and the Base boundary. A survey of off-Base water rights was conducted. Based on sampling of off-Base waters, contaminants were found in several springs more than 1,500 feet from the source area (trenches) and outside of the boundaries of Hill AFB. Based on the human health risk assessment, risk posed to future offsite and onsite residents including adults and children were unacceptable. For future offsite adults, the cancer and non-cancer risks based on the reasonable maximum exposure (RME) concentration were $2x10^{-2}$ and 20, respectively; for children the respective risks were $9x10^{-3}$ and 30. For future onsite residents, the cancer and non-cancer risks based on the RME concentration were $3x10^{-2}$ and 20, respectively; for children the respective risks were $1x10^{-2}$ and 30. The exposure pathways that contributed most to these risks include inhalation or ingestion of and dermal contact with water (**CH2M HILL, 1996**). |
| **Remedial Actions** | **Remedy Selection (ie. ROD/ESDs).** A final ROD was signed in September of 1996. The selected remedy includes: (1) treatment of groundwater from non-source and source areas; (2) a performance and compliance sampling program; (3) institutional controls; (4) residuals management (that is, granular activated carbon filters); (5) five-year reviews; (6) installation of a containment wall at the source area; (7) a surface cap; (8) DNAPL extraction and treatment; (9) soil vapor extraction; (10) treatability studies; and (11) collection, treatment, and discharge of contaminated spring and seep waters. Groundwater extraction is expected to last 30 years at the source area and from 15 to 30 years at non-source areas during which time the system's performance will be reviewed and adjusted as necessary. If it is determined that portions of the aquifer cannot be restored to their beneficial use, various measures may be implemented including but not limited to engineering and institutional controls, waiving of chemical-specific ARARs, long-term monitoring, and periodic reevaluation of remedial technologies (**CH2M HILL, 1996**).<br><br>Remedial action objectives as defined in the ROD (**CH2M HILL, 1996**) include: (1) meet chemical-specific ARARs such as drinking water MCLs under the SDWA and meeting MCLs will also meet Utah Groundwater Quality Standards for the chemicals of concern; (2) limit cancer risk to less than $10^{-4}$ with a target of $10^{-6}$ due to incidental ingestion, dermal contact, or inhalation of vapors; (3) reduce contaminant concentrations low enough to avoid chronic health effects (as indicated by a hazard index of less than one); (4) remove as much of the DNAPL as practicable; (5) eliminate the sources of groundwater contamination either through source control or removal in accordance with the Utah Corrective Action Cleanup Standards Policy – UST and CERCLA Sites; and (6) prevent further degradation of groundwater quality in |

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| | accordance with the Utah Corrective Action Cleanup Standards Policy – UST and CERCLA Sites. |
| | **Remedy Implementation.** The SRS was completed in October 1993 as part of the 1991 Interim ROD, and by the end of 1993, approximately 25,834 gallons of DNAPL had been removed from the source area by a combination of pumping source area wells and previous investigation activities. Source area well pumping and SRS operations continued in 1994 and included installation of an air-lift pump in one of the five existing extraction wells (U2-031) to reduce problems of DNAPL emulsification caused by the original centrifugal pumps. In 1996 as part of the OU 2 ROD, the slurry containment wall (including an upgradient control system) was installed around the source area to form a vertical barrier with low permeability around the DNAPL pools. Additionally, two treatability studies were funded and conducted in 1996, removing approximately 500 gallons of DNAPL. In 1997, an additional DNAPL pool, identified as Griffith's Pool (G-Pool), was discovered outside of the containment wall on the northeast side of the OU 2 site. The NIT was also constructed in 1997 in an effort to contain the leading edge of the off-Base plume. Water from the trench sump was pumped up the hill to either the ASTP or to the on-Base IWTP for treatment, though it is currently discharged directly to the CWSID. Two additional treatability studies (steam flood demonstrations) were conducted in 1997 and resulted in the removal of 2,600 gallons of DNAPL. In 1998, a well field was installed to pump and treat the contaminated water and free-phase DNAPL from G-Pool as well as hydraulically contain the groundwater within G-Pool to minimize further contaminant flux to the off-Base plume. An additional off-Base trench, U2-326, was completed in 1998 to drain a seasonal spring located near the NIT while a gravel interceptor trench for spring U2-304 was constructed in 1999. Pumping of the mobile DNAPL in the G-Pool area started in 1999. In 2000, the first full-scale Surfactant Enhanced Aquifer Remediation (SEAR) application was completed in a portion of the source area thought to contain the largest majority of DNAPL removing about 430 gallons of DNAPL; the air strippers were placed online in January. A cometabolic bioventing application in the source area of OU 2 was also conducted in 2000. In October 2001, implementation of SEAR technology in a portion of the source area thought to contain a large amount of DNAPL was initiated as a full-scale remediation technique. In 2002, an NIT booster pump station was added. A mobile DNAPL pump was also utilized to recover additional DNAPL from monitoring wells located throughout the source area from September through November (**URS, 2003b**). In August 2005, an enhanced in-situ bioremediation demonstration project at the G-Pool was initiated and is currently ongoing. It should be noted that neither the surface cap nor the SVE system, each identified in the ROD as part of the selected remedy, have been implemented to-date. An SVE system; however, was brought online for three weeks during the summer of 1997 in the source zone as part of the PRAXIS Steam Flood demonstration (**URS, 2006**).<br><br>**Progress Since Implementation.** As of January 31, 2007, 44,376 gallons of DNAPL have been recovered from the source area (**CH2M HILL, 2007b**). |
| | **Operations and Maintenance.** Operation and maintenance activities required as part of the Operation and Maintenance Plan include system inspection and monitoring, system operation, system maintenance, and system troubleshooting (**Hill AFB CEVR, 2007a**). URS began operating, maintaining, and upgrading the groundwater extraction system at OU 2 since SRS construction was completed in 1993; CH2M HILL took over O&M in 2006. According to the most recent Cost and Operations report for 2005 (**URS, 2006**), system operations for 2005 were efficient with no lengthy, unplanned system down time. As of the end of September 2007 (end of the third five-year review period), the Cost and Performance report for 2006 was still in preparation.<br><br>Operation and Maintenance Plans are maintained and updated online through the CEVR Dynamic Documents System and O&M procedures follow the most current version of the O&M Plan (**Hill AFB CEVR, 2007a**). |

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| **Progress Since Last FYR** | Recommendations based on the 2003 five-year review (**URS, 2003a**) for OU 2 are presented in **Table OU2-3** along with the current status of each recommendation.<br><br>**Current Status**: According to an interview with the site O&M technician, John Barlow, the most significant change to the remedial system since the 2003 five-year review includes the repiping within the SRS to allow treatment of source zone water with the air strippers (bypassing the steam stripper). Hill AFB is currently conducting testing to determine if the air stripper can meet discharge goals, and plans to discontinue use of the steam stripper if treatment can be accomplished with the air strippers. Additionally, an aboveground line has been added to pump groundwater from G-pool, located outside the containment wall, to inside the containment wall. This line was constructed to allow water from G-Pool to be processed through the extraction system within the containment wall, though it has not been used to-date. The NIT has been reconfigured to discharge directly to the CWSID, an off-Base publicly owned treatment works, instead of having to pump the water back up the hill, and the sewer lines have been cleaned to remove fouling. Complications that have occurred since the last five-year review include occasional pump failures, problems with the epoxy flooring in the buildings, and unanticipated holes in the Inconel® plates of the heat exchanger in the steam stripper, which is past its expected design life. Additionally, a leak in the floor line from the building sump to tank T-105 resulted in the line being redesigned and rerouted (**CH2M HILL, 2007d**).<br><br>In September 2003, the CSM for the source zone was reviewed and updated (**URS, 2003c**) (as recommended in the Calendar Year 2002 Cost and Performance Report [**URS, 2003b**]). The updated CSM included a three-dimensional model of the soil stratigraphy within the OU 2 source zone to provide the geologic framework for the numerical site model and an estimate of both the phase (DNAPL, sorbed, dissolved, and vapor) and spatial distributions of remaining contaminant mass within the alluvium and in the underlying clay aquitard. The remaining volume of DNAPL and TCE contained within the OU 2 source zone was estimated to range from approximately 284 to 1,587 gallons with a best estimate of 616 gallons. The largest fraction of remaining contaminant mass was estimated to reside in the central portion of the source area, located inside of the containment wall. Although the remedial activities conducted at OU 2 have removed a significant portion of the DNAPL mass from the source zone (approximately 44,000 gallons), residual DNAPL trapped within the pore volume in the upper elevations of the aquifer and mobile-phase DNAPL contained in localized depressions on the surface of the clay aquitard represent the largest contribution to the remaining mass. Recommendations based on this evaluation included (1) optimizing mobile DNAPL recovery operations to target areas of the shallow aquifer identified as containing pooled DNAPL, (2) investigating the presence of a shallow channel located to the west of the main paleochannel to delineate its possible connection to the main paleochannel and further characterize contamination in this area of the source zone, and (3) using the results of the updated source zone model to establish key decision criteria to support modifications to existing treatment systems and/or the implementation of future remedial actions at the site.<br><br>The recommendations made as part of the CSM update have been addressed. To enhance mobile DNAPL recovery operations from the OU 2 source area, well U2-238 was installed in 2005 to a depth of approximately 55 feet bgs. This represents one of the deepest portions of the paleochannel and is approximately 25 feet south of well U2-063, from which over 120 gallons of DNAPL have been recovered using mobile DNAPL recovery operations. Following the installation of U2-238, approximately 46 gallons of DNAPL were recovered from U2-238 from late November through December 2004. Approximately 173 gallons of DNAPL have been recovered from U2-238 through the end of June 2005 (**URS, 2005c)**. During 2004, the shallow channel located west of the main paleochannel was investigated. Lithologic data collected during the west channel investigation suggests that the channel is composed of several discontinuous shallow depressions with isolated connections between the channel fill and the upper Provo Formation within the main paleochannel. Soil sampling results indicated the potential presence of DNAPL within sand laminations within the clay of the Alpine Formation in the isolated western channel. It was concluded that DNAPL may reside in an isolated sand |

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| | and gravel deposit (**URS, 2005a**). The updated source zone model continues to be used to assess system optimization. In an effort to determine potential exposure of off-base residents near OU plumes to TCE, sampling was conducted at multiple residences near OU 2 in 2004 under the Basewide Air Sampling and Analysis Plan Indoor Residential Air Sampling (**MWH, 2004**). Trichloroethene was detected in indoor air samples collected at one off-base residence under this effort in 2004. Although concentrations were less than mitigation levels, a carbon monoxide detector and sub-slab vapor removal system was installed at this residence (**MWH, 2005**).<br><br>During 2005, a Data Needs Analysis Report (**URS, 2005b**) (as recommended in the Calendar Year 2002 Cost and Performance Report [**URS, 2003b**]) summarizing an effort to improve data collection activities at OU 1 and OU 2 was completed and an enhanced in-situ bioremediation demonstration project at OU 2 was initiated in August of 2005 and is ongoing (**URS, 2006**).<br><br>A flow and contaminant transport model was also developed in 2005 (**URS and Intera, 2005**). The report concludes that the transport modeling suggests that the plume may have reached its maximum extent and is in retreat. The simulation results indicate that the containment wall is the most effective component of the remedial systems with respect to inhibiting contaminant migration from the source area. Although the modeling suggests that the containment wall does not completely prevent the escape of contaminants from the source area, it diminishes mass flux by deflecting transport pathways downward, thereby reducing groundwater velocities due to vertical permeability anisotropy. The report states that natural degradation is the major mechanism for removing contaminant mass from and promoting retreat of the plume in the off-base plume despite a relatively low decay rate utilized in the model. Contaminant mass removal by groundwater extraction from the source area, or by the NIT and U2-326 interceptor trenches is an order of magnitude smaller than by natural degradation. The negligible impact on plume dynamics of groundwater extraction activities conducted from within the source area should be considered for optimizing future site operations.<br><br>The PSVReport is currently in draft form (**URS, 2007**). According to the draft report, because numerous modifications to the source area systems have been proposed and are in various stages of implementation, this report only focuses on non-source area remedies. The source-area contamination has been greatly reduced based on the success of the source-area groundwater extraction and treatment system, various treatability studies, and DNAPL removal using a mobile pump. These source-area remedies will be evaluated in future efforts when modifications have been completed and enough data are available for analysis. Findings of the non-source area remedies indicate that (1) the upgradient control system is effectively controlling groundwater levels upgradient of the containment wall and there is no evidence of slope instability or significant slope displacement; (2) the NIT and spring U2-326 interceptor trench capture approximately 50 percent of groundwater flowing through the trenches and more contaminant mass flows around the NIT than is captured by it; (this report is draft and the calculations supporting this statement are currently being reviewed); (3) springs at OU 2 are generally dry (with the exception of U2-302); however, U2-304 did have a flow rate of 2 gallons per minute in 2006 and had a TCE concentration of 79 ug/L which may require further evaluation if flow persists; (4) no additional spring collection systems are needed; (5) the mass of the TCE in the toe area of the plume has declined and centers of mass are stable; and (6) additional ICs, including inspection of OU 2 for further development, visual inspection of the area to identify any unpermitted domestic water supply sources, and annual contact with the South Weber City Planning Department to determine if any development is planned in the contaminated area, were not documented in the 2006 *Land Use Control Assessment Report*. Additionally, based on recommendations of the *Land Use Control Assessment Report*, warning signs at NIT, U2-326 interceptor trench, and WP007 Chemical Disposal Pit 3 need to be updated with current contact information (**URS, 2007**). These signs were subsequently updated.<br><br>Recommendations based on the Draft PSVReport include (1) changing the data analysis methodology, the monitoring well network, and the sampling frequency of the performance monitoring; (2) changing the method used to evaluate the performance of the NIT and spring |

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| | U2-326 interceptor trench; and (3) other very minor changes to the performance monitoring program. In an effort to reduce uncertainties in the OU 2 CSM, the Draft PSVReport recommends (1) initiating a modified groundwater sampling and analysis program in 2008; (2) developing a cis-1,2-DCE plume representation using a 3-D model; (3) determining the potential impacted area of active remediation downgradient of the spillway in the source area in an effort to shorten the remedial timeframe in the non-source area plume; and (4) updating the OU 2 CSM using the above information. All recommendations made in the Final PSVReport should be prioritized and acted on as appropriate. |

Table OU 2-2

## Chronology of Site Events for Operable Unit 2

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 2 | OU 2 | 9 | 2003 | Post-ROD Study | Additional investigation at OU 2 was performed to verify and update the conceptual site model. | Conceptual Model Update for OU 2 Source Zone. |
| 2 | OU 2 | 1 | 2004 | Post-ROD Study | The Basewide Indoor Air Sampling and Analysis Plan Indoor Residential Air Sampling report was published. The report proposed air sampling at OU 2. | Basewide Air Sampling and Analysis Plan Indoor Residential Air Sampling. |
| 2 | OU 2 | 6 | 2004 | Indoor Air Program | Residential indoor air sampling and vapor mitigation was performed. A carbon monoxide detector and soil gas reduction system were installed at an off-Base property near OU 2. | Basewide Air Sampling and Analysis Plan Indoor Residential Air Sampling. |
| 2 | OU2 | | 1981 | Remedial Investigation | First investigations under the Installation Restoration Program (IRP) began at OU 2. | Focused Feasibility Study (FS) for OU 2 |
| 2 | OU2 | 7 | 1987 | NPL Listing | Hill Air Force Base (AFB) placed on the NPL by the Environmental Protection Agency (EPA). | Focused FS for OU 2 |
| 2 | OU2 | 4 | 1991 | Federal Facilities Agreement | Hill AFB entered into an FFA between the US Air Force, Utah Department of Environmental Quality (UDEQ), and US Environmental Protection Agency. | ROD for Interim Action at OU 2, Final |
| 2 | OU2 | | 1998 | 1998 Five-Year Review | The remedial actions implemented at OU 2 were determined to be protective. The review included some recommendations for additional Operations and Maintenance of the OU 2 remedy. | Hill AFB Five-Year Review, September 1998 |
| 2 | OU2 | 9 | 2003 | 2003 Five-Year Review | The protectiveness of human health and the environment at OU 2 cannot be determined. | Final CERCLA Five-Year Review. September 2003. |
| 2 | SS021 | 6 | 1991 | NFRAP | The decision was made to no longer track the Perimeter Road (SS021) as an IRP Site. The decision was based on the results of a 1988 soil gas study documented in: Radian, 1990. Site Evaluation Report for Perimeter Road and the Spoils Area. August 1990. | Decision Document for Perimeter Road, Site SS21 |
| 2 | WP007 | | 1967 | Historical Operations | Disposal of wastes begins in Chemical Disposal Pit 3. Wastes disposed consisted of solvents and sludges from Hill Air Force Base (HAFB) degreasing operations. Disposal continued until 1975. Volume of disposed wastes is unknown, but estimated at between 100,000 and 1,000,000 gallons. | Record of Decision (ROD) for Interim Action at Operable Unit (OU) 2, Final |
| 2 | WP007 | | 1983 | Remedial Investigation | Volatile organic compounds first identified at OU 2. How contaminants were identified, and in what media, is not described in the reference document (ROD). | ROD for Interim Action at OU 2, Final |
| 2 | WP007 | | 1986 | Remedial Investigation | High levels of VOCs confirmed in shallow groundwater near Base boundary. Contaminants found in springs downgradient from the disposal trenches. Maximum trichloroethylene (TCE) concentration detected in groundwater off-Base was 11,000 ug/L. | ROD for Interim Action at OU 2, Final |
| 2 | WP007 | | 1986 | Interim Action | Interim measures were taken to protect off-Base users of shallow groundwater near OU 2. Five properties were provided alternate sources of water. Two of the five were provided municipal drinking water; the remaining three were provided with alternate sources of irrigation water. Note that the year(s) in which this occurred is uncertain. It is not specified in the reference document. | ROD for Interim Action at Operable Unit (OU) 2, Final |

Table OU 2-2

## Chronology of Site Events for Operable Unit 2

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 2 | WP007 | 8 | 1991 | Interim Action | Pump-and-treat system for removal and destruction of free-phase dense nonaqueous phase liquids (DNAPLs) from groundwater is selected as the remedy for interim action at OU 2. Operating life is expected to be approximately two years following a one year construction period. | ROD for Interim Action at OU 2, Final |
| 2 | WP007 | 3 | 1992 | Remedial Investigation | The Baseline Risk Assessment was issued. It estimated that carcinogenic risk values for the off-site future residential scenarios, due to the presence of TCE in groundwater, exceeded the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) risk range site remediation goal. | Baseline Risk Assessment for OU 2 Sites WP07, SS21 Volume 1 Report |
| 2 | WP007 | 12 | 1993 | Interim Action | Construction of the Source Recovery System (SRS) was completed in August 1993, implementing the 1991 ROD for interim action. The initial period of sustained operation began in December 1993 and continued through the first part of June 1994. The SRS pumped 22,904 gallons of free-phase DNAPL from the aquifer during initial extended operation and the system startup test (October - November 1993); an additional 456 gallons of DNAPL was generated by steam stripping/recondensation. | System Evaluation Report SRS Commissioning, Startup, and Initial Operation Interim Remedial Action, 2 |
| 2 | WP007 | 12 | 1996 | Remedial Action | The source containment system, including a containment wall and upgradient control trench, was constructed. | O&M and Performance Verification Plan OU 2 |
| 2 | WP007 | | 1996 | Treatability Study | Three partitioning interwell tracer tests and two surfactant enhanced aquifer remediation tests were conducted in a portion of the DNAPL pool in the vicinity of the disposal trenches near Panels 3 and 4. PITTs were determined to be effective and were later used to characterize the entire source area. Full-scale SEARs were also judged to be feasible in portions of the source area, and were conducted in 2000, 2001, and 2002, each in different portions of the source area. | 2001 Cost and Performance Report OU 2 |
| 2 | WP007 | 3 | 1997 | Treatability Study | A surfactant/foam flood demonstration project was performed in the OU 2 source area. Approximately 40 gallons of DNAPL were removed. | AATDF Surfactant/Foam Process for Aquifer Remediation |
| 2 | WP007 | | 1997 | Remedial Action | The off-Base North Intercept Trench (NIT) is constructed. The NIT is a groundwater collection trench designed to cut off the leading edge of the off-Base plume. The water is pumped uphill to the Air stripper treatment plant (ASTP). | 2001 Cost and Performance Report (CPR) OU 2 |
| 2 | WP007 | | 1997 | Remedial Action | The ASTP was constructed to treat contaminated groundwater through an air stripper treatment process. | 2001 CPR OU 2 |
| 2 | WP007 | | 1997 | Treatability Study | A surfactant flood involving a foam surfactant to enhance subsurface sweep recovered little DNAPL.<br>Approximately 2,000 gals DNAPL recovered as a result of steam injection and the installation of the steam injection wellfield. | 2001 CPR OU 2 |
| 2 | WP007 | | 1997 | Post-ROD Study | Additional PITTs performed in late 1997 and 1998 to characterize the entire subsurface channel containing DNAPL. PITTs conducted in areas thought to contain large amounts of DNAPL. | 2001 CPR OU 2 |

Table OU 2-2

## Chronology of Site Events for Operable Unit 2

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 2 | WP007 | | 1997 | Post-ROD Study | During the characterization of the entire subsurface channel, a DNAPL pool was discovered outside of the northeast corner of the containment wall. This DNAPL pool is denoted the G-pool. | 2001 CPR OU 2 |
| 2 | WP007 | | 1998 | Remedial Action | Off-Base trench U2-236 was constructed to drain a seasonal spring located near the NIT. Water from the trench is pumped to the NIT sump, where it is conveyed for treatment at either the industrial wastewater treatment plant (IWTP) or the air stripper treatment plant (ASTP). | 2001 CPR OU 2 |
| 2 | WP007 | | 1998 | Post-ROD Study | Four large-scale PITTs conducted in source area to further delineate the DNAPL source area. | Final Dense Nonaqueous Phase Liquid (DNAPL) Source Delineation Report OU 2 |
| 2 | WP007 | | 1999 | Remedial Action | A new extraction well field is installed in the G-Pool. Seventeen wells were drilled and installed. The well field was connected to the existing SRS piping to convey DNAPL and groundwater extracted from the G-Pool to the SRS for phase separation and treatment. Approximately 2,200 gals of additional DNAPL removed since the start-up of the well field. | 2001 CPR OU 2 |
| 2 | WP007 | | 1999 | Post-ROD Study | After the mobile DNAPL was extracted from the G-Pool well field, the remaining DNAPL was characterized using a PITT. An additional 350 gals of DNAPL were recovered during the PITT. | 2001 CPR OU 2 |
| 2 | WP007 | | 1999 | Remedial Action | A gravel interceptor trench for spring U2-304 was constructed. The purpose of the trench is to collect contaminated groundwater and prevent it from advancing in the off-Base plume. | 2001 CPR OU 2 |
| 2 | WP007 | 1 | 2000 | Remedial Action | The air strippers were placed on-line in January 2000 after a successful demonstration of a datalink required by South Weber City to monitor the volume of water treated by the ASTP and sent to the Central Weber Sewer Improvement District (CWSID). Over 5 million gallons of contaminated water from the UCS and NIT were treated and sent to the CWSID. | 2001 CPR OU 2 |
| 2 | WP007 | | 2000 | Treatability Study | The first full-scale SEAR at OU 2 was completed in Panel 2, recovering 430 +/- 59 gallons of DNAPL. | 2001 CPR OU 2 |
| 2 | WP007 | | 2000 | Treatability Study | The Remediation Technology Development Forum (RTDF) funded a cometabolic bioventing test in the source area of OU 2. A vadose zone PITT was completed using the RTDF well field and acclimation of the subsurface microbes was initiated. | 2001 CPR OU 2 |
| 2 | WP007 | | 2001 | Treatability Study | Approximately 1,100 gals of DNAPL were recovered as a result of the application of a SEAR in Panel 1. Foam injection was used to improve subsurface sweep. A post-SEAR PITT suggests that additional DNAPL remains in the southern portion of the panel. | 2001 CPR OU 2 |
| 2 | WP007 | | 2001 | Operations and Maintenance | Modifications to the SRS were required to break down surfactant in the SEAR effluent, including a hydrolysis unit that treated the wastewater to mitigate foam generation downstream of the SRS at the IWTP and the North Davis Publicly Owned Treatment Works (POTW). During the Panel 1 SEAR, approximately 31,000 pounds of sodium hydroxide were used to treat over 350,000 gals of surfactant-laden wastewater. | 2001 CPR OU 2 |

Table OU 2-2

## Chronology of Site Events for Operable Unit 2

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 2 | WP007 | 12 | 2002 | Treatability Study | A water flood event was performed in Panel 5. 5.5 gallons of TCE was removed from 12/2002 to 02/2003. | URS Corporation. 2004. Cost and Performance Report OU 2 Hill Air Force Base, Utah, January to December 2003. March. |
| 2 | WP007 | | 2002 | Treatability Study | SEAR conducted in areas thought to contain large concentrations of DNAPL from September 21 to November 1. As part of these efforts, 232 gallons of DNAPL were removed. | Final OU 2 Panel 1 and 5 Surfactant Enhanced Aquifer Remediation (SEAR) Report |
| 2 | WP007 | 6 | 2003 | Operations and Maintenance | Pumps were installed in to U2-068 and U2-098 during June 2003. Additional groundwater extraction capacity has resulted in increased operational efficiency at the SRS. | Cost and Performance Report OU 2 Hill Air Force Base, Utah, January to December 2003. |
| 2 | WP007 | | 2004 | Operations and Maintenance | The NIT was reconfigured to discharge directly to the sewer instead of having to pump the water back up the hill to the ASTP for treatment. | Five-Year Review Interview Record for John Barlow |
| 2 | WP007 | 8 | 2005 | Treatability Study | An enhanced in-situ bioremediation demonstration project at source area of OU 2 was initiated in August of 2005 and is ongoing. | Cost and Performance Report OU 2 Hill Air Force Base, Utah, January to December 2005. |
| 2 | WP007 | 10 | 2007 | PSVReport | The Draft Performance Standard Verification Report (PSVReport) was prepared. This report is draft and subject to change. | Draft OU 2 Performance Standard Verification Report, Hill Air Force Base, Utah. |
| 2 | WP007 | | 2007 | Operations and Maintenance | Bypass piping has been constructed in an effort to bypass the steam stripper. Testing of the air stripper is being conducted to determine if this alone will adequately treat the groundwater. | 2008 Five-Year Review Interview Record with John Barlow |
| 2 | WP007 and SS021 | 9 | 1996 | Record of Decision | Perimeter Road (IRP Site SS021) is found to be free of contamination except in those areas being addressed as part of existing OUs. No further action is needed for Perimeter Road as part of OU 2. 'The selected remedy for WP007 addresses contaminated groundwater, contaminated soil, and contaminated surface water at OU 2. Two components are addressed: the source area and non-source area. Remedy for both areas includes environmental monitoring and institutional controls. | Final ROD and Responsiveness Summary for OU 2 |

**Notes**

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| AFB | Air Force Base |
| ASTP | air stripper treatment plant |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CWSID | Central Weber Sewer Improvement District |
| DNAPL | Dense non-aqueous phase liquid |
| EPA | United States Environmental Protection Agency |
| IRP | installation restoration program |
| IWTP | industrial wastewater treatment plant |
| NIT | north interceptor trench |
| NPL | National Priorities List |
| O&M | Operations and Maintenance |
| OU | Operable Unit |
| POTW | Publicly owned treatment works |
| PSVReport | Performance Standard Verification Report |
| RTDF | Remediation Technology Development Forum |
| ROD | Record of Decision |
| SRS | source recovery system |
| UDEQ | Utah Department of Environmental Quality |

Table OU 2-3

Progress Since Last Five Year Review - Status of Recommendations and Follow-Up Actions at OU 2

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Site | 2003 Five-Year Review Recommendations | Current Status | Carry Over to Next FYR? |
|---|---|---|---|
| Chemical Pit 3 (WP007) | Jointly evaluate the effectiveness of the Source Recovery System (SRS) and containment wall | **Complete.** A flow and contaminant transport model was developed in 2005 (**URS and Intera, 2005**) and evaluated the effectiveness of the SRS and containment wall. The combined impacts of the containment wall and groundwater extraction by SRS pumping are evident. The number of particles (contaminant mass) leaving the subsurface through groundwater extraction operations conducted within the containment wall is substantial. The containment wall, together with the local effect on hydraulic gradient imposed by groundwater extraction, impedes the migration of contaminant mass from the source area inside of the containment wall. The containment wall affects the path of all particles to some degree, northern particles the most. Few, if any, of the particles flow through the wall. Particles remain within the containment wall for more than a year, whereas in the pre-remedial action scenario particles move well beyond the source area in a year. The simulation results indicate that the containment wall is the most effective component of the remedial systems with respect<br><br>to inhibiting contaminant migration from the source area. Although the containment wall does not completely prevent the escape of contaminants from the source area, it diminishes mass flux by deflecting transport pathways downward, thereby reducing groundwater velocities due to vertical permeability anisotropy. (Note: Neither modeling nor existing data provide solid answers to the question of appropriate water level elevations; however, a study is currently being conducted to determine if increasing water levels in the Source Area result in increased contaminant mass flux.) | No |
| | Identify the appropriate action level for well field operations and document any new levels and rationale in the Performance Standard Verification Plan (PSVPlan). [Related to the issue addressing water level metrics associated with the SRS] | **Ongoing.** The updated Draft PSVReport did not address the source area, and metrics for the source area related to groundwater elevation should be addressed in the next PSVReport update when source areas will be addressed. | Yes |
| | Evaluate NIT performance data with respect to the dissolved-phase plume | **Ongoing.** This was evaluated in the Flow and Contaminant Transport Report (**URS and Intera, 2005**). This report concluded that the NIT captures contaminant mass along most of its length; however, deeper contamination may run beneath the trench. The U2-326 interceptor trench is less effective. A significant fraction of particles escape capture by the trench systems and travel beyond the system or leave through the bottom layer of the modeling domain. In addition the contaminant mass bypassing the ends of the NIT/U2-326 trench system suggests that the system does not exert sufficient hydraulic influence to deflect flow laterally. Additionally, the Draft PSVReport indicates that only about half of the groundwater flowing toward the NIT is captured. | Yes |
| | Expedite submittal of Long Term Monitoring (LTM) data to Environmental Restoration Program Information Management System (ERPIMS) for timely review of remedy effectiveness | **Complete.** The issue regarding expediting submittal of LTM data to ERPIMSs for timely review of remedy effectiveness is addressed in the Basewide Monitoring and Maintenance Work Plan (**CH2M HILL, 2007c**). A schedule presents the anticipated submittal dates. | No |
| | Continue use of portable Dense nonaqueous phase liquid (DNAPL) pump assembly to remove free-phase DNAPL. Consider use of a second system which would enable simultaneous recovery of DNAPL from two separate wells. | **Complete.** Based on the updated Conceptual Site Model (CSM) evaluation (**URS, 2003c**) the need for a second mobile pump to enhance DNAPL recovery as recommended in the Calendar Year 2002 Cost and Performance Report (**URS, 2003b**) and the 2nd FYR was not considered necessary; however, it was recommended that the existing pump be used as efficiently as possible by continuing to identify wells with the largest potential for DNAPL production (**URS, 2004**). | No |
| | Re-evaluate the risk analysis for Operable Unit (OU) 2 to determine if revised contaminant action levels are warranted based on new standards and toxicity factors. | **In Progress.** Risks for OUs 1-8 were assessed in the 2003 Five-Year Review Risk Assessment Recommendation (**Hill AFB CEVR and SES, 2007**). There were no recommended actions for OU 2 based on this review. | Yes |
| Chemical Pit 3 (WP007) (cont.) | Evaluate whether a thorough review of the remedies can be performed before Fiscal Year 2006 | **Ongoing.** A thorough review of remedies was not conducted in 2006. Optimization projects are on-going, and the Draft PSVReport was published in October 2007 (**URS, 2007**). However, remedies in place at the source area were not evaluated in the Draft PSVR update. | Yes |

Table OU 2-3

Progress Since Last Five Year Review - Status of Recommendations and Follow-Up Actions at OU 2

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Site | 2003 Five-Year Review Recommendations | Current Status | Carry Over to Next FYR? |
|---|---|---|---|
| | Ensure that regulatory approval is granted before the Corrective Action Management Unit (CAMU) is used for any future remedial actions [Related to the following issue: "The ROD established a CAMU according to the rule in place in 1993. The CAMU was established because contaminated soils were staged onsite during construction of remedial components. Changes to the materials in, or usage of, the CAMU may not comply with rule changes."] | **Ongoing.** CEVR has indicated that interactions with regulators will be ongoing and approval of any future remedial actions will be obtained prior to initiation of such events. According to the CEVR, this issue was discussed at an RPM meeting in 2004. | No |
| | Monitoring plume extent, particularly with respect to NE ¼, Sect. 29, T5N R1W, and applying water use restrictions as appropriate. Investigate the relationship between new residential development and the plume. | **Ongoing.** Based on data collected under the Long-Term Monitoring Groundwater Project there is no evidence that the plume has expanded into NE ¼, Sect. 29, T5N R1W. Three monitoring wells (U2-037, U2-087, and U2-029) exist to monitor the toe of the plume. Of the seventeen samples collected from U2-037 since 1994, TCE has been below the MCL with a historical maximum of 7.4 ug/L. Of the nine samples collected from U2-087, TCE has been below the MCL with a historical maximum of 12.61 ug/L since 1998. TCE has not been detected in twenty-four samples collected from U2-029. Because this plume does not appear to have migrated beyond the water use restricted area based on the water rights map provided in the LUCAR (**Hill AFB CEVR, 2007b**), the need for additional water rights in this area is unwarranted. However, if residential development falls within the plume boundary at some point in the future, evaluation of indoor air will be conducted under the Basewide Indoor Air Program and land use controls will be implemented to ensure that exposure pathways remain incomplete. | No |

**Notes**

CAMU = corrective action management unit
CSM = conceptual site model
DNAPL = dense non-aqueous phase liquid
ERPIMS = environmental restoration program information management system
FY = fiscal year
LTM = long-term monitoring
MCL = maximum contaminant level
NIT = north interceptor trench
OU = operable unit
PSVPlan = Performance Standard Verification Plan
PSVReport = Performance Standard Verification Report
SRS = source recovery system
ug/L = micrograms per liter

Table OU 2-4
# Operable Unit 2
# Five-Year Review Process

Reviewer: Kelly Taylor

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| **Introduction** | This 2008 five-year review for Hill AFB has been conducted in accordance with the EPA's Comprehensive Five-Year Review Guidance dated June 2001 (**EPA, 2001**). Administrative and community involvement components of the five-year review are described in **Section 2.0** of this report for the overall five-year review. In addition, interviews were conducted with relevant parties. A site inspection of OU 2 was performed. Relevant site documents and applicable data covering the period of the five-year review were evaluated. The site interviews, site inspection, and data review are further discussed in the following sections. |
| **Interviews** | Interviews for OU 2 were conducted with Jason Dalpias/Environmental Management, CEVR O&M manager, John Barlow/O&M contractor with CH2M HILL, and Kyle Gorder/CEVR site manager. Copies of the Interview Record Forms are provided in **Appendix D**.<br><br>In his interview, Jason Dalpias stated, "CEVR is continually making changes in O&M requirements, maintenance schedules, and sampling routines in order to more efficiently and effectively operate the OU 2 remedial systems. These changes enable Hill AFB to ensure that the remedy is protective and effective."<br><br>Mr. Barlow indicated that the OU 2 system operates very well and he was impressed with the overall performance. He also indicated that several O&M difficulties have been encountered since the last five-year review. These include occasional problems with pump failures, epoxy flooring issues, holes in the inconel plates of the heat exchanger in the steam stripper, and a leak in the floor line from the building sump to tank T-105. He also stated that the steam stripper was past the expected design life. Optimization efforts and operational improvements since the last five-year review include the addition of an above ground line to pump from the G-pool outside the containment wall to inside the containment wall (not currently used) and reconfiguration of the NIT to discharge directly to the sewer. Additionally, the sewer lines were cleaned to remove fouling (likely associated with OU 1 but the lines are commingled). However, the most significant change to the system since the last five-year review includes the bypassing of the steam stripper, which is not currently a part of the treatment process. The steam stripper is still in place and can be used as necessary.<br><br>Kyle Gorder was interviewed and indicated that management at OU 2 continues to be focused on maintaining control of the source zone while reducing overall costs. An enhanced biostimulation treatability study was implemented in the Panel 5 portion of the source zone and shows reductive dechlorination of TCE to ethane, albeit at rates slower than anticipated. Efforts to reduce cost (without any reduction in containment) associated with source zone pump and treatment are underway. These consist of studying the effect of source zone water levels on mass release and evaluation of the efficacy of using the air stripper treatment facility (rather than the steam stripper) to treat pumped water. He also noted that performance of the NIT may need to be improved (as indicated in the latest Draft PSVReport) and should be evaluated. However, data collected since the 2003 five-year review indicate progress toward achieving remedial goals. Mass has been removed from the source zone (both as DNAPL and dissolved phase) and TCE concentrations in off-Base wells are generally stable or decreasing. DNAPL recovery has steadily declined since it began (mobile DNAPL has been removed), and appears to be at the point of diminishing returns.<br><br>Based on all interviews, no unexpected contamination has been found outside the capture zone and no unknown source areas have been identified. Additionally, none of the interviewees were aware of any community concerns or ongoing concerns regarding the implementation of the remedy at OU 2, from a technical or regulatory perspective. |

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| | Community interviews were also conducted as part of this five-year review. Interviews were conducted with Mr. Joe Gertge/South Weber City Mayor and Mr. Matt Dixon/South Weber City Manager. Copies of the Interview Record Forms are provided in **Appendix B**.<br><br>Mayor Gertge said that it appears the Base has taken a multi-faceted approach to clean up a widespread problem. The Base has been forthcoming and anxiously engaged with the city and values the city's advice. The Base has also been willing to work with the community and explain things at a non-technical level for the layman. He also said he is very comfortable with the information mechanism. The Base is very open and provides reports to the city and the RAB representatives, Mr. Joel Workman and Ms. Jan Ukena. He also feels that over the last 5 years the Base has improved both the dissemination of information and the quality of the information distributed, though he did note that some of the cancer studies are difficult to understand.<br><br>Mr. Dixon said that he has been impressed with Hill AFB's technical people in the restoration program. He said he has met with Mr. Jason Dalpias and Mr. Bob Elliott and they have explained the cleanup process to him. Hill AFB's people are accessible, responsive, and willing to supply charts or maps, if requested. He suggested that the Base educate the newly elected officials at the first of the year, and perhaps offer a tour of the cleanup sites.<br><br>Both Mayor Gertge and Mr. Dixon indicated that development has been slowed due to concerns associated with the contamination and community concerns are focused on impacts to property values. |
| **Site Inspection** | The site inspection for OU 2 was conducted on September 24 and 28, 2007. The completed site inspection checklist is provided in **Appendix E**.<br><br>Based on the site inspection, the site is well maintained, staff are onsite daily, and equipment is kept in working condition. Most wells and sumps were located and inspected. All that were inspected were in good condition. No evidence was found to indicate that the containment wall has been breached or that containment has been lost in the source area. There are collection sumps located at several off-Base seeps/springs; the springs and seeps no longer flow, and these structures were not operating. There are several groundwater interceptor trenches installed on the downgradient end of the plume (referred to as the NIT). Water is collected into a sump and discharged directly to the sanitary sewer of the CWSID. Ground water extracted at the NIT was previously pumped uphill to the air stripper for treatment. Increased discharge limits to the CWSID allowed for the direct discharge to the sanitary sewer. All components of this portion of the remedy appeared to be in good condition and proper working order.<br><br>The site inspection checklist addressed four discussion topics. These discussion topics are presented below, followed by responses and general observations based on the site inspection.<br><br>(1) Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).<br><br>The OU 2 remedy was to achieve five remedial action goals for contaminated ground water, soil, springs, and seeps: restoration of ground water to the MCLs; limit cancer risk to a target of $1x10^{-6}$ due to incidental ingestion, dermal contact, or inhalation of vapors; maintain contaminant concentrations low enough to avoid chronic health effects (hazard index less than 1); prevent further degradation of groundwater; and, remediate groundwater, water flowing from springs and seeps, source contaminants, and soils in a timely manner in compliance with the selected remedy to achieve the remediation goals. The long-term remedial action objective for DNAPL in the source zone was to remove free-phase, residual, and vapor phase DNAPL to the extent practicable and contain DNAPL sources that cannot be removed.<br><br>The ROD stated that a surface cap would be installed at the OU 2 Source Area to limit exposure to contaminants, minimize infiltration into the Source Area groundwater, and to prevent erosion of surface soils. The ROD stipulated that this portion of the remedy would |

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| | be completed once the Source Area treatment is completed and has been evaluated. This portion of the remedy has not yet been implemented.<br><br>The ROD also stated that a SVE system would be installed to remediate soils. The ROD stipulated that this system would be installed once a portion of the soils were dewatered, but no specific timeframe was established. The 2003 five-year review stated that implementation of this portion of the remedy was pending completion of treatability studies, but that a pilot-scale SVE study was under review. This portion of the remedy has not yet been implemented, but according to CEVR, a schedule has been proposed which includes an SVE pilot study to be conducted in Summer of 2008, with SVE implementation as appropriate in 2009.<br><br>Institutional controls are in place to prevent exposure to contaminated groundwater and soils at OU 2. Some off-Base portions of OU 2 are fenced to restrict access. The on-Base portion of the remedy is not fenced. Buildings associated with the OU 2 remedy are locked when unoccupied.<br><br>The non-source area groundwater plume is being addressed through the NIT. Groundwater extracted by the NIT is discharged directly to the CWSID under permit.<br><br>A series of extraction wells, and upgradient control system (interceptor trench), and containment wall have been installed in the source area to address contaminated groundwater and DNAPL removal. DNAPL is separated from groundwater and shipped offsite for disposal. Extracted groundwater was previously treated using the steam stripper and then routed to the air stripper, though by the end of 2007 water was often only treated in the air stripper and discharged to the CWSID under permit.<br><br>Collection systems are in place at several springs at OU 2 to collect contaminated water. However, the springs and seeps only flow intermittently.<br><br>Based on the site inspection, all components of the remedy appear to be functioning as designed.<br><br>(2) Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.<br><br>Operation and maintenance at the site includes maintenance of the extraction wells and associated sumps and piping, long-term monitoring of the site groundwater, water level monitoring, and O&M of the spring collection systems, NIT, conveyance systems, and the SRS and Air Stripper Buildings. Monitoring data do not indicate that the containment wall has been breached. The effluent is monitored to ensure that the treatment and discharge criteria are met. Proper inspection and maintenance procedures are in place and implemented to ensure the integrity of the remedy and to ensure the enforcement of ICs (groundwater use restrictions, land use restrictions on-site, integrity of fencing, and signage).<br><br>(3) Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.<br><br>There are no issues related to the O&M procedures (cost or scope) that would indicate the protectiveness of the remedy may be compromised in the future. The design of the system and the nature of the DNAPL are such that a constant O&M presence onsite will be required for the foreseeable future.<br><br>(4) Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.<br><br>Operation and maintenance contractors make recommendations to optimize performance and/or reduce costs. No optimization opportunities were identified as part of the site inspection. |

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| **Data Review** | The data reviewed as part of the 2008 five-year review included groundwater samples, effluent discharge samples, surface water samples from seeps and springs, mass removal data for NIT and spring interceptor trenches, groundwater elevations, slope stability data, DNAPL recovery data, and system flow data. Groundwater data were collected on a semiannual basis at 65 monitoring wells during the review period. Effluent discharge sampling was conducted quarterly during the review period. Surface water samples from seeps and springs were collected on an annual basis if adequate flow was present. Mass removal estimates were calculated annually based on sump flow measurements as presented in the Draft PSVReport. Groundwater elevations were collected quarterly. Slope stability was measured annually in July or August. Dense non-aqueous phase liquids recovery data and system flow data were reported monthly as presented in the monthly reports.<br><br>The ROD established remediation goals for groundwater, soils, and springs and seeps at OU 2. For groundwater and seeps and springs, the remediation goals were set at the MCLs established under the SDWA and UDEQ regulations. For soils, the remediation goals are risk-based levels. System discharge effluent is discharged to the CWSID. These discharges are permitted and comply with CWSID permit #HAFB/OU1246, which is valid through September 1, 2010. Due to relatively low contaminant concentrations observed in the effluent from the OU 2 NIT, the effluent is discharged directly into the sanitary sewer without treatment. Discharge from the OU 2 Source Area System and the OU 2 UCS was treated in the steam stripper and then routed to and treated in the ASTP. The discharge is then combined with the OU 1 Source Area water and discharged into the sanitary sewer without further treatment. It should be noted that by the end of 2007, the steam stripper was only occasionally operated and discharge was often routed directly to the ASTP. Remediation goals and effluent discharge limits are presented in **Tables OU 2-5** and **OU 2-6**.<br><br>Based on the data review, the system generally seems to be achieving the RAOs. Groundwater flow direction appears to be consistent based on groundwater elevation data at OU 2 during the review period and all effluent discharge samples during the review period were within the permitted limits as presented in **Table OU 2-6**. Sump flow data from the UCS was measured daily and is an indicator of whether groundwater is being intercepted and removed by the extraction trench. In addition, groundwater levels upgradient of the UCS are metrics used to monitor UCS performance. Based on the UCS sump flow data and groundwater elevation data upgradient of UCS from 2003 through 2007, the UCS is apparently performing as designed and no evidence of significant groundwater mounding has been identified. Because the containment wall is located in a known landslide area, the UCS was constructed to prevent groundwater mounding against the containment wall, a condition that could lead to slope failure. The key objective of the UCS is to maintain slope stability above the Davis-Weber canal by lowering groundwater levels around the wall. Based on slope stability measurements since 2003, the escarpment slope is stable at the end of each containment wall.<br><br>Based on a flow and contaminant transport model that was developed in 2005 (**URS and Intera, 2005**), the simulation results indicate that the containment wall is the most effective component of the remedial systems with respect to inhibiting contaminant migration from the source area; however, the model also indicated that the containment wall does not prevent the escape of contaminants from the source area, but rather it diminishes mass flux by deflecting transport pathways downward, thereby reducing groundwater velocities due to vertical permeability anisotropy.<br><br>From 2004 through the first quarter of 2007, 22.72 pounds of TCE and 4.16 pounds of other dissolved VOCs were removed by the NIT and Spring Interceptor trenches. NIT and Spring U2-326 interceptor trenches capture approximately 50 percent of the groundwater flowing through the trenches, as estimated in the most recent Draft PSVReport (**URS, 2007**). Seeps and springs are monitored annually and sampled when adequate flow is present. Recent results in the spring of 2006 indicated that TCE was present in spring U2-304 (79.6 µg/L) above the MCL. Additionally, U2-302 was found to be flowing in Spring 2005, Spring 2006, and Spring 2007. In 2007, low levels of chloroform (5.2 µg/L) were detected in U2-302. In February 2005, TCE was detected in U3-326 at a maximum of 243 µg/L exceeding the MCL. No samples have been |

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| | collected since then. These springs, specifically U2-302 which does not have an interceptor or collection system, should be continuously monitored to determine if flow is persistent and monitor contaminant concentrations.<br><br>Based on groundwater data collected during the review period, TCE concentrations in wells U2-018, U2-117, U2-018, U2-023, U2-025, U2-019, U2-045, U2-021R, U2-042, U2-009, U2-118 U2-080, U2-082, U2-083, U2-084, U2-043, U2-039, U2-079, U2-676, U2-677, and U2-078 were generally stable or decreasing. Trichloroethene concentrations in U2-042 appear to have reached historical maximum concentrations in 2005 (327 µg/L) but have since reduced in 2006 and 2007 to levels of less than 110 ug/L. TCE concentrations in U2-675 appear to be highly variable without a consistent concentration trend. Wells outside of the known plume are all non-detect or less than MCLs suggesting that the plume is not expanding. Trichloroethene concentrations in wells near G-pool appear to be variable in some wells (U2-211, U2-212, and U2-214) though concentrations in U2-213, U2-206, U2-207, U2-208, U2-209, and U2-210 appear to be decreasing. Concentrations in U2-215 may actually be increasing though concentrations are highly variable. Effluent concentrations combined from OU 1 and OU 2 (U2-695) have consistently been below discharge limits. |

Table OU 2-5

# Chemicals of Concern and Remediation Goals at OU 2

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Media | Chemical of Concern | Remediation Goal | Units |
|---|---|---|---|
| Groundwater/ Seeps and Springs | 1,2-Dichloroethene | 70 | µg/L |
| | Methylene Chloride* | 6 | µg/L |
| | Tetrachloroethene | 5 | µg/L |
| | 1,1,1-Trichloroethane | 200 | µg/L |
| | Trichloroethene | 5 | µg/L |
| | Toluene | 1000 | µg/L |
| | Beta-BHC* (in source area only) | 0.01 | µg/L |
| | Gamma-BHC (Lindane) (in source area only) | 0.2 | µg/L |
| Soil and Sediment | Tetrachloroethene* | 12.31 | mg/kg |
| | Trichloroethene* | 58.21 | mg/kg |

**Notes**

* Remediation goals for these chemicals are risk-based levels

Unless otherwise specified, the concentrations for ground and surface water are maximum contaminated levels (MCLs) established under the Safe Drinking Water Act and/or Utah Primary Drinking Water Standards

mg/kg = milligrams per kilogram

µg/L = micrograms per liter

Table OU 2-6

## OU 2 System Effluent Discharge Limits for Discharge to the Central Weber Sewer Improvement District

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Analyte | Discharge Limit | Units |
|---|---|---|
| Total VOCs* | 2.13 | mg/L |
| Arsenic | None | |
| Nickel | 4.1 | mg/L |
| Lead | 1.14 | mg/L |
| Zinc | 4.57 | mg/L |
| pH | 5.0-11.0 | |

**Notes**

* Based on Method E624

mg/L= milligrams per liter

VOCs = volatile organic compounds

Table OU 2-7
# Operable Unit 2
# Five-Year Review Technical Assessment

Reviewer: Kelly Taylor

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| **Introduction** | The five-year review must determine whether the remedy at a site is protective of human health and the environment. The EPA guidance describes three questions used to provide a framework for organizing and evaluating data and information and to ensure all relevant issues are considered when determining the protectiveness of a remedy (**EPA, 2001**). These questions are assessed for OU 2 in the following sections. The implementation of ICs is also described. At the end of this table is a summary of the technical assessment. |
| **Question A.** | **Is the remedy functioning as intended by the decision documents?**<br><br>Yes. The documents that detail the remedial decisions for OU 2 are the 1991 *Interim Record of Decisio*n (**CH2M HILL, 1991**) and the 1996 *Record of Decision* (**CH2M HILL, 1996**).<br><br>The SRS was completed in October 1993 as part of the 1991 Interim ROD, and by the end of 1993, approximately 25,834 gallons of DNAPL had been removed from the source area by a combination of pumping source area wells and previous investigation activities. In 1996 as part of the OU 2 ROD, the slurry containment wall (including an upgradient control system) was installed around the source area to form a vertical barrier with low permeability around the DNAPL pools. The NIT was also constructed in 1997 in an effort to contain the leading edge of the off-Base plume. In 1998, a well field was installed to pump and treat the contaminated water and free-phase DNAPL from the G-Pool as well as hydraulically contain the groundwater within the G-Pool to minimize further contaminant flux to the off-Base plume. An additional off-Base trench, U2-326, was completed in 1998 to drain a seasonal spring located near the NIT while a gravel interceptor trench for spring U2-304 was constructed in 1999.<br><br>Based on review of data and reports during this review period, the remedy appears to be functioning as intended. Approximately 44,342 gallons of DNAPL have been removed from the plume since 1992. Because of the aggressive early removal of free-phase DNAPL from the source area, the source area well field now recovers primarily highly contaminated groundwater containing little, if any, DNAPL (**URS, 2007**). Based on a flow and contaminant transport model developed in 2005 (**URS and Intera, 2005**), transport modeling suggests that the plume may have reached its maximum extent and is in retreat. The simulation results indicate that the containment wall is the most effective component of the remedial systems with respect to inhibiting contaminant migration from the source area. Although the containment wall does not completely prevent the escape of contaminants from the source area, it diminishes mass flux by deflecting transport pathways downward, thereby reducing groundwater velocities due to vertical permeability anisotropy. The report also states that natural degradation is the major mechanism for removing contaminant mass from and promoting retreat of the plume in the off-Base plume despite a relatively low decay rate utilized in the model. Contaminant mass removal by groundwater extraction from the source area or by the NIT and U2-326 interceptor trenches is an order of magnitude smaller than by natural degradation. According to the Draft PSVReport (**URS, 2007)** the mass of TCE in the toe area of the plume (downgradient of the NIT) has declined and centers of mass are stable. Concentrations of PCE, cis-1,2-DCE, and vinyl chloride have been below their respective MCLs since 1999. The estimated remediation timeframe for the toe area of the plume is 27 years. The mass of PCE and TCE in the entire non-Source Area plume is declining, and the centers of mass are moving away from the Source Area; though, the centers of mass for cis-1,2-DCE and vinyl chloride do not appear to be declining, and the centers of mass are moving away from the source area. The remedial timeframe estimate for the entire non-source area plume is 372 years or more (**URS, 2007**). The remedial timeframe for the non-source area plume is strongly influenced by the attenuation of |

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| | cis-1,2-DCE and vinyl chloride. A review of groundwater data generally indicates that TCE concentrations are stable or declining.<br><br>It should be noted that neither the surface cap nor the SVE system, each identified in the ROD as part of the selected remedy, have been implemented to date. However, an SVE system was brought online for three weeks during the summer of 1997 in the source zone as part of the PRAXIS Steam Flood demonstration (**URS, 2006**). As stated in the ROD, the cap is to be delayed until source area treatment by either conventional or innovative technologies is completed and effectiveness evaluated. A pilot study is scheduled for 2008 to assess the need for SVE. If deemed necessary, SVE will be installed in 2009.<br><br>Opportunities for Optimization:<br><br>URS began operating, maintaining, and upgrading the groundwater extraction system at OU 2 since SRS construction was completed in 1993; CH2M HILL took over O&M in 2006. Operation and maintenance contractors make recommendations to optimize performance and/or reduce costs. No optimization opportunities were identified as part of the site inspection. The CEVR is currently working to determine if decommissioning of the steam stripper, which is operated only occasionally, is appropriate and if the air stripper alone can adequately treat the groundwater. Additionally, the efficiency of DNAPL removal appears to be decreasing. Additional evaluation should be conducted to determine if continuing removal efforts is productive or if removal efforts are no longer effective. The Draft PSVReport estimated a remedial timeframe of more than 30 years for the non-source area plume (**URS, 2007**). If this estimate holds in the Final PSVReport, additional action may be required in the non-source area to reduce the remedial timeframe. Consequently, the installation of extraction wells may need to be considered to optimize remedial efforts and ensure a shorter remedial timeframe.<br><br>Early Indicators of Potential Remedy Problems:<br><br>There are no issues related to the O&M procedures (cost or scope) that would indicate the protectiveness of the remedy may be compromised in the future. The design of the system and the nature of the DNAPL are such that a constant O&M presence onsite will be required for the foreseeable future. |
| **Question B.** | **Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?**<br><br>Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics:<br><br>No, the inhalation slope factor for benzo(a)pyrene and the inhalation reference dose for trans-1,2-dichloroethene became available since the ROD was signed which may affect the cleanup levels for these compounds by becoming more stringent. As stated in the 2003 five-year review, the toxicity factors used to develop the cleanup levels for beta-BHC, methylene chloride, tetrachloroethene, and trichloroethene are now 10 to 10,000 times more stringent. In addition, beryllium and toluene toxicity factors have also become more stringent (since the 2003 five-year review). However, toxicity factors for 1,1,1-trichloroethane, chromium, and dieldrin have either been withdrawn or become less stringent than when the ROD was signed.<br><br>Changes in Applicable or Relevant and Appropriate Requirements:<br><br>Applicable or Relevant and Appropriate Requirements for this OU were identified in the ROD. Chemical-specific, action-specific, and location-specific ARARs were reviewed and all but a few ARARs were determined to be either applicable or relevant and appropriate as presented in **Appendix G**. The Solid Waste Disposal Act (42 USC §§ 6901-6987) was not determined to be applicable or relevant and appropriate because no landfills are associated with OU 2. Additionally, standards for thermal treatment (Solid Waste Disposal Act – 42 USC §§ 6901-6987) are not currently considered to be applicable or relevant and appropriate because thermal treatment is not occurring at OU 2. |

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| **Question C.** | **Has any other information come to light that could call into question the protectiveness of the remedy?**<br><br>No. However, based on flow and transport modeling (**URS and Intera, 2005**), the effectiveness of the NIT and U2-326 interceptor trench is uncertain. A significant fraction of particles escape capture by the trench systems and travel beyond the system or leave through the bottom layer of the modeling domain. However, because the mass of the TCE in the toe area has declined and the center of mass is stable, any contamination escaping the trench systems is assimilated in the toe area and is not impacting the stability of the plume. |
| **Institutional Controls** | Institutional controls are generally defined as non-engineered instruments such as administrative and legal tools that do not involve construction or physically changing the site, and that help minimize the potential for human exposure to contamination and/or protect the integrity of a remedy by limiting land and/or resource use (**EPA, 2005**). Institutional controls can be used for many reasons including restriction of site use, modifying behavior, and providing information to people (**EPA, 2000**). Institutional controls may include deed notices, easements, covenants, restrictions, or other conditions on deeds, and/or groundwater and/or land use restriction documents (**EPA, 2001**). The following paragraphs describe ICs implemented at OU 2, the potential affect of future land use plans on ICs, and any plans for changes to site contamination status.<br><br><u>Types of ICs in Place at the Site:</u><br><br>Institutional controls required by the ROD at OU 2 include: (1) water rights and well drilling restrictions and advisories to prevent exposure to contaminated groundwater; (2) fencing with warning signs to restrict access to exposure areas, construction areas, and treatment facilities; (3) issuance of a continuing order (which remains in effect as long as the property is owned by the Air Force), which restricts access to or disturbance of contaminated soil or groundwater such as construction activities or installation of water supply wells in zones of contaminated groundwater; (4) filing a notice to the deed detailing the restrictions of the continuing order, and; (5) a covenant to the deed in the event of property transfer. Additionally, fencing was installed around contaminated springs to restrict access by livestock.<br><br>Access and Institutional controls are currently in place at OU 2. Based on the site inspection, fencing at OU 2 is the Hill AFB boundary security fence and OU 2 site is not completely fenced. However, one locked gate through the boundary fence was present and locked. Additionally, signs were posted at various areas of OU 2 and appeared to be in good condition. Signs noted contact information and many noted restrictions and/or presence of contamination.<br><br>Hill AFB performs an annual evaluation of the ICs in place for the Base. This includes verification of orders, leases, groundwater use restrictions, and inspections of signage, fences, and monitoring wells. According to the most recent basewide LUC report (**Hill AFB CEVR, 2007b**), during the last Annual LUC assessment, some of the existing warning signs installed at OU 2 did not have 75 CEG/CEV contact information but according to the OU 2 CEVR Site Manager, have since been updated.<br><br><u>Effects of Future Land Use Plans on ICs:</u><br><br>No land use changes are anticipated.<br><br><u>Plans for Changes to Site Contamination Status:</u><br><br>No changes are anticipated to the site contamination status in the near future. |

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| **Summary of the Technical Assessment** | The technical assessment, based on the data review, site inspection, technical evaluation, and interviews indicates that the remedial actions selected for OU 2 generally appear to have been implemented as intended by the decision documents. Analysis of monitoring data during this review period indicates that mass has been removed from the source zone (both as DNAPL and dissolved phase) and TCE concentrations in off-Base wells are generally stable or decreasing though concentrations of 1,2-DCE and vinyl chloride appear to be increasing in some areas and should be further evaluated. DNAPL recovery has steadily declined since it began (mobile DNAPL has been removed), and appears to be at the point of diminishing returns. The efficiency of continuing the DNAPL recovery efforts should be assessed.<br><br>Neither the NIT or the U2-236 Spring Interceptor trench appear to be fully capturing contaminated groundwater based on modeling results. However, the mass of the TCE in the toe area of the plume has declined and centers of mass are stable; therefore the significance of the capture rate is likely low. |

Table OU 2-8
# Operable Unit 2
# Technical Assessment Summary for OU 2

Reviewer: Kelly Taylor

| Site ID | Remedy Description | Technical Assessment* | | | Protectiveness | Next Five-Year Review |
|---|---|---|---|---|---|---|
| | | Question A* | Question B* | Question C* | | |
| WP007 | Source removal, containment, and institutional controls | Yes | No | No | The remedy is protective in the short term | 2013 |
| SS021 | No Further Response Action Planned | NA | NA | NA | NA | NA |
| OU 2 | Source removal, containment, and institutional controls | Yes | No | No | The remedy is protective in the short term | 2013 |

*Question A: Is the remedy functioning as intended by the decision documents?
Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objective (RAO) used at the time of the remedy still valid?
Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
NA = Not Applicable
OU = operable unit

Table OU 2-9
## Operable Unit 2
## Five-Year Review Issues, Recommendations and Follow-Up Actions, and Protectiveness Statement

Reviewer: Kelly Taylor

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| **Issues** | Operation and maintenance activities are ongoing at OU 2. Based on the document review, data review, site inspection, interviews, and the technical assessment, it appears the remedy has been implemented as planned and is functioning as intended by the decision documents in the short-term. To ensure continued protectiveness, six issues are identified in the 2008 five-year review for OU 2, as described below. These issues do not currently affect the protectiveness of the remedy, although they need to be addressed to ensure continued protectiveness.<br><br>1) The 2003 five-year review recommended identifying the appropriate water level action level for well field operations and documenting any new levels and rationale in the PSVPlan and conducting a thorough review of the remedies. According to the Flow and Transport Modeling effort (**URS and Intera, 2005**), neither modeling nor existing data provide solid answers to the question of appropriate water level elevations. A study is currently being conducted to determine if increasing water levels in the Source Area result in increased contaminant mass flux.<br><br>2) The Draft PSVReport only addresses non-source areas and does not address the SRS extraction well field. No evaluation of the source area remedies was conducted as part of the Draft PSVReport.<br><br>3) The 2003 five-year review indicated that the risk analysis for OU 2 should be reevaluated to determine if revised contaminant action levels are warranted based on new standards and toxicity factors. Based on the 2003 Five-Year Review Risk Assessment Recommendation (**Hill AFB CEVR and SES, 2007**), there were no recommended actions for OU 2. Based on the review of toxicity values as part of this five-year review, it was noted that several toxicity factors have changed which may have impacts on cleanup goals and estimated risk.<br><br>4) Based on flow and transport modeling results (**URS and Intera, 2005**) and evaluations conducted in the Draft PSVReport (**URS, 2007**), the NIT may not appear to capture all the groundwater flowing toward it. The NIT is located near the edge of the OU 2 plume, and contaminant mass in this portion of the plume appears to be decreasing. This indicates that the NIT is effective at preventing further degradation of groundwater quality downgradient. It also concluded that contaminant mass removed by the NIT is small in comparison with the overall plume. However, the performance metrics in the Draft PSVReport do not currently indicate what is considered acceptable performance by the NIT; therefore, once capture rates are estimated, there is no metric to evaluate this against.<br><br>5) As indicated in the Draft PSVReport (**URS, 2007**), data indicate that natural degradation in the non-source area plume is occurring at OU 2. Concentrations of cis-1,2-DCE and vinyl chloride appear to be increasing as a result, specifically in wells U2-117 and U2-039 (though concentrations in U2-039 recently seem to have decreased). Concentrations of cis-1,2-DCE and vinyl chloride currently exceed their respective MCLs in some off-base wells. In addition, vinyl chloride is not identified in the ROD as a contaminant of concern for OU 2. |

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| | 6) Based on an interview with Kyle Gorder, the Environmental Management, Restoration Division (CEVR) site manager (**CH2M HILL, 2007e**), dense non-aqueous phase liquids (DNAPL) recovery has become increasingly less efficient. According to the Draft PSVReport (**URS, 2007**), because of early aggressive removal of free-phase DNAPL from the Source Area, the Source Area well field now recovers primarily highly contaminated groundwater containing little if any DNAPL. Once DNAPL recovery efforts are ceased, soil remediation efforts should be evaluated. As part of the ROD, soil vapor extraction (SVE) is required to address contamination in soil. According to the Draft PSVReport, the SVE system of the remedy has not yet been implemented (**URS, 2007**). However, a study is planned to evaluate the effectiveness of SVE in 2008 and to provide design parameters if SVE is deemed effective. SVE will be implemented in 2009, if deemed appropriate. |
| **Recommendations and Follow-Up Actions** | As described in the previous section, six issues were identified in the 2008 five-year review for OU 2. To address these issues, the following recommendations and follow-up actions have been defined.<br>1) Further evaluation of the water level metrics in association with the source areas should be conducted as planned and results should be used to determine if water levels in the source area act are useful performance metrics.<br>2) Because the draft PSVReport only addresses non-Source Areas, Source Areas should be addressed as soon as possible in consideration of ongoing optimization efforts.<br>3) Because toxicity factors are likely to change again, site closure is not anticipated for many years, and the remedy is still considered protective because exposure pathways are incomplete as a result of enforcement of institutional controls (ICs), no action at this time is recommended. While modifications based on toxicity values are not currently recommended because current ICs ensure protectiveness, if circumstances change and exposure pathways become complete, risk and clean up goals will need to be reevaluated at that time.<br>4) Currently, the performance objective of "intercepting and removing VOC contaminated groundwater from the downgradient region of the contaminant plume" is vague and does not address what the acceptable levels of contaminant mass and groundwater capture are for the NIT system. The PSVReport should provide a metric for determining acceptable mass removal rates for the NIT and evaluating at what point the operation of the NIT is no longer cost effective.<br>5) A plume map should be developed for cis-1,2-DCE and vinyl chloride, and the conceptual site model for OU 2 should be updated to provide a basis for understanding the natural attenuation processes and the potential effects on these contaminants. Vinyl chloride, while not identified in the ROD as a contaminant of concern, should be monitored in groundwater concentrations assessed relative to the MCL. The concentrations and extent of cis-1,2-DCE and vinyl chloride should be evaluated in terms of the RAOs and their potential to inhibit remedy protectiveness if concentrations continue to increase.<br>6) A process needs to be included in the O&M manual and PSVReport that outlines the parameters required to determine where the mobile DNAPL pump should be used to ensure that DNAPL removal is most efficient and to determine at what point DNAPL recovery efforts should cease. If it is determined that DNAPL recovery is no longer efficient, the implementation of the SVE system, as required by the ROD, should be considered to remediate soils in the area. The study to evaluate the effectiveness of SVE should be conducted and documented. If SVE is considered appropriate based on the results of this study, a schedule should be developed for implementation of SVE and documented. If SVE is not considered appropriate an explanation of significant difference (ESD) should be considered to indicate why these components are no longer necessary. |

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| **Remedial Timeframe** | **Table 3-3** in **Section 3.1.4** presents the remedial timeframe estimates for OU 2. The remedial timeframe for the source area is indefinite. Remediation associated with the non-source area is estimated to be complete sometime during the 2030's. |
| **Protectiveness Statement** | **The remedial actions performed at OU 2 are considered protective of human health and the environment in the short-term.** Water-use restrictions and land-use controls are in place. ICs and land-use controls are assessed annually. The groundwater plume is well defined and stable, and there are no completed exposure pathways present at OU 2. The selected remedy will continue to be protective if the recommendations and follow-up items identified in this five-year review are addressed. |
| **Next Five-Year Review** | Remedial actions at OU 2 will be reviewed in the next five-year review for Hill AFB to be completed during or before September 2013. |

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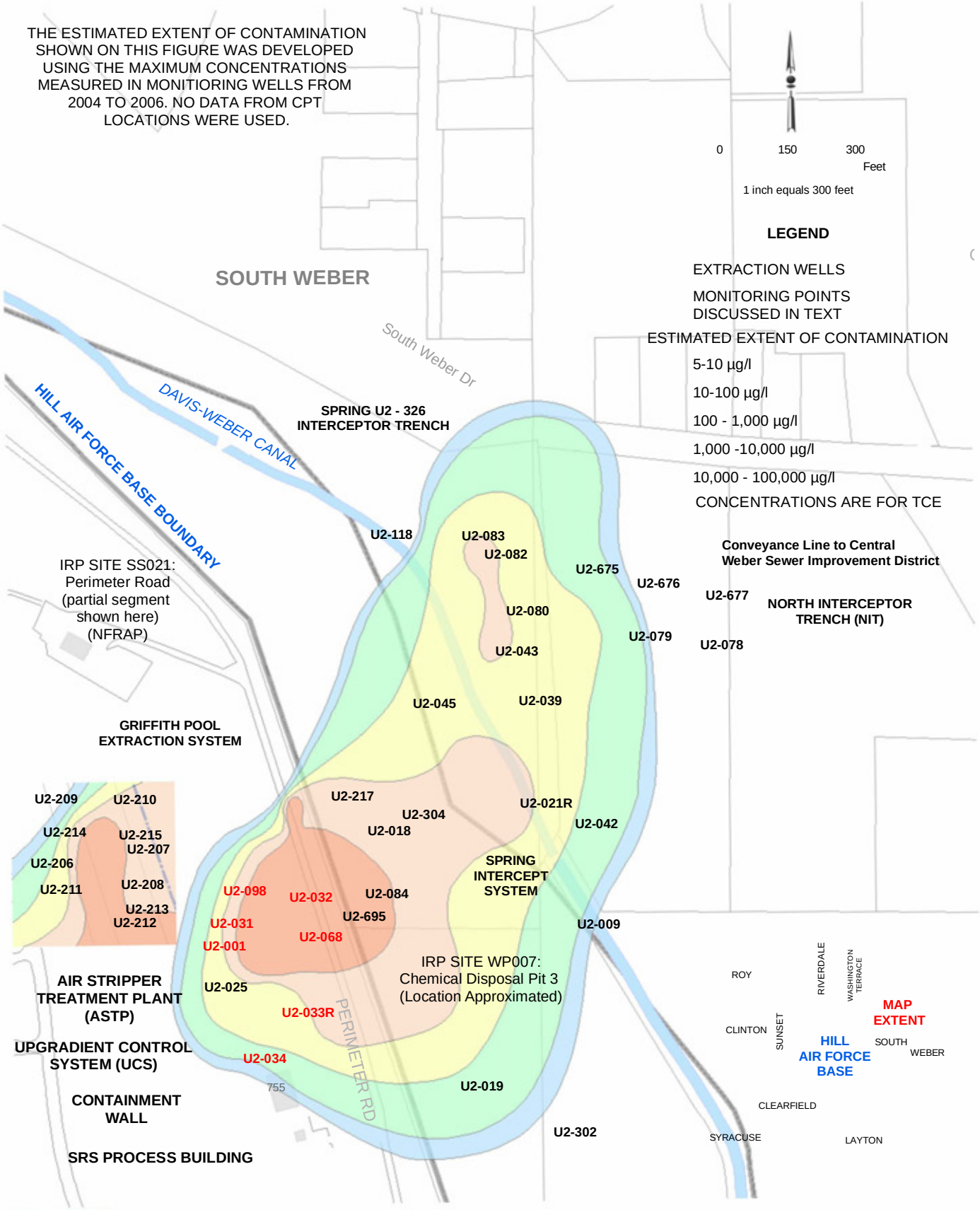


FIGURE OU 2 - 1
**SITE FEATURES OF OPERABLE UNIT 2**
2008 FIVE-YEAR REVIEW
IRP SITES: SS021, WP007
HILL AIR FORCE BASE, UTAH

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Table OU 3-1
# Operable Unit 3
# Background Information

Reviewer: Kelly Taylor

<table>
<tr><td>Introduction</td><td>
Operable Unit 3 is located near the South Gate Entrance at Hill AFB (Figure OU 3-1). Operable Unit 3 is a soils-only OU and includes two open IRP sites (Sodium Hydroxide Tank Site [ST004] and Berman Pond [WP005]), and three closed IRP sites (IWTP Sludge Drying Beds [WP006], Refueling Vehicle Maintenance Facility [RVMF] [ST018], and Pond 2 [SD046]). The closed IRP sites were either closed following remedial action success (ST018) or after the RI indicated that no contamination was evident (SD046 and WP006). No further remedial action is planned for these sites. The two no action sites (SD046 and WP006) will not be discussed further. Two additional sites were originally investigated as part of OU 3 [Pond 1 (SD034) and Pond 3 (SD023)]. These sites were closed under OU 3, but have been reopened and are undergoing further investigation as part of OU 9. These sites are discussed further under OU 9.<br><br>
The Sodium Hydroxide Tank Site (ST004) supported two 12,000 gallon USTs that were used to store a 25 percent by weight solution of sodium hydroxide. From 1940 to 1956, Berman Pond (WP005) was operated as an unlined evaporation pond that received stormwater runoff and industrial wastewater, which may have included spent solvents, heavy metals, and hydrocarbons. The remedial actions for the two open sites (Sodium Hydroxide Tank Site [ST004] and Berman Pond [WP005]) are cap installation, cap maintenance, and ICs. Contaminated soils from these two sites have been capped with an asphalt cover to minimize infiltration. The caps are inspected and maintained annually. Groundwater contamination below OU 3 is being addressed as part of OU 8 (URS, 2003).<br><br>
A list of the documents reviewed for OU 3 as part of the 2008 five-year review is provided in Appendix C.
<table>
<tr><th>IRP Identification</th><th>IRP Site Name</th><th>Status</th></tr>
<tr><td>ST004</td><td>Sodium Hydroxide Tank Site</td><td>LTO/LTM</td></tr>
<tr><td>WP005</td><td>Berman Pond</td><td>LTO/LTM</td></tr>
<tr><td>WP006</td><td>IWTP Sludge Drying Beds</td><td>NFRAP</td></tr>
<tr><td>ST018</td><td>RVMF</td><td>NFRAP</td></tr>
<tr><td>SD046</td><td>Pond 2</td><td>NFRAP</td></tr>
</table>
</td></tr>
<tr><td>Site Chronology</td><td>Provided separately. See Table OU 3-2.</td></tr>
</table>

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| **Background** | **Physical Characteristics.** This OU consists of five soils-only sites, of which only two are currently undergoing remedial efforts. These two sites include the sodium hydroxide tank site and Berman pond. The maximum dimensions of Berman Pond were approximately 800 feet long and 420 feet wide, and had an areal extent of 6 acres.<br><br>Subsurface conditions below OU 3 are dominated by interbedded silty sands, sandy silts, and clays. The OU 3 area overlies three aquifers, although these aquifers are not included as part of OU 3.<br><br>The Davis-Weber Canal and Ponds 1 and 3 are the primary surface water bodies at and near OU 3. The Davis-Weber Canal, a privately owned irrigation canal used each year from April to October, is located west of Pond 3. . There are no streams, lakes, or rivers at or near OU 3, but there are wetlands, including Ponds 1 and 3 (**Hill AFB, 1995**). |
| | **Land and Resource Use.** OU 3, located in the southeastern quadrant of Hill AFB, is generally located in an industrial area that is used for servicing and maintaining aircraft. In the Layton area south of OU 3 (now part of OU 8), land use includes residential, commercial, and agricultural. This area has undergone rapid residential development over the last 10 to 20 years, and agricultural use has declined. Crop production in the agricultural areas primarily consists of cereal grains, wheat and barley, and alfalfa. Although there is some pastureland, very few livestock are raised on the pastures south of Hill AFB. The OU 3 area overlies three aquifers, although these aquifers are not included as part of OU 3 The shallow aquifer consists of approximately 200 feet of relatively low yielding materials. Groundwater is encountered between 10 and 110 feet bgs at OU 3. The Delta and Sunset Aquifers, used at Hill AFB and by surrounding communities as domestic water supplies, are approximately 300 and 600 feet bgs at OU 3 respectively (**Hill AFB, 1995**). |
| | **History of Contamination.** Contamination at the Sodium Hydroxide Tank Site (ST004) is the result of two leaking 12,000 gallon USTs that were used to store a 25 percent by weight solution of sodium hydroxide. During the period the tanks were in use, several hundred thousand gallons of solution were lost due to leakage. Both tanks were removed in September 1992, in accordance with the UST Regulations administered by the UDEQ (**Hill AFB, 1995**).<br><br>Information obtained from aerial photographs indicates that the maximum dimensions of Berman Pond were approximately 800 feet long and 420 feet wide, and encompassed an area of approximately 6 acres. Prior to 1956, Berman Pond was connected to Pond 1, which received overflow from Berman Pond during high intensity storms. After construction of the IWTP in 1956, Berman Pond was connected to a sanitary sewer line and was used only as a stormwater retention pond. In 1958, pond overflow was re-routed to the storm drainage system, and between 1958 and 1970, the pond was filled with construction rubble and soils, and regraded (**Hill AFB, 1995**).<br><br>From the late 1950s until 1985, the RVMF (ST018) was used for draining excess fuel from refueling vehicles prior to their maintenance in Building 514. Although the actual source of contaminants in soils under the RVMF is unknown, it is presumed that the drained fuels and any solvents used for parts cleaning in maintenance procedures were collected in a floor drain within the RVMF, passed through an OWS, and either disposed of or recycled. Defects in the drainage system and/or incidental spills inside or outside the RVMF may have been sources for soils contamination. Collected water from the drain was stored in a small UST and subsequently pumped to the IWTP for treatment. Since September 1988, Building 514 has been the Base's Hazardous Waste Control Facility (**Hill AFB, 1995**) |

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| | **Initial Response.** Aside from characterization efforts and investigations, no remedies or actions were taken at Berman Pond (WP005) or RVMF (ST018) prior to the ROD signed in September of 1995. However, an interim remedial action was performed at the Sodium Hydroxide Tank Site (ST004) prior to the 1995 ROD and included the installation of an asphalt cap in August 1993 (**Hill AFB, 1995**). |
| | **Basis for Taking Action.** Based on the findings and conclusions of the OU 3 RI/FS and the risk assessments, high pH soil (soil with pH greater than 8.5) required remedial action at the Sodium Hydroxide Tank Site. The area of soil impacted by the sodium hydroxide solution extends vertically to an approximate depth of 70 feet bgs and laterally to a width of approximately 170 feet. The area of highest pH appears to be located between 25 and 40 feet bgs (**Hill AFB, 1995**). Based on the human health risk assessment (HHRA), analytes in soils at the Sodium Hydroxide Tank Site were not found to pose unacceptable risk (**Hill AFB, 1995**).<br><br>Based on the findings and conclusions of the OU 3 RI/FS and the risk assessments, several VOCs and SVOCs are present in Berman Pond soil at concentrations that, based on modeling results, have the potential to contaminate underlying ground water at levels that exceed Utah Ground Water Quality Standards, the MCLs, or may present a human health risk (**Hill AFB, 1995**). Based on the HHRA, some analytes in soils at Berman Pond posed unacceptable risk to future construction workers. The estimated excess cancer risk under this scenario was $1 \times 10^{-5}$, which may be significant. Compounds with individual excess cancer risks greater than $1 \times 10^{-6}$ included benzo(a)pyrene, arsenic, and cadmium. The estimated excess cancer risk to future residents is $1 \times 10^{-4}$, which is considered significant. Compounds with individual cancer risks greater than $1 \times l0^{-6}$ included benzo(a)pyrene, PCB-1254, and arsenic. Non-cancer risk was less than 1 and considered insignificant. Risks associated with contamination in groundwater are addressed under OU 8.<br><br>Based on the findings and conclusions of the OU 3 RI/FS and the risk assessments for RVMF, the only contaminant requiring cleanup is 1,l -DCE. Based on the HHRA, for future on-Base residents, the estimated excess cancer risk from ingestion of and dermal contact with soil is $2 \times 10^{-5}$, which may be significant. The only contaminant of potential concern with individual excess cancer risk greater than $1 \times l0^{-6}$ is l,l-DCE. The area of contaminated soil is centered around a floor drain located within Building 514. The l,l-DCE contamination extends to an approximate depth of 5 feet bgs; approximately 100 cubic yards of soil are contained within the area of contamination (**Hill AFB, 1995**). |
| **Remedial Actions** | **Remedy Selection (i.e., ROD/ESDs).** A final ROD was issued in 1995. The selected remedy for the Sodium Hydroxide Tank Site (ST004) is Cap Maintenance and Institutional Controls. This remedy consists of (1) the asphalt cap, which was installed as an IRA, and continuation of the inspection, maintenance and repair program for this cap, (2) long-term groundwater monitoring, and (3) institutional controls (Hill AFB, 1995).<br><br>The selected remedy for Berman Pond (WP005) is Cap Installation and Institutional Controls. This remedy consists of (1) extracting perched water from the pond, (2) installing a multi-media cap, (3) cap inspection and maintenance, (4) conducting long-term groundwater monitoring, and (5) implementing ICs (**Hill AFB, 1995**).<br><br>The selected remedy for RVMF (ST018) is in-situ SVE. This remedy consists of (1) SVE; (2) long-term environmental (groundwater) monitoring; (3) an inspection, maintenance, and repair program for the building floor; and (4) and a continuing order from the Installation Commander to limit exposure to contaminated soil (**Hill AFB, 1995**).<br><br>Remedial action objectives for OU 3 as defined in the ROD (**Hill AFB, 1995**) are to (1) reduce contaminant transport from within source areas and reduce chemical transport from soil to groundwater by minimizing surface water infiltration; (2) prevent human exposure to contaminated soil through ingestion, inhalation, and dermal contact, so that the individual |

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| | excess cancer risk is below 1 x $10^{-4}$ with a target of 1 x $10^{-6}$, and the threshold non-cancer hazard index is less than 1.0; and (3) reduce concentrations of contaminants so that the individual cancer risk is below 1 x $10^{-4}$ with a target of 1 x $10^{-6}$ and the threshold non-cancer index is less than 1.0. |
| | **Remedy Implementation.**<br><br>Sodium Hydroxide Tank Site: The asphalt cap was installed at this site in August 1993 as an interim remedial action. In 1999, a permanent asphalt layer was applied over the cap.<br><br>Berman Pond: In 1995, a dewatering system was installed to extract contaminated perched water remaining within the backfill of Berman Pond. The system was operated from September 1995 to May 1997 when it was shut down to allow construction of the asphalt cap. In 1997, the area was graded to drain and the asphalt cap was constructed. The extraction system was upgraded during the construction of the cap and placed back into operation from 1997 to 1998. The system has not operated since 1998. In 2007, a treatability study was initiated at Berman Pond to identify and eliminate sources of perched water, which accumulates under the cap (**MWH, 2007a**).<br><br>RVMF: An SVE system was installed to reduce the concentrations of 1,1-DCE in the soil and began operation in October 1997 (**Hill AFB, 1998**). The SVE system consisted of a concrete pad foundation and security fence, a 15-foot deep SVE well inside Building 514, two trenches (one from the new SVE well and another from an existing well outside Building 514) leading to the SVE system pad.<br><br>**Progress Since Implementation.**<br><br>Sodium Hydroxide Tank Site: As required by the ROD, the cap was initially inspected on a quarterly basis though this frequency has been reduced to annual as stated in the *CERCLA Cap Inspection Work Plan* (**Hill AFB CEVR, 2007b**). Semi-annual groundwater monitoring downgradient of the site has been conducted since the development of the 2001 PSVPlan (**CH2M HILL, 2007d**).<br><br>Berman Pond: Cap inspection has been performed on a quarterly to yearly basis since cap installation (**Hill AFB CEVR, 2007b**). Monitoring of perched groundwater elevations beneath the cap and annual settlement monitoring have been conducted since the development of the 2001 PSVPlan (**Hill AFB CEVR, 2007c**). Groundwater monitoring at Berman Pond was added as a performance standard in the most recent PSVPlan (**Hill AFB CEVR, 2007c**).<br><br>RVMF**:** The SVE remedial action decreased the soil contamination of 1,1-DCE to below detectable concentrations (0.005 mg/kg) in all of the samples collected from the confirmation soil borings. The goal of the remedy was to decrease the concentrations of 1,1-DCE to less than 0.8 mg/kg. The remedy (SVE) was successful and closure was therefore approved on May 2001. Institutional controls consisted of fence installation with warning signs to restrict access to the treatment facility and implementation of the continuing order to restrict access (**URS, 2003**). Because the site has since been closed, it will not be discussed further. |
| | **Operations and Maintenance.**<br><br>Operation and maintenance contractors for OU 3 during this review period included URS and CH2M HILL. The current O&M contractor (CH2M HILL) for the OU 3 caps is responsible for (1) inspection of the caps at a predetermined interval; (2) performing corrective maintenance of the CERCLA caps; (3) recommending (to Hill AFB) cap repairs and/or modifications to increase system efficiency and economy; (4) conducting discharge water quality and water-level measurements (if necessary); and (5) submitting monthly, quarterly, and annual reports to Hill AFB. Tasks conducted under this effort include (1) system performance evaluation and reporting; (2) system operation tasks; (3) inspection, monitoring, and sampling activities; (4) system operational data collection; and (5) system maintenance |

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| | tasks (**Hill AFB CEVR, 2007b**).<br><br>Performance monitoring at the Sodium Hydroxide Tank Site is performed to verify that it is preventing surface water infiltration. Performance monitoring activities include visual inspection of the cap and associated repairs and groundwater monitoring downgradient of the site (**Hill AFB CEVR, 2007c**).<br><br>Performance monitoring at the Berman Pond is performed to demonstrate that the low-permeability cap achieves the remediation goal of preventing surface water infiltration and subsequent mobilization of contaminants contained within the pond sediments. Performance monitoring activities consist of (1) inspecting the integrity of the cap through visual inspection, repairs, and survey elevation marker monitoring; (2) monitoring perched groundwater elevations beneath the cap; (3) verifying that no other sources of water (e.g., landscape irrigation water) are present near the cap boundary; and (4) groundwater monitoring downgradient of the pond (**Hill AFB CEVR, 2007c**). In 2007, a treatability study was conducted at Berman Pond to identify and eliminate sources of perched water, which accumulates under the cap (**MWH, 2007a**). Recommendations were made to repair a nearby sprinkler box and an irrigation line which were suspected as being the sources of perched water.<br><br>All O&M Plans are maintained and updated online through the CEVR Dynamic Documents System and O&M procedures follow the most current version of the O&M Plan for CERCLA Caps at OUs 1, 3, 4, and 7 as it appears at www.hafbdyndocs.com. The O&M Manual available as of July 2007 (**Hill AFB CEVR, 2007b**) was reviewed for this 2008 Five-Year Review. The groundwater monitoring associated with the Sodium Hydroxide Tank Site and at Berman Pond, as discussed in the OU 3 PSVReport (**Hill AFB CEVR, 2007c**), are not included in the O&M Manual for the caps because these efforts are conducted by the contractor providing groundwater sampling for OU 8 (**MWH, 2006** and **MWH, 2007b**). |
| **Progress Since Last FYR** | Issues identified at OU 3 based on the 2003 five-year review include the groundwater levels in the extraction sumps at Berman Pond (**URS, 2003**). The groundwater levels have been above the PSVPlan mandated groundwater elevation action level for the past 4 years. Pumps were removed after the cap was installed in 1997. Pumps have not been re-installed in the sumps because it is believed that groundwater from OU 3 is captured in the OU 8 extraction system. Recommendations and followup actions for the Sodium Hydroxide Tank Site and Berman Pond are included in **Table OU 3-3** along with the current status of each recommendation.<br><br>**Current Status**: According to the 2006 Treatment System Operation Report and Inspection, Monitoring, and Maintenance Report, the caps are in good condition. Some defects were noted and recommendations were made for repair (**CH2M HILL, 2007a**). According to an interview with Mike Cox (CH2M HILL O&M contractor), plans were in place to do a hot patch asphalt crack fix at Berman Pond (**CH2M HILL, 2007c**). Based on the consistency of the perched groundwater levels underlying Berman Pond, it was recommended that the groundwater levels be monitored quarterly, instead of monthly. The monthly data do not provide a significantly greater level of data as compared with quarterly data. The quarterly data should be collected in January, April, July, and October of the calendar year. This frequency will allow for the recording of the seasonal fluctuations (**CH2M HILL, 2007a**). However, according to CEVR, weekly measurements appear to be the most efficient way of understanding the various contributors of perched water (i.e., irrigation, precipitation) beneath the cap and should be continued until the sources of the perched water are fully understood. The following performance standards have been added to the OU 3 PVSPlan: (1) groundwater monitoring at the former Berman Pond; (2) acceptable values for perched water beneath the Berman Pond cap were modified; and (3) assessment of lateral migration of water beneath the cap has been addressed in the cap inspection and the perched water level metrics; but because cap performance cannot be evaluated in the presence of lateral migration of water beneath the cap, it is assumed that lateral migration is not occurring when evaluating cap performance. In addition, the evaluation of groundwater downgradient of Berman Pond has been added to the |

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| | monitoring efforts (**Hill AFB CEVR, 2007c**). Modifications in the PSVPlan including monitoring of groundwater at Berman Pond have been captured in the current sampling and analysis plan (**MWH, 2007b**).<br><br>For the Sodium Hydroxide Tank Site, it was recommended that collection of groundwater samples continue for 1 year (Spring and Fall in 2007). Based on the results of these samples, the Sodium Hydroxide Tank Site is being evaluated for closure in the annual monitoring report. Subsurface soil sampling should also be collected to support the closure effort (**Hill AFB CEVR, 2007c**). |

Table OU 3-2

## Chronology of Site Events for Operable Unit 3

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 3 | OU3 | 7 | 1987 | National Priorities List (NPL) | The Base was put on the Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA) NPL list. | 1995 ROD OU 3. |
| 3 | OU3 | 4 | 1991 | Federal Facilities Agreement | Hill AFB entered into an FFA between the US Air Force, Utah Department of Environmental Quality (UDEQ), and US Environmental Protection Agency. | 1995 ROD OU 3. |
| 3 | OU3 | | 1993 | Transfer to Another OU | Due to multiple sources of groundwater contamination, the contaminated groundwater underlying the South Area of the Base was designated as OU 8. | PSVPlan OU 3 |
| 3 | OU3 | 9 | 1995 | ROD | The selected remedy called for soil vapor extraction (SVE) at the RVMF (ST018), a cap at Berman Pond (WP005), and cap maintenance at the NaOH tank site (ST004). The ROD also closed the IWTP Sludge Drying Beds (WP006). | 1995 ROD OU 3. |
| 3 | OU3 | | 1995 | Remedial Investigation | The Remedial Investigation was submitted to EMR in 1995. The Baseline Risk Assessment was included in this submission. | Remedial Investigation Report for OU 3 (IRP Sites ST04, WP05, WP06, ST18, SD23, OT33, SD34, and SD46), Draft Final |
| 3 | OU3 | | 1995 | Feasibility Study | The Final Feasibility Study was submitted to EMR in 1995. Results concluded that no remedial action was required for the IWTP Sludge Drying Beds. | Feasibility Study for Operable Unit 3 (IRP Sites ST04, WP05, WP06, ST18, SD23, SD34) |
| 3 | OU3 | 1 | 1997 | Transfer to Another OU | Pond 1 had previously been included in OU 3. The ROD for OU 3 (in 1995) concluded that cleanup actions at Pond 1 were not necessary. The investigation of Pond 1 was reopened under OU 9 as a result of contamination detected in the storm water system at Berman Pond. | Engineering Evaluation/Cost Analysis for the OU 9 Pond 1 Removal Action, Final Report |
| 3 | OU3 | 9 | 1998 | 1998 Five-Year Review | Remedy at OU 3 was considered protective of human health and the environment. | Hill AFB Five Year Review. September 1998. |
| 3 | OU3 | 9 | 1999 | Transfer to Another OU | Pond 3 had previously been included in OU 3. The ROD for OU 3 (in 1995) concluded that cleanup actions at Pond 3 were not necessary. The investigation of Pond 3 was reopened under OU 9 following discovery of contamination at the inlet of Pond 1. | Final Data Summary Report and Preliminary Conceptual Model for Operable Unit 9 Investigation Areas |
| 3 | OU3 | 9 | 2003 | 2003 Five-Year Review | Remedy at OU 3 was considered protective of human health and the environment. | Final CERCLA Five-Year Review. September 2003. |
| 3 | OU3 | 9 | 2007 | Operations and Maintenance | Operations and maintenance activities as well as groundwater sampling continued through September 2007. | |
| 3 | SD046 | | 1974 | Historical Operations | Pond 2 was an ephemeral stormwater pond that received occasional excess surface runoff from Hill AFB until 1974. At that time, the storm drain was rerouted to Pond 3. | U.S. Air Force IRP Remedial Investigation/Feasibility Study Hill AFB, Utah, Decision Paper Site SD046 - Storm Pond 2 No Further Response Action Planned. |

Table OU 3-2

## Chronology of Site Events for Operable Unit 3

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 3 | SD046 | | 1991 | NFRAP | The Pond 2 site was closed with a decision document in 1992 and sold off-Base to a private entity in 1991 | U.S. Air Force IRP Remedial Investigation/Feasibility Study Hill AFB, Utah, Decision Paper Site SD046 - Storm Pond 2 No Further Response Action Planned. |
| 3 | ST004 | | 1950 | Historical Operations | Two storage tanks for sodium hydroxide (NaOH) were constructed at the NaOH site. | Record of Decision (ROD) or Interim Action at OU 3 Site ST04 |
| 3 | ST004 | | 1980 | Historical Operations | Approximately 150,000 gallons of NaOH leaked from tanks in a one year period. | ROD for Interim Action at Operable Unit 3 Site ST04 |
| 3 | ST004 | 4 | 1984 | Historical Operations | An additional 134,000 gallons leaked from April to June in 1984. The concentration of NaOH was 25 percent by weight. | ROD for Interim Action at Operable Unit 3 Site ST04 |
| 3 | ST004 | 9 | 1992 | Historical Operations | Both 12,000 gallons NaOH tanks were removed in accordance with UDEQ requirements. | 1995 ROD OU 3. |
| 3 | ST004 | 8 | 1993 | Interim Action | An asphalt surface covering was installed over the area of the NaOH tank site. | ROD for Interim Action at Operable Unit 3 Site ST04 |
| 3 | ST004 | | 1999 | Remedial Action | The interim remedial cap at the NaOH tank site was covered with a permanent remedial asphalt layer. | 1995 ROD OU 3. |
| 3 | ST004 | | 2005 | Operations and Maintenance | A new curb was poured on top of the NaOH site cap to divert surface water from the northern portions of the cap away from the IWTP. | Final Report Treatment System Operation Report and Inspection, Monitoring, and Maintenance Report. February 2006. |
| 3 | ST018 | | 1985 | Historical Operations | The Refueling Vehicle Maintenance Facility (RVMF) operated from the late 1950s until 1985. Through 1985, drained fuels were collected in a floor drain at the RVMF, passed through an oil/water separator, and either disposed of or recycled. Collected water was stored in a small underground storage tank (UST) and subsequently pumped to the IWTP for treatment. | 1995 ROD OU 3. |
| 3 | ST018 | 10 | 1997 | Remedial Action | A soil vapor extraction (SVE) system was installed at Building 514 (RVMF) and began operation on October 10, 1997. The system was operated for approximately one year. | Remedial Action Project Close-Out Report for Operable Unit 3 |
| 3 | ST018 | 5 | 2001 | NFRAP | The RVMF (ST018) was recommended for NFRAP status and was accepted due to the success of the SVE system. | Statement of Concurrence With NFRAP, Building 514 Refueling Vehicle Maintenance Facility (RVMF), IRP Site ST018 |
| 3 | WP005 | | 1940 | Historical Operations | From 1940 to 1956, Berman Pond (WP005) was operated as an unlined evaporation pond that received storm water runoff and industrial wastewater, which may have included spent solvents, heavy metals, and hydrocarbons. | Performance Standard Verification Plan (PSVPlan) Operable Unit (OU) 3 |

Table OU 3-2

## Chronology of Site Events for Operable Unit 3

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 3 | WP005 | | 1956 | Historical Operations | Prior to 1956, Berman Pond was connected to Pond 1, which received overflow from Berman Pond during high intensity storms. After construction of the industrial wastewater treatment plant (IWTP) in 1956, Berman Pond was connected to a sanitary sewer line and was used only as a storm water retention pond. In 1958, pond overflow was re-routed to the storm drainage system, and between 1958 and 1970, the pond was filled with construction rubble and soils, and regraded. | PSVPlan OU 3 |
| 3 | WP005 | | 1984 | Interim Action | The soil cap was not effective in reducing infiltration through Berman Pond. | Hill AFB Environmental Restoration Management Action Plan - 2001 |
| 3 | WP005 | | 1986 | Interim Action | A cap, consisting of silt and clay, was installed over a portion of the pond. | ROD for Interim Action at Operable Unit 3 Site ST04 |
| 3 | WP005 | | 1994 | Treatability Study | A dewatering treatability study was completed at the Berman Pond. The pond was dewatered for the installation of a cap. | ROD for Interim Action at Operable Unit 3 Site ST04 |
| 3 | WP005 | | 1995 | Interim Action | A dewatering system was installed to extract contaminated perched water remaining within the backfill of Berman Pond. The system was operated from September 1995 to May 1997 when it was shut down to allow construction of the asphalt cap. The extraction system was upgraded during the construction of the cap and placed back into operation from 1997 to 1998. The system has not operated since 1998. | OUs 1, 3, 4, and 7 CERCLA Cap System Inspection, Operation, and Maintenance Plan. |
| 3 | WP005 | | 1997 | Remedial Action | An asphalt cap was installed over the entire Berman Pond to reduce infiltration. | Hill AFB Environmental Restoration Management Action Plan - 2001 |
| 3 | WP005 | | 2003 | Operations and Maintenance | Slurry seal applied to Berman Pond cap | Calendar Year 2006 Treatment System Operation Report and Inspection, Monitoring, and Maintenance Report. |
| 3 | WP005 | 3 | 2007 | Treatability Study | A treatability study was performed to identify and eliminate the source(s) of perched groundwater entering the Berman Pond. A sprinkler box and irrigation line were determined to be causing standing water at Berman Pond. These items were recommended for repair. | Berman Pond Treatability Study Investigation Report OU 3. |
| 3 | WP005 | | 2007 | Operations and Maintenance | Crack sealing at Berman Pond completed in summer 2007 | CH2M HILL. 2007. Calendar Year 2006 Treatment System Operation Report and Inspection, Monitoring, and Maintenance Report. March. |
| 3 | WP005 | | 2007 | Operations and Maintenance | Repairs were completed of the sprinkler box and irrigation lines to remove suspected source of perched water at Berman Pond. Water levels were monitored more frequently to assess the effect of the repairs on perched groundwater levels underneath the Berman Pond cap. | 2008 Five-Year Review Interview Record for Barbara Hall |

Table OU 3-2

## Chronology of Site Events for Operable Unit 3

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 3 | WP006 | | 1956 | Historical Operations | Use of the Industrial Wastewater Treatment Plant sludge drying beds initiated beginning in 1956. Sludge from the clarifier was pumped to two sludge drying bed areas south of the treatment facility. The sludge material was composed of paint stripping, chrome plating, and degreasing wastes and was stored in the sludge beds to dry. | Remedial Investigation Report for OU 3 (Installation Restoration Program [IRP] Sites ST04, WP05, WP06, ST18, SD23, OT33, SD34, and SD46), Draft Final |
| 3 | WP006 | | 1985 | Remedial Investigation | Remedial Investigation (RI) at the IWTP initiated. Based on the findings, the industrial water treatment plant (IWTP) Sludge Drying Beds did not pose any current or future health risks or present a threat to groundwater | Remedial Design Report and Work Plan for OU 3 |
| 3 | WP006 | | 1987 | Historical Operations | In June 1987, a sludge dewatering facility was put into operation to dewater IWTP sludge with a filter press and dryers. The sludge drying beds are still used for temporary storage before running the sludge through the dryers. | Remedial Investigation Report for OU 3 (IRP Sites ST04, WP05, WP06, ST18, SD23, OT33, SD34, and SD46), Draft Final |
| 3 | WP006 | | 1995 | NFRAP | The IWTP Sludge Drying Beds were accepted for No Further Remedial Action Planned (NFRAP) status in the ROD. | ROD for Operable Unit 3 |

**Notes**

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| AFB | Air Force Base |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| EPA | United States Environmental Protection Agency |
| IRP | installation restoration program |
| IWTP | industrial wastewater treatment plant |
| NaOH | sodium hydroxide |
| NPL | National Priorities List |
| O&M | Operations and Maintenance |
| OU | Operable Unit |
| PSVPlan | Performance Standard Verification Plan |
| ROD | Record of Decision |
| SVE | soil vapor extraction |
| UDEQ | Utah Department of Environmental Quality |

Table OU 3-3

## Progress Since Last Five Year Review - Status of Recommendations and Follow-Up Actions at OU 3

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Site | 2003 Five-Year Review Recommendations | Current Status | Carry Over to Next FYR? |
|---|---|---|---|
| Sodium Hydroxide Tank | Continuing inspection and monitoring program for the cap | **Complete.** Currently being conducted as required by the Record of Decision (ROD) (**CH2M HILL, 2007a**). | No |
| | Patching any damaged areas of the cap where the roll-off bins were stored | **Complete.** The cap has been repaired as considered necessary but not specifically in areas where the roll-off bins were stored (CH2M HILL, 2007d_3). According to the 2006 Treatment System Operation Report and Inspection, Monitoring, and Maintenance Report (**CH2M HILL, 2007b**), the caps are in good condition. | No |
| | Continue with the groundwater monitoring plan | **Complete.** Currently being conducted as presented in the Basewide Monitoring and Maintenance Work Plan (**CH2M HILL, 2007b**). | No |
| | Adding painted delineations to the perimeter of the asphalt cap. | **Complete.** Based on the site inspection checklist (OU 3 Site Inspection Checklist, Appendix D), the painted delineations recommended as part of the Five-Year Review (FYR) for the asphalt cap were not completed because it was believed that they would be confusing for drivers in the area. | No |
| | Posting warning signs prohibiting storage of equipment and excavation without permission | **Complete.** According to CEVR, signs restricting excavation have been added. The ROD does not specifically restrict storage on the cap and activities such as storage are allowed as long no damage to the cap occurs. The integrity of the cap is also protected by annual site inspections as required by the ROD (**CH2M HILL, 2007a**). The most recent LUCAR made no recommendations for OU 3 (**Hill AFB CEVR, 2007a**). | No |
| | Developing procedures for excavation and equipment storage to minimize defects of the asphalt cap | **Complete.** The ROD does not specifically restrict storage and activities such as storage are allowed as long as no damage to the cap occurs. The integrity of the cap is also protected by annual site inspections as required by the ROD (**CH2M HILL, 2007a**). There are procedures in place, through Base permitting procedures, to address excavation. The AF 332 work order review process implementing Air Force Instruction (AFI) 32-7020 Hill AFB Supplement 1 (AFI 32-7020 HAFBS1, 18 February 2004) requires CEVR review and coordination on any planned construction projects. | No |
| Berman Pond | Revising the Performance Standard Verification Plan (PSVPlan) to reflect the change of remedial actions at the site | **Ongoing.** Preparation of an Explanation of Significant Difference to the Berman Pond remedy is deferred until it is verified that the sources of perched groundwater have been eliminated. The Draft PSVReport was prepared in July 2007. | Yes |
| | Changing the watering scheme for the landscaping around the asphalt cap at Berman Pond according to the recommendations made in the 2002 cap inspection (Vicelja, 2002) | **Complete.** According to the treatability study (**MWH. 2007a**), irrigation of planter boxes was not determined to be the source of standing water; therefore, modification of the watering scheme was not conducted. It was determined that the perched water was likely from a broken irrigation line. Based on an interview with Barbara Hall of CEVR, repairs were made and the water levels appear to be dropping (**CH2M HILL, 2007d**). | No |
| | Slurry sealing the asphalt cap in the summer of 2003 to prevent excess infiltration according to recommendations made following the 2002 cap inspection (Vicelja 2002) | **Complete.** Slurry seal completed in 2003. Crack sealing accomplished in the spring of 2007 (**CH2M HILL, 2007a**). | No |

Table OU 3-3

## Progress Since Last Five Year Review - Status of Recommendations and Follow-Up Actions at OU 3

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Site | 2003 Five-Year Review Recommendations | Current Status | Carry Over to Next FYR? |
|---|---|---|---|
| | Posting warning signs prohibiting storage of equipment and excavation without permission | **Complete.** According to CEVR, signs restricting excavation have been added. The ROD does not specifically restrict storage on the cap and activities such as storage are allowed as long no damage to the cap occurs. The integrity of the cap is also protected by annual site inspections as required by the ROD (**CH2M HILL, 2007a**). The most recent LUCAR made no recommendations for OU 3 (**Hill AFB CEVR, 2007a**). | No |
| | Adding painted delineations to the perimeter of the asphalt cap | **Complete.** Based on the site inspection checklist (OU 3 Site Inspection Checklist, Appendix D), the painted delineations recommended as part of the Five-Year Review (FYR) for the asphalt cap were not completed because it was believed that they would be confusing for drivers in the area. | No |
| OU 3 | Human health risks should be re-evaluated at Operable Units (OUs) 1 through 8. | **Ongoing.** Human health risks were re-evaluated in a recent technical memorandum (**Hill AFB CEVR and SES, 2007**). Conclusions for OU 3 stated that because the calculated non-carcinogenic risk changed significantly for Berman Pond, a revised risk assessment should be conducted prior to allowing construction work involving subsurface soils in this area. This area is already identified on the Contamination Summary Map Hill Air Force Base Utah (The Restricted Use Access Map). The AF 332 work order review process implementing Air Force Instruction (AFI) 32-7020 Hill AFB Supplement 1 (AFI 32-7020 HAFBS1, 18 February 2004) requires CEVR review and coordination on any planned construction projects. In the event that construction activities are proposed, contaminant concentrations in the soil will be compared to the then current risk screening concentrations (i.e., EPA Region 3 Risk-Based Concentrations) to determine what, if any, action is required to protect construction workers from unacceptable exposure. Additionally, the review identified changes to the PRGs for soil associated with OU3. Because site closure is not anticipated for many years and additional changes to risk-based cleanup goals are likely, no action is recommended. | Yes |

**Notes**

FYR - Five-Year Review

LUCAR - land use controls annual report

PSVPlan - Performance Standard Verification Plan

ROD - Record of Decision

Table OU 3-4
## Operable Unit 3
## Five-Year Review Process

Reviewer: Kelly Taylor

| | |
|---|---|
| **Introduction** | This 2008 five-year review for Hill AFB has been conducted in accordance with EPA Comprehensive Five-Year Review Guidance dated June 2001 (**EPA, 2001**). Administrative and community involvement components of the five-year review are described in **Section 2.0** of this report for the overall five-year review. In addition, interviews were conducted with relevant parties. A site inspection of OU 3 was performed. Relevant site documents and applicable data covering the period of the five-year review were evaluated. The site interviews, site inspection, and data review are further discussed in the following sections. |
| **Interviews** | Interviews for OU 3 were conducted with Barbara Hall/ Civil Engineer Environmental Restoration Division (CEG/CEVR), Ray Spencer/75 Civil Engineer Environmental Restoration Section (CEG/CEVOR), and Mike Cox/CH2M HILL O&M contractor. Copies of the Interview Record Forms are provided in **Appendix D**.<br><br>Barbara Hall was interviewed on September 28, 2007. She indicated that while leaking irrigation lines were contributing to perched water beneath the Berman Pond cap, the lines have been repaired and the water levels underneath the cap have been dropping since the leaks were repaired. The PSVPlan is in place to continue monitoring these groundwater elevations since cap repair. She also indicated that the Air Force is working toward a NFRAP status for the sodium hydroxide tank site.<br><br>Ray Spencer, interviewed on December 13, 2007, stated that in his opinion the remedies at OU 3 are successful and functioning as expected and that there have been no O&M problems at OU 3.<br><br>On September 28, 2007, Mike Cox was interviewed and indicated that the current level of maintenance is adequate and the cap is functioning as intended. However, it was his opinion that something needed to be done to remove the water or reduce water levels in the perched zone at the Berman Pond. He noted that water levels were being evaluated weekly since the irrigation lines were repaired but since mid-October 2007 they have been evaluated only monthly. He also stated that there were plans to repair minor cracking in the Berman Pond asphalt cap using a hot patch sealant. Since the last five-year review, cap inspections are only conducted annually.<br><br>Because OU 3 is entirely contained on Base, none of the interviewees indicated that there were any community concerns related to this site. |
| **Site Inspection** | The site inspection for OU 3 was conducted on September 28, 2007. The completed site inspection checklist is provided in **Appendix E**.<br><br>Based on the site inspection, minor cracking of the asphalt cap at Sodium Hydroxide site was noted. The cap on Berman Pond is designed with a top layer that is intended to wear and cracking is patched across the top of the cap. There are plans to perform a hot asphalt patch to the cap at Berman Pond. Institutional controls were considered adequate.<br><br>The site inspection checklist addressed four discussion topics. These discussion topics are presented below, followed by responses and general observations based on the site inspection.<br><br>(1) Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.). |

| | |
|---|---|
| | The OU 3 remedies for the Sodium Hydroxide Tank Site and the Berman Pond were to achieve 2 remediation goals: (1) reduce transport of contamination from soil to groundwater by minimizing surface water infiltration and; (2) prevent exposure to contamination soils.<br><br>Caps are in place for both sites to meet the remediation goals for OU 3. Water levels are monitored at the Berman Pond to verify that infiltration underneath the cap is not a problem. Nearby irrigation system leaks were recently repaired, and water levels in the perched zone underneath the Berman Pond Cap are being assessed to determine if an impact to the perched zone is occurring. Environmental Management, Restoration Division is currently in the process of evaluating obtaining NFRAP status for the Sodium Hydroxide Tank Site.<br><br>Institutional controls are in place to prevent exposure to contaminated soils at OU 3 and prevent excavation in the area of each cap without CEVR's approval. Both sites are located within active areas of the Base, and neither area is fenced. The caps prohibit exposure to underlying soils, and therefore access restrictions are not required.<br><br>(2) Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.<br><br>Operation and maintenance includes an annual inspection of both caps and water level monitoring at the Berman Pond. Water level monitoring was being performed weekly to evaluate the impacts of the irrigation system leak repairs on the perched groundwater. Proper inspection and maintenance procedures are in place and implemented to ensure the integrity of the remedy and to ensure the enforcement of ICs (land use restrictions) through the Hill AFB 332 permitting process.<br><br>(3) Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.<br><br>There are no issues related to the O&M procedures (cost or scope) that would indicate the protectiveness of the remedy may be compromised in the future. The water levels in the perched zone underneath the Berman Pond Cap are being monitored to evaluate the impacts of the leaking irrigation lines that were recently repaired.<br><br>(4) Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.<br><br>No opportunities to further optimize the O&M for OU 3 were identified as part of the site inspection. However, additional evaluation of perched water levels at Berman Pond needs to continue to ensure that the source of perched water has been corrected. |

| | |
|---|---|
| **Data Review** | The data reviewed as part of the 2008 five-year review included groundwater sampling at Sodium Hydroxide tank site and Berman Pond, groundwater elevations at Berman Pond, and elevation surveys at Berman Pond. Groundwater data were collected on a semiannual basis at one monitoring location for Berman Pond and at two locations for the Sodium Hydroxide Tank Site during the review period. Groundwater elevation data were collected monthly for Berman Pond, though for a period of time in 2007, groundwater elevations were measured weekly to assess the effects of the irrigation line repair. Water level monitoring at Berman Pond was reduced to monthly starting in mid-October 2007.<br><br>The ROD established remediation goals for soils at OU 3. Remediation goals are based on the COC's potential to leach to groundwater and result in groundwater contaminant or on health risks as presented in **Table OU 3-5**.<br><br>Based on a review of data from 2003 through 2007, the remedies in place appear to be working to support RAOs. For the sodium hydroxide tank, groundwater samples from U3-029R and U9-002 were analyzed for arsenic, selenium, sodium, total dissolved solids, and pH on a semiannual basis. None of the parameters exceeded action levels during the review period suggesting that soil contamination is not migrating through soils or causing soils to leach metals which migrate to groundwater.<br><br>Data collected to assess the performance of remedial actions at Berman Pond include perched water levels and elevation survey data. Perched water levels were consistently elevated during the review period. However, the reason for this perched water is believed to have been a leaking irrigation line. The line was fixed in July of 2007, after which water levels were monitored weekly. No elevation data were available in ERPIMS for U3-208, U3-211, U3-063, or U3-067 beyond June 2007; however, according to the CEVR site manager, water levels have continued to decrease since the line was repaired. Continued evaluation of water levels is necessary to confirm that the levels continue to decrease. Elevation survey data at Berman Pond are collected to ensure that the surface of the cap is not susceptible to cracking as a result of elevation changes. Elevation survey data have not exceeded action levels at any point during this review period suggesting that the integrity of the cap has not been impacted by land settlement. Based on these performance metrics, it appears that the caps are working as intended to inhibit surface water infiltration and limit impacts to groundwater and to ensure that exposure pathways to contaminated soil remain incomplete and therefore limit human health risk. |

Table OU 3-5

# Chemicals of Concern and Remediation Goals at OU 3

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Media | Chemical of Concern | Remediation Goal | Units |
|---|---|---|---|
| Soil | Benzene | 0.5 | mg/kg |
| | Bis(2-Ethylhexyl)phthlate | 6 | mg/kg |
| | Chlorobenzene | 0.95 | mg/kg |
| | 1,2-Dichlorobenzene | 20 | mg/kg |
| | 1,4-Dichlorobenzene | 2.8 | mg/kg |
| | 1,2-Dichloroethane | 0.03 | mg/kg |
| | trans-1,2-Dichloroethene | 0.7 | mg/kg |
| | Heptachlor epoxide | 0.004 | mg/kg |
| | Methylene chloride | 0.02 | mg/kg |
| | 1,1,2,2,-Tetrachloroethane | 0.001 | mg/kg |
| | 1,1,1 -Trichloroethane | 4 | mg/kg |
| | 1,1,2-Trichloroethane | 0.04 | mg/kg |
| | Trichloroethene (TCE) | 0.07 | mg/kg |
| | Vinyl chloride | 0.02 | mg/kg |
| | Benzo(a)pyrene* | 0.07 | mg/kg |
| | PCB-1254* | 0.06 | mg/kg |
| | Arsenic** | 4.1 | mg/kg |
| | Cadmium* | 16 | mg/kg |

**Notes**

Remediation goals are based on the COCs potential to leach to groundwater and result in groundwater contaminant concentrations in excess of MCLs, unless otherwise noted.

* Remediation goals for these chemicals are risk-based levels

** The remediation goal for arsenic is based on background arsenic

COC = chemical of concern

mg/kg = milligrams per kilogram

Table OU 3-6
# Operable Unit 3
# Five-Year Review Technical Assessment

Reviewer: Kelly Taylor

| | |
|---|---|
| **Introduction** | The five-year review must determine whether the remedy at a site is protective of human health and the environment. The EPA guidance (**EPA, 2001**) describes three questions used to provide a framework for organizing and evaluating data and information and to ensure all relevant issues are considered when determining the protectiveness of a remedy. These questions are assessed for OU 3 in the following sections. The implementation of ICs is also described. At the end of this table is a summary of the technical assessment. |
| **Question A.** | **Is the remedy functioning as intended by the decision documents?**<br><br>Yes. The document that details the remedial decisions for OU 3 is the 1995 *Record of Decision* (**Hill AFB, 1995**).<br><br>The asphalt cap at the Sodium Hydroxide Tank Site was installed at this site in August 1993 as an interim remedial action (**Hill AFB, 1995**). In 1999, a permanent asphalt layer was applied over the cap. In 1995, a dewatering system was installed to extract contaminated perched water remaining within the backfill of Berman Pond. The system was operated from September 1995 to May 1997 when it was shut down to allow construction of the asphalt cap. In 1997, the area was graded to drain and the asphalt cap was constructed. The extraction system was upgraded during the construction of the cap and placed back into operation from 1997 to 1998. The system has not operated since 1998. In 2007, a treatability study was conducted on Berman Pond to identify and eliminate the source of perched water entering Berman Pond (**MWH, 2007a**).<br><br>Based on a review of data from 2003 through 2007, the remedies in place appear to be working as intended to support RAOs. For the sodium hydroxide tank, groundwater samples from U3-029R and U9-002 were analyzed for arsenic, selenium, sodium, total dissolved solids, and pH on a semiannual basis. None of the parameters exceeded action levels during the review period suggesting that soil contamination is not migrating through soils or causing soils to leach metals which migrate to groundwater. Data collected to assess the performance of remedial actions at Berman Pond include perched water levels and elevation survey data. Perched water levels were consistently elevated during the review period. However, the reason for this perched water is believed to have been a leaking irrigation line. The line was fixed sometime in 2007 after which water levels were monitored weekly until mid-October 2007. According to the CEVR site manager, water levels have decreased since the irrigation line was prepared suggesting that this was the source of perched water. Continued evaluation of water levels is necessary to confirm that the levels continue to decrease. Elevation survey data at Berman Pond have not exceeded action levels at any point during this review period suggesting that the integrity of the cap is not influenced as a result of land settlement. Based on these performance metrics, it appears that the caps are working as intended to inhibit surface water infiltration and limit impacts to groundwater and to ensure that exposure pathways to contaminated soil remain incomplete and therefore limit human health risk.<br><br>It should be noted that SVE was implemented at ST018 and the site has since been closed and been granted a NFRAP status. Additional evaluation of this site in this five-year review was not required based on the 2003 five-year review. |

| | |
|---|---|
| | Opportunities for Optimization:<br><br>No opportunities to further optimize the O&M for OU 3 were identified as part of the site inspection. However, if it is concluded that the perched water beneath Berman Pond is no longer an issue, water level measurement sampling could be reduced to a quarterly basis as opposed to monthly.<br><br>Early Indicators of Potential Remedy Problems:<br><br>There are no issues related to the O&M procedures (cost or scope) that would indicate the protectiveness of the remedy may be compromised in the future. The water levels in the perched zone underneath the Berman Pond Cap are being monitored to evaluate the impacts of the leaking irrigation lines that were recently repaired. |
| **Question B.** | **Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?**<br><br>Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics:<br><br>No, the toxicity factors used to develop cleanup levels for dibromochloromethane, tetrachloroethene, toluene, arsenic, hexavalent chromium, and vanadium have become more stringent since the signing of the ROD. The oral slope factors for 1,1-dichloroethene, chloroform, and beryllium have been withdrawn making the cleanup levels listed in the ROD for these compounds overprotective. In addition, the toxicity values for PCBs, barium, trivalent chromium, and manganese have become less stringent.<br><br>Changes in Applicable or Relevant and Appropriate Requirements:<br><br>Applicable or Relevant and Appropriate Requirements for this OU were identified in the ROD. Chemical-specific, action-specific, and location-specific ARARs were reviewed and were all determined to be either applicable or relevant and appropriate as presented in **Appendix G**. |
| **Question C.** | **Has any other information come to light that could call into question the protectiveness of the remedy?**<br><br>No. While the water levels in the perched zone underneath the Berman Pond Cap are being monitored to evaluate the impacts of the leaking irrigation lines that were recently repaired, groundwater is expected to be contained by the OU 8 groundwater system and protectiveness is not considered to be affected. |
| **Institutional Controls** | Institutional controls are generally defined as non-engineered instruments such as administrative and legal tools that do not involve construction or physically changing the site, and that help minimize the potential for human exposure to contamination and/or protect the integrity of a remedy by limiting land and/or resource use (**EPA, 2005**). Institutional controls can be used for many reasons including restriction of site use, modifying behavior, and providing information to people (**EPA, 2000**). Institutional controls may include deed notices, easements, covenants, restrictions, or other conditions on deeds, and/or groundwater and/or land use restriction documents (**EPA, 2001**). The following paragraphs describe ICs implemented at OU 3, the potential affect of future land use plans on ICs, and any plans for changes to site contamination status.<br><br>Types of ICs in Place at the Site:<br><br>Institutional controls for the Sodium Hydroxide Tank Site and Berman Pond as required by the ROD include: (1) issuing a continuing order to restrict onsite worker access to high-pH soil or contaminated soil, and restrict or control construction activities; (2) filing a notice to the deed detailing the restrictions of the continuing order, and (3) a covenant to the deed in the event of property transfer. |

| | |
|---|---|
| | Access and ICs are currently in place at OU 3. Based on the site inspection, ICs were implemented as required. Hill AFB performs an annual evaluation of the ICs in place for the Base. This includes verification of orders, leases, groundwater use restrictions, and inspections of signage, fences, and monitoring wells. An annual land use controls report is prepared documenting the results of this work as discussed in **Section 2** (**Hill AFB CEVR, 2007a**). Based on the most recent LUC review, LUCs at OU 3 were considered appropriate and no recommendations were made.<br><br>Effects of Future Land Use Plans on ICs:<br><br>There are no anticipated future changes to the current land use.<br><br>Plans for Changes to Site Contamination Status:<br><br>Hill AFB is currently evaluating the Sodium Hydroxide Tank Site for closure. |
| **Summary of the Technical Assessment** | The technical assessment, based on the data review, site inspection, technical evaluation, and interviews indicates that the remedial actions selected for OU 3 generally appear to have been implemented as intended by the decision documents.<br><br>Based on monitoring data during the review period, it appears that the caps are working as intended to inhibit surface water infiltration and limit impacts to groundwater and to ensure that exposure pathways to contaminated soil remain incomplete and therefore limit human health risk. While perched water beneath Berman Pond has been an issue historically, repairs to an irrigation line in 2007 likely corrected the issue and subsequent water level monitoring indicates that water levels are declining (**CH2M HILL, 2007d**). Continuing monitoring should be evaluated to ensure that water levels remain below action levels. |

Table OU 3-7
# Operable Unit 3
# Technical Assessment Summary for OU 3

Reviewer: Kelly Taylor

| Site ID | Remedy Description | Technical Assessment | | | Protectiveness | Next Five-Year Review |
|---|---|---|---|---|---|---|
| | | Question A* | Question B* | Question C* | | |
| ST004 | Cap Maintenance and Institutional Controls | Yes | No | No | Protective | 2013 |
| WP005 | Cap Maintenance and Institutional Controls | Yes | No | No | Protective | 2013 |
| WP006 | NFRAP | NA | NA | NA | NA | NA |
| ST018 | In-Situ Vapor Extraction and Institutional Controls. Remediation complete. | NA | NA | NA | NA | NA |
| SD046 | NFRAP | NA | NA | NA | NA | NA |
| OU 3 | Cap Maintenance and Institutional Controls | Yes | No | No | Protective | 2013 |

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

NA = Not applicable because the site is planned for or already designated NFRAP or the remediation is complete.

Table OU 3-8
## Operable Unit 3
## Five-Year Review Issues, Recommendations and Follow-Up Actions, and Protectiveness Statement

Reviewer: Kelly Taylor

| | |
|---|---|
| **Issues** | Operation and maintenance activities are ongoing at OU 3. Based on the document review, data review, site inspection, interviews, and the technical assessment, it appears the remedy has been implemented as planned and is functioning as intended by the decision document. To ensure continued protectiveness, three issues are identified in the 2008 five-year review for OU 3, as described below. These issues do not currently affect the protectiveness of the remedy, although they need to be addressed to ensure continued protectiveness.<br><br>1) Perched groundwater levels were historically above action levels. A treatability study identified the possible source of perched water as a leaking irrigation line, and repairs were made to the line in 2007. Subsequent water levels appear to be dropping based on interviews with CEVR but need continuing evaluation. The pumps used to extract perched water as required by the ROD have not been operating since 1998.<br><br>2) As noted in the 2003 five-year review, it is necessary to reassess human health risks. Based on an evaluation conducted for this five-year review, the toxicity factors used to develop the cleanup levels for tetrachloroethene and trichloroethene are now 10 to 100 times more stringent than they were when the ROD was signed, which may make the cleanup levels for these compounds more stringent. In addition, newly released inhalation reference doses for benzene, 1,2-dichloroethane, trans-1,2-dichloroethene, barium, and boron may affect the cleanup levels for these compounds. Less stringent toxicity factors changes include chloroform, 1,1-dichloroethene, chlordane (alpha and gamma), and PCBs, which may indicate their cleanup levels are overprotective.<br><br>3) Hill AFB is currently evaluating the Sodium Hydroxide Tank Site for NFRAP status, but the current dataset is not adequate to fully support site closure. |
| **Recommendations and Follow-Up Actions** | As described in the previous section, three issues were identified in the 2008 five-year review for OU 3. To address these issues, the following recommendations and follow-up actions have been defined.<br>1) Because perched groundwater levels were historically above action levels, continued monitoring of these water levels is necessary to ensure that the source of perched water has been identified and corrected. If additional evaluation, as recommended in the PSVPlan, indicates that perched water is no longer an issue, water level monitoring could likely be reduced to quarterly as opposed to monthly. Additionally, an ESD needs to be prepared to address the fact that perched groundwater is no longer being extracted from Berman Pond as required by the ROD. This should be prepared once it is verified that the source of perched groundwater has been eliminated.<br>2) While it is noted that toxicity values have changed for some analytes, the remedy is still considered protective because no complete exposure pathways exist. If exposure pathways become complete, a reevaluation of risk should be conducted. Additionally, risk should be reevaluated at site closure to ensure protectiveness.<br>3) As recommended in the PSVReport, because results of groundwater monitoring at the Sodium Hydroxide Tank Site showed no increase in pH, sodium, selenium, arsenic, or TDS, collection of groundwater samples associated with the Sodium Hydroxide Tank Site should continue for one year (Spring and Fall in 2007). Based on the results of these samples, the Sodium Hydroxide Tank Site should be evaluated for closure in the annual monitoring report. The PSVReport also recommended collecting subsurface |

| | |
|---|---|
| | soil sampling to support the closure effort. The need for this should be evaluated and, if it is determined necessary to gain site closure, a sampling plan should be completed to facilitate this sampling. |
| **Remedial Timeframe** | **Table 3-3** in **Section 3.1.4** presents the remedial timeframe estimates for OU 3. The remedial efforts at the sodium hydroxide tank are anticipated to be complete sometime during the 2010s. Long-term monitoring and O&M efforts associated with Berman Pond are indefinite. |
| **Protectiveness Statement** | **The remedies in place at OU 3 are considered protective of human health and the environment.** Caps in place at both sites prevent surface water infiltration, thus inhibiting the migration of soil contaminants beneath the caps. Continued O&M as part of the remedial action, including annual cap inspections, will ensure that the selected remedy continues to be protective. |
| **Next Five-Year Review** | Remedial actions at OU 3 will be reviewed in the next five-year review for Hill AFB to be completed during or before September 2013. |

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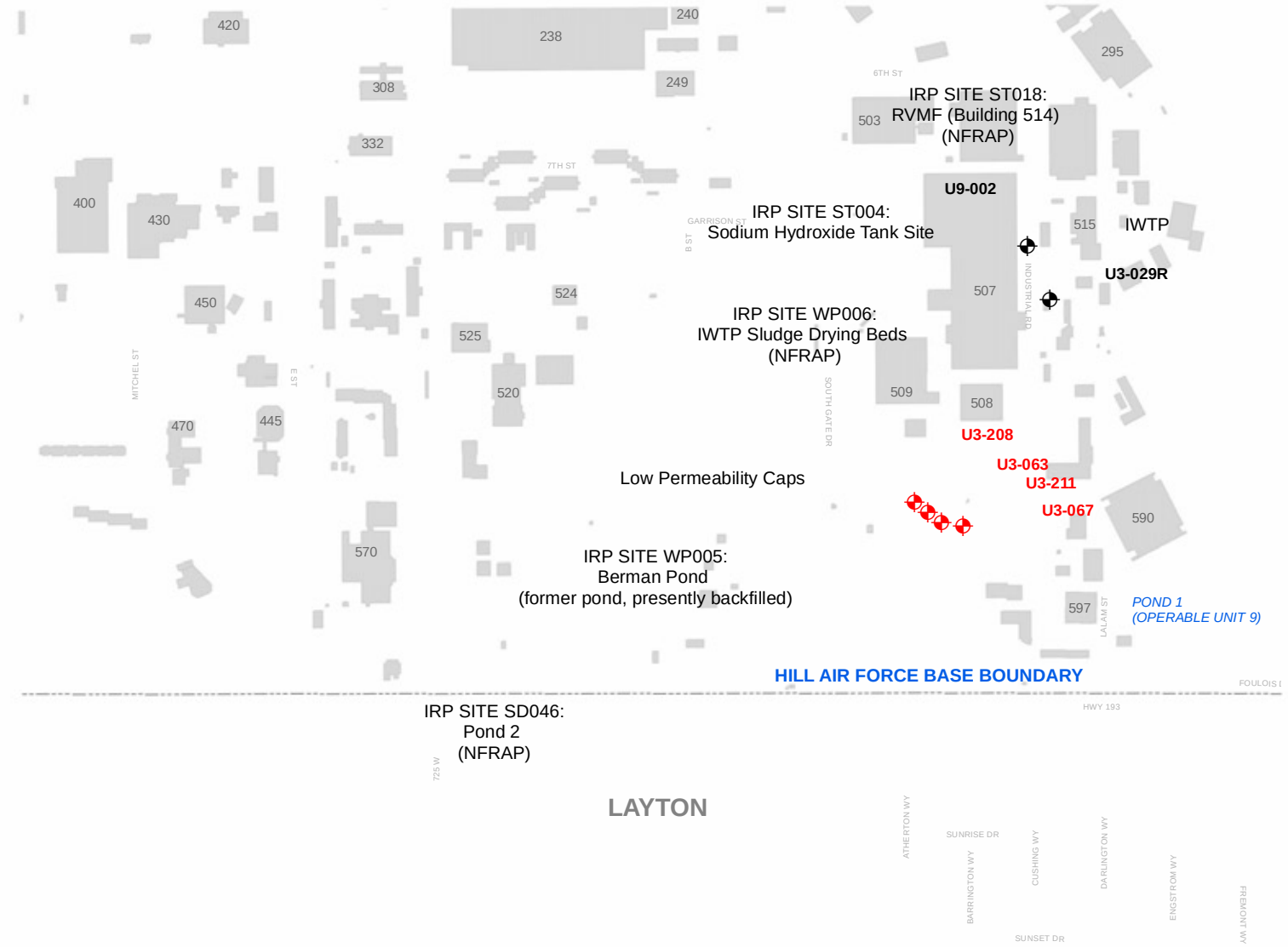



0 350 700
Feet

1 inch equals 700 feet

**LEGEND**

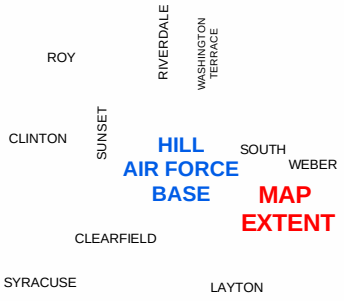
EXTRACTION WELLS

MONITORING WELLS DISCUSSED IN TEXT

IRP SITE

ENGINEERED LOW PERMEABILITY CAP

SURFACE WATER




75th AIR BASE WING

FIGURE OU 3 - 1
**SITE FEATURES OF OPERABLE UNIT 3**
2008 FIVE-YEAR REVIEW
IRP SITES: ST018, ST004, WP006, WP005, SD046
HILL AIR FORCE BASE, UTAH

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Table OU 4-1
# Operable Unit 4
# Background Information

Reviewer: Victor Martinez

**Introduction**

Operational Unit 4 is located on the northern boundary of Hill AFB. Operable Unit 4 is divided into five IRP Sites that include: Landfills 1 and 2, the Spoils Area, the North Gate Dump, and the Munitions Dump (see **Figure OU 4-1**). The RI identified Landfill 1 as the sole source of groundwater contamination at OU 4. Trichloroethene was identified as the primary groundwater contaminant at OU 4. The groundwater contaminant plume extends off-Base in the direction of South Weber Drive as depicted in **Figure OU 4-1** (**URS, 2003**). Landfill 2 was not considered a source of contamination during the RI process and therefore was designated as NFRAP status in 1994. However, additional phases of investigation conducted at OU 4 after the ROD was signed, in conjunction with past site investigations, suggest that Landfill 2 is a contributing source to groundwater contamination at OU 4 (**MWH, 2006**). The selected remedy at OU 4 addressed contaminated groundwater, surface water, and indoor air. The major components of the selected remedy include: (1) groundwater extraction and treatment prior to discharge to a POTW; (2) surface water collection and treatment from springs and seeps and discharge of treated water through infiltration trenches; (3) capping the contents of Landfill 1 by regrading and revegetation of the landfill cap to reduce infiltration and control runoff, and treatment of the source of contamination by SVE; and, (4) indoor air remedy was to be addressed through semiannual air monitoring of the off-Base residences overlying the contaminated groundwater plume (**URS, 2003**). Currently residential indoor air sampling is being addressed through the Basewide Indoor Residential Air Sampling Program.

A list of the documents reviewed for OU 4 as part of the 2008 five-year review is provided in **Appendix C**.

| IRP Identification | IRP Site Name | Status |
|---|---|---|
| LF011 | Landfill 1 | Ongoing |
| LF012 | Landfill 2 | NFRAP |
| OT020 | Spoil Pit | NFRAP |
| OT041 | North Gate Dump | NFRAP |
| OT042 | Munitions Dump | NFRAP |

**Site Chronology**

Provided separately. See **Table OU 4-2**

**Background**

**Physical Characteristics.** Operable Unit 4 is located on a steep, terraced, north-facing escarpment of the Weber Delta. The geologic units underlying OU 4 consist mainly of the Alpine Formation. The Alpine Formation consists mainly of silty clay materials with thin, fine-grained sand interbeds. Groundwater appears to flow mainly along the thin, fine-grained sand layers. Due to the thinness and discontinuous nature of the fine-grained sand layers, separate water-bearing zones could not be identified. Therefore, the fine-grained sand layers are considered a single water-bearing zone at OU 4 (**CH2M HILL, 2001**). OU 4 overlies three aquifers—the shallow, Sunset, and Delta Aquifers. The shallow aquifer consists of 200 feet of relatively low-yielding materials and lies within about 30 feet of ground surface. The Sunset and Delta Aquifers are approximately 300 and 600 feet below the OU 4 landfills, respectively. Groundwater flow in the shallow aquifer is to the north, discharging to off-Base seeps along the north escarpment or to the floodplain deposits of the Weber River (**Hill AFB EMR, 1994**). The Weber River and the Davis-Weber Canal are the primary surface water bodies near OU 4. The Weber River is located over 3,000 feet north of OU 4 and approximately 300 feet below the terrace where Landfills 1 and 2 are located. The canal is approximately 600 feet north and approximately 100 feet below Landfills 1 and 2. The canal flows in a northwest direction in the

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| | vicinity of OU 4. Well response data presented in the final RI report indicate that, in the past, water has infiltrated from the canal to the shallow aquifer via leaks. Results of analyses of canal water during the RI indicated that the canal has not been impacted by contamination. In 1993, portions of the canal were relined in with concrete, which decreased or eliminated infiltration from the canal and reduced or cut off flow to some of the seeps (**Hill AFB EMR, 1994**). In 2000, the canal was again relined and partially piped underground in the vicinity of OU 4. It appears that since 2000 the canal does not gain water from the shallow aquifer as a result of the modifications performed to the canal. Currently, the impact of groundwater recharge from the canal to the shallow aquifer appears to be minimal (**MWH, 2006**). |
| | **Land and Resource Use.** The communities of Riverdale and South Weber are adjacent to the north and northeast of OU 4. These communities are comprised mainly of moderately developed residential areas separated by large tracts of agricultural land. The City of Ogden is located further north of OU 4 and is a heavily developed community and county government center. The off-Base area of OU 4 is comprised of terraces and steep slopes or escarpments. The escarpments connect the terraces to the on-Base areas to the south and to the Weber River flood plain to the north. The Davis-Weber Canal is a privately owned irrigation canal used each year from April to October. Typical discharge rates in the Davis-Weber Canal range from 150 to 200 cfs near the point of diversion from the Weber River (**MWH, 2006**). Historically, the terraces have been used for agriculture; whereas the escarpments are heavily vegetated with large trees and shrubs. Currently the western portion of the off-Base terrace is used for agriculture. Hill AFB owns a portion of the eastern edge of the off-Base terrace in the vicinity of the horizontal drains and access to this area is restricted. Future development of the off-Base terraces is limited to low-occupancy commercial use (**MWH, 2006**). No land use changes were observed on-Base or off-Base during the 2008 Five-Year Review Site Inspection (**CH2M HILL 2007a**). |
| | **History of Contamination.** In the past, chemicals and waste products were disposed of at the IWTP, in chemical disposal pits and landfills, and off-Base. Waste dumping and burning activities at Landfills 1 and 2 took place between the late 1940s until the official closures in 1967. Landfill 1 was determined to be a source of the OU 4 TCE groundwater plume during the Phase II IRP Investigation performed in 1982. The Spoils Pit received construction debris and yard waste (i.e., concrete, wood, soil, etc.) from on-Base activities from the early 1970s to the late 1980s. No records were found that indicate that the Spoils Pit received industrial or hazardous waste. Results of investigations suggest that the Spoils Pit is not a source of subsurface contamination at OU 4. The Munitions Dump was operated by the Ogden Arsenal as an above ground munitions storage area between 1940 and 1946. Results from the remedial investigations and data review suggest that the Munitions Dump is not a source of the TCE groundwater contaminant plume at OU 4. The North Gate Dump was reportedly used to dispose of drums of waste solvent. Investigation of the North Gate Dump began in the late 1980s and no drums were located during the investigations. The ROD did not identify the North Gate Dump as a source of contamination at OU 4 (**Hill AFB EMR, 1994**). However, investigations and sampling performed in the area of the North Gate Dump prior to 1994 and after 1994, when the ROD was signed, suggest the North Gate Dump could be a source of contamination contributing to the OU 4 TCE groundwater contaminant plume (**MWH, 2006**). |
| | **Initial Response.** OU 4 was first identified as a potential source of contamination at Hill AFB during initial assessment of the Installation and Restoration Program Phase II. The report identified potential sources of contamination in this area of Hill AFB and designated OU 4 as an IRP site. Additional investigation began in 1989 as part of the RI, which was completed in 1992. The limits of the groundwater contamination and the contamination levels in the Source Areas were defined during this investigation and reported in the RI. Further, a more-detailed investigation was completed in 1993 and reported in the RI Addendum. The FS started in early 1993 and was finalized in early 1994. The FS identified potential methods to remediate the site. The ROD was completed in June of 1994. Before the ROD was signed, no removal actions or interim remedial actions were taken at OU 4. (**Hill AFB EMR, 1994**). |

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| | **Basis for Taking Action.** The purpose of the response actions conducted at OU 4 was to protect possible future risks to human health and the environment and because remedial action is warranted when MCLs are exceeded. The major future potential risks from contamination at OU 4 included inhalation of VOCs in contaminated soil gas which may enter off-Base residential basements, inhalation of VOCs by workers excavating contaminated landfill contents, inhalation of VOCs during showering with contaminated groundwater and surface water, and ingestion of contaminants while using contaminated groundwater and surface water as a drinking water source. At the time when the ROD was signed, risks to human health associated with the contaminants at OU 4 were below levels considered by the United States EPA to be significant. However, remedial action was warranted based on possible future risks to human health and the environment and because MCLs were exceeded in ground water (**Hill AFB EMR, 1994**). |
| **Remedial Actions** | **Remedy Selection (i.e. ROD/ESDs)**. The selected remedy for OU 4 addressed the threat to human health and the environment by containing and treating the source area and the contaminated groundwater, surface water, and air. The OU 4 ROD describes the remedy as: (1) contaminated shallow groundwater extraction and collection using horizontal drains or vertical wells, treatment on site using air stripping and discharge to the local POTW; (2) surface water collection from springs and seeps, treatment using carbon adsorption when a sufficient volume is produced to operate the treatment system and discharge of treated water through infiltration trenches; (3) capping the contents of Landfill 1 and treating the source of contamination using soil vapor extraction—air emissions from the soil vapor extraction system will be treated if emissions exceed regulatory limits; (4) semi-annual monitoring of indoor air in residences overlying contaminated groundwater plume; and (5) institutional controls, including: water rights restrictions, easements and leases for monitoring and installing equipment, and fencing seeps (**Hill AFB EMR, 1994**).<br><br>The ROD stated that extracted groundwater from OU 4 was to be pretreated at the OU 4 ASTP and then sent on to a POTW for final treatment. In August 2000, a permit change in VOC limits in the CWSID allowed for concentrations up to 2,130 µg/L total VOCs in effluent discharged to the CWSID. As a result of the change, the OU 4 air stripper was subsequently taken off line in January 2001 due to consistent untreated influent concentrations well below the current discharge limit. The fact that extracted groundwater at OU 4 is no longer being pre-treated using an air stripper constitutes a significant, but not fundamental, difference to the selected remedy outlined in the ROD. An SVE pilot study was conducted to determine appropriate design parameters. The SVE system was not completed because analysis of the SVE pilot study concluded that gas concentrations were too low to justify operation of the system. Because the SVE system was never installed, a significant difference exists from the landfill contents remedy outlined in the ROD although completion of this component of the selected remedy does not hinder the effectiveness of the cleanup remedy. Semi-annual air monitoring has not been conducted because no homes are located within the boundaries of the groundwater plume. Hill AFB has developed a Basewide Indoor Air Sampling Program to identify and mitigate vapor intrusion in all affected off-Base areas. Air monitoring at OU 4 will be addressed under the Basewide Indoor Air Sampling Program. Following this sampling plan represents a significant difference from the semi-annual indoor air monitoring included in the ROD. An ESD describing these changes was prepared and signed on September, 2006 (**Hill AFB CEVR, 2006**). |
| | **Remediation Goals.** Remedial action objectives and remediation goals were established to address potential future unacceptable risk scenarios. The RAOs associated with each medium of concern at OU 4 are presented below (**Hill AFB EMR, 1998**).<br><br>**Groundwater and surface water RAOs**. The RAOs for groundwater and surface water are to: limit cancer risk to less than $10^{-4}$ with a target of $10^{-6}$ due to accidental ingestion, dermal contact, or inhalation of vapors; meet chemical-specific ARARs, which are drinking water MCLs; maintain contaminant concentrations low enough to avoid chronic health effects (as indicated by a hazard index of less than 1); and prevent further degradation of groundwater quality in accordance with the Utah Corrective Action Cleanup Policy. |

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| | **Landfill contents RAOs**. The RAOs for landfill contents are to: limit cancer risk to less than $10^{-4}$ with a target of $10^{-6}$ due to accidental ingestion, dermal contact, or inhalation of vapors; maintain contaminant concentrations low enough to avoid chronic health effects (as indicated by a hazard index of less than 1); and eliminate the source(s) of groundwater contamination either through removal or source control in accordance with Utah Corrective Action Cleanup Policy.<br><br>**Air RAOs**. The RAOs for air are to: prevent the migration of contaminated soil gas into residences; prevent inhalation of carcinogens in excess of $10^{-6}$ cancer risk within off-Base residences; and prevent inhalation of noncarcinogens at levels exceeding a hazard index of 1 within off-Base residences. |
| | **Remedy Implementation.** Remedial actions implemented at OU 4 addresses both on-Base and off-Base contamination. Landfill 1 was capped in 1996 and pipes were placed beneath the cap as part of the planned SVE system. The SVE system has not been fully installed to date because analysis of soil gases demonstrated that gas concentrations are too low to justify completing the installation. The groundwater remedy includes the installation of a passive groundwater extraction system. The HDUS includes an air stripper to pre-treat the extracted groundwater prior to discharge to the CWSID, if necessary. The collection system for the surface water remedy has not been installed due to insufficient flow from springs and seeps. However, the OU 4 springs and seeps are monitored on a regular basis as part of the Basewide Groundwater Sampling Program. Institutional Controls for these components of the selected remedy were intended to restrict access and potential exposure pathways and were intended to include fencing, groundwater use restrictions, easements, leases, and signs (**MWH, 2006**). Except for fencing at all locations, these ICs have been enacted. The Annual Land Use Control Assessment report indicates that while signs have been placed at seeps U4-304 and U4-308, no fences have been installed. At seep U4-308, located off-Base, the property owner was contacted by Hill AFB regarding fencing the seep due to historical TCE contamination. However, the property owner decided to wait until the seep flows again before making a decision on whether or not to fence the seep (**Hill AFB CEVR, 2007a**). |
| | **Operations and Maintenance.** General tasks conducted during O&M activities at OU 4 consist of: (1) system operation tasks; (2) system maintenance tasks; (3) answering alarms and system troubleshooting; (4) horizontal drain groundwater sampling; (5) air stripper effluent water sampling; (6) air sampling; (7) system operational data collection; and (8) system performance evaluation and reporting (**Hill AFB CEVR, 2007a**). Overall, the Landfill 1 cap is in very good condition. Only minor defects were observed during the 2006 calendar year (**CH2M HILL, 2007a**). Repairs have been relatively minor, involving repairs to fences and gates, replacing signs, cleaning culverts, and repairing animal burrows. The landfill cap limits infiltration, and land use controls are in place and effective. There are no receptors present in relation to the landfill contents at OU 4. Overall, the cap appears to performing as designed (**CH2M HILL, 2007b**). Semi-annual groundwater and surface water sampling of select OU 4 monitoring wells and springs is currently being performed as part of the Basewide Groundwater Sampling Program. Current O&M activities at OU 4 are simple and straightforward. Performance goals are met by making sure contaminant levels are below the permit levels and monitoring the flow at each drain set. As previously discussed, the CWSID permitted discharge limits were increased and thus, the effluent is now discharged directly to the sewer without treatment in the air stripper plant. The air stripper has not operated since January 2001 (**CH2M HILL, 2007c**). Based on the site inspection performed at OU 4 during September 2007, proper inspection and maintenance procedures are in place and being implemented to ensure the integrity of the landfill caps and to ensure the enforcement of ICs (fencing, groundwater use restrictions, easements, leases, and signage) (**CH2M HILL, 2007d**). The current O&M manual for OU 4 is the Horizontal Drain Upgrade System Operation and Maintenance Plan. The O&M manual and as-built drawings are maintained through CEVR's Dynamic Documents system. All changes are managed and updated electronically through this system (**CH2M HILL, 2007b**). |

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| | **Progress Since Initiation of Remedial Action.** All remedial actions specified by the ROD are in place with the exception of the SVE system because analysis of soil gases demonstrated that gas concentrations are too low to justify completing the installation (**AEEC, 2006**). As of May 31, 2007, 187.27 pounds of TCE have been removed using the groundwater extraction system, and approximately 39,817,228 gallons of groundwater have been extracted (**AEEC, 2007**). Monitoring and data analysis has been conducted at OU 4 as specified in the 2001 PSVPlan. |
| **Progress Since Last FYR** | The 2003 five-year review identified recommendations and follow up actions for OU 4. These are presented in **Table OU 4-3** along with the current status of each recommendation.<br><br>Current Status:<br><br>All remedial actions specified by the ROD are in place. Additional investigation is ongoing to address potential additional sources. The O&M of the implemented remedies is ongoing and performance goals are met. The CWSID permitted discharge limits were increased and allowed for the extracted groundwater to be discharged directly to the sewer without prior treatment in the air stripper plant. Remedial actions have only been implemented at Landfill 1; however, remedial actions at the other four IRP sites at OU 4 have not been implemented because of their NFRAP status. In January 2006, a site recommendations for OU 4 report was prepared. The purpose of the report was to document the results of the OU 4 Site Recommendations Study. The objectives of the study were: (1) identify data gaps at OU 4, ( 2) identify OU 4 ROD compliance deficiencies, (3) provide initial recommendations for future management of the site for long-term monitoring, and (4) present recommendations for additional investigative efforts. The report presented the following findings (**MWH, 2006)**:<br><br>• Currently contaminated groundwater is being removed by the HDUS. Groundwater removed by the HDUS is currently discharged untreated to the sanitary sewer of the CWSID. The groundwater is not being treated by an air stripper due to low VOC concentrations relative to the CWSID permit limits. No vertical extraction wells have been installed at OU 4. Semi-annual groundwater sampling of select OU 4 monitoring wells is currently being performed as part of the Basewide Groundwater Sampling Program. Groundwater ICs are currently being maintained.<br><br>• The surface water remedy has never been implemented due to insufficient flow from springs and seeps. Semi-annual surface water sampling of OU 4 springs (spring locations U4-304, U4-308, U4-309, and U4-332) is currently performed as part of the Basewide Groundwater Sampling Program. However, the majority of OU 4 springs, including those previously mentioned, have been dry since at least 2002. Currently, none of the springs are fenced; however, six springs (i.e., U4-304, U4-308, U4-309, U4-312, U4-332, and U4-336) have had TCE detected at concentrations greater than 5 µg/L and therefore may require fencing.<br><br>• Landfill 1 was capped in 1996. The SVE system was partially installed, but due to low concentrations of TCE detected during previous soil-gas investigations, the system was never fully operational. Soil-gas concentrations within Landfill 1 are currently unknown. Currently, SVE lines are used to collect perched infiltrating groundwater that occasionally enters the horizontal drains and is then collected in sumps and periodically extracted, analyzed, and treated. All required ICs have been implemented and are being maintained.<br><br>• Residential indoor air sampling is included as part of the Basewide Indoor Residential Air Sampling Program. Residences overlying contaminated groundwater or within the immediate vicinity of groundwater plumes have been solicited annually since 2003 for indoor air sampling. Two homes have been sampled in the OU 4 area as part of the Basewide Indoor Air Sampling Program. Neither home overlies the most recent depiction of the OU 4 plume and air sampling result shows that neither home had detectable levels of contaminants of concern. |

Table OU 4-2

## Chronology of Site Events OU4

*2008 Five -Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 4 | OU4 | | 1981 | Remedial Investigation | Provided a history of landfill operations and indicated that organic chemicals had not been disposed in Landfills 1 and 2. | Technical Memorandum Second Draft Vol 1 Report Site Characteristics Summary Report, First Phase of Remedial Investigation, Operable Unit 4, Landfills 1 and 2 |
| 4 | OU4 | | 1987 | Remedial Investigation | 13 volatile organic and 2 inorganic contaminants were detected in water from monitoring wells and seeps in the area of OU 4. Comparison of the concentrations of observed contaminants to appropriate standards indicated that TCE exceeded the primary MCL in water from 20 monitoring wells and 3 seeps; benzene exceeded the MCL in 1 well; and 1,2-DCA, nitrate, and sulfate did not exceed the MCL in water from any of the wells or seeps. TCE was identified as a COC. | Vol. 1 Report Remedial Investigation Report for Operable Unit 4, First Draft |
| | OU4 | 7 | 1987 | Hill AFB placed on the National Priorities List (NPL) | The U.S. EPA placed HAFB on the NPL under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). | Record of Decision Operable Unit 1 IRP Sites LF01, WP02, LF03, FT09, FT81, and WP80 |
| 4 | OU4 | 4 | 1993 | Remedial Investigation | Findings of the initial RI were confirmed and revised, the extent and quantity of the ground-water contamination were defined, and the primary source of contamination was identified as Landfill 1. | Remedial Design Work Plan for Operable Unit 4 (IRP Sites LF11, LF12, OT20, OT41, OT42) |
| 4 | OU4 | 6 | 1994 | Record of Decision | ROD signed for OU 4. The selected remedy for OU 4 addressed the threat to human health and the environment by containing and treating the source area and the contaminated groundwater, surface water, and air. The major components of the selected remedy for Hill AFB OU 4 include:<br>(1) Extracting contaminated ground water using horizontal drains or vertical wells, treating the ground water by air stripping, and discharging the treated ground water to the local publicly-owned treatment works (POTW).<br>(2) Collecting surface water and treating it with carbon adsorption when a sufficient volume of water is produced to operate the treatment system.<br>(3) Capping the contents of Landfill 1 and treating the source of contamination by soil vapor extraction. | Record of Decision and Responsiveness Summary for Operable Unit 4 (IRP Sites LF11, LF12, OT20, OT41, OT42) |
| 4 | OU4 | 9 | 2003 | Five-Year Review | The second Five-Year Review stated the remedies at OU 4 protect human health and the environment in the short-term. There is no immediate risk to human health and the environment at this site. This, however, is not due to the implementation of the groundwater remedy at the site, but is due to institutional controls and the lack of receptors. | Final CERCLA Five-Year Review Report, Second Five-Year Review Report for Hill Air Force Base, Utah. |
| 4 | OU4 | 1 | 2006 | Site Recommendation Report | In January 2006, a Site Recommendation Report (SRR) for OU 4 was prepared. The purpose of the report was to document the results of the OU 4 Site Recommendations study. The objectives of the study were: 1) identify data gaps at OU 4, 2) identify OU 4 ROD compliance deficiencies, 3) provide initial recommendations for future management of the site for long-term monitoring, and 4) present recommendations for additional investigative efforts. | MWH Americas 2006. Final Site Recommendations for Operable Unit 4. January, 2006. |
| 4 | OU4 | 7 | 2006 | Explanation of Significant Differences | An Explanation of Significant Differences (ESD) signed for OU 4. In August 2000, a permit change in VOC limits in the Central Weber Sewer Improvement District (CWSID) allowed for concentrations up to 2,130 µg/L total VOCs in effluent discharged to the CWSID. As a result of the change, the OU 4 air stripper was subsequently taken off line in January 2001 due to consistent untreated influent concentrations well below the current discharge limit. An SVE pilot study was conducted to determine appropriate design parameters. The SVE system was not completed because analysis of the SVE pilot study concluded that gas concentrations were too low to justify operation of the system. Semi-annual air monitoring has not been conducted because no homes are located within the boundaries of the groundwater plume. Hill AFB has developed a Basewide Indoor Air Sampling Program to identify and mitigate vapor intrusion in all affected off-Base areas. Air monitoring at OU 4 will be addressed under the Basewide Indoor Air Sampling Program. The ESD incorporated these changes into the remedy for OU 1. | Final Explanation of Significant Difference for Operable Unit 4, July 2006. |

Table OU 4-2

## Chronology of Site Events OU4

*2008 Five -Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 3 | OU4 | 9 | 2007 | Operations and Maintenance | Operations and maintenance activities as well as groundwater sampling continued through September 2007. | |
| 4 | LF011 | | 1946 | Historical Operations | Photos in the RI show activity in 1946 at Landfill 1. | Site Conceptual Model Review OU 4 |
| 4 | LF011 | | 1955 | Historical Operations | Landfill 1 officially operated as a hillside dump with a daily burning operation from 1955 until 1967, when burning at Hill AFB was terminated and the dump was closed. | Vol. 1 Report Remedial Investigation Report for Operable Unit 4, First Draft |
| 4 | LF011 | | 1982 | Remedial Investigation | Landfill 1 identified as potential hazardous site in Phase I of the IRP. | Record of Decision and Responsiveness Summary for Operable Unit 4 (IRP Sites LF11, LF12, OT20, OT41, OT42) |
| 4 | LF011 | 11 | 1985 | Remedial Investigation | Groundwater monitoring was conducted from November 1985 to November 1987 during the Phase II Installation Restoration Program (IRP). High concentrations of trichloroethene (TCE), 4,185 µg/L, were detected in the well downgradient of Landfill 1. The detection of TCE indicated that further investigation was necessary. | Technical Memorandum Second Draft Vol 1 Report Site Characteristics Summary Report, First Phase of Remedial Investigation, Operable Unit 4, Landfills 1 and 2 |
| 4 | LF011 | | 1991 | Groundwater Sampling | Semi-annual ground water sampling initiated at OU 4. | Site Conceptual Model Review OU 4 |
| 4 | LF011 | 4 | 1993 | Remedial Investigation | Landfill 1 determined to be the "most probable" source of TCE. | Addendum to Remedial Investigation Report for Operable Unit 4, Volume 12 Appendices A, B, C, D, E, and F (Vol 2 of 8) |
| 4 | LF011 | | 1993 | Groundwater Sampling | Quarterly ground water sampling began for VOCs at selected monitor wells. | Site Conceptual Model Review OU 4 |
| 4 | LF011 | 9 | 1995 | Remedial Action | Landfill 1 Cap construction began in Sept. 1995 and was completed in June 1996 | Remedial Action Report for the Landfill 1 Cap Site (IRP Site LF11) |
| 4 | LF011 | 9 | 1996 | Remedial Action | Construction of the Horizontal Drain Upgrades began on September 13, 1996, and was completed on June 5, 1997. | Remedial Action Report Phase II Remedial Action Horizontal Drain Upgrades Operable Unit 4 |
| 4 | LF011 | | 1997 | Post-ROD Studies | Remediation by Natural Attenuation showed biodegradation of groundwater contamination was unlikely. This was re-emphasized in the Site Conceptual Model Review in December 2002. | Site Conceptual Model Review OU 4 |
| 4 | LF011 | | 1997 | Operations and Maintenance | Air stripper brought online. The air stripper reduced total VOC content in extracted groundwater to below 100 µg/L, in accordance with the discharge permit. | Annual Report for Operable Unit 4 - 1997 |
| 4 | LF011 | | 1998 | Remedial Design | Design basis presented for the use of groundwater extraction trench systems for removal of contaminants in the plume to help the HDUS with the Groundwater Remedy. | Remedial Design Report and Work Plan Phase III Groundwater Extraction Trench System Operable Unit 4 |
| 4 | LF011 | 1 | 2001 | Operations and Maintenance | Use of the air stripper system bypass was approved in January 2001 as a result of an increase in the allowable discharge concentration for the CWSID discharge permit. The bypass connects the influent line directly to the effluent line, therefore bypassing the equalization tank and air stripper. The air stripper was taken offline, and recovered groundwater was redirected through the bypass on January 23, 2001. | Treatment System Operation Report for OU 4, 2002 |
| 4 | LF011 | 3 | 2001 | Post-ROD Studies | A slope stability study was conducted to determine the long-term impact of additional extraction trenches. | Geotechnical Report OU 4 Proposed Extraction Trenches Long-Term Impact Review |
| 4 | LF011 | | 2001 | Post-ROD Studies | Report evaluation of the impact of the Groundwater Extraction Trench System would have on the surrounding geology, short-term and long-term, and the effectiveness of the system as a remedial action. It was recommended to re-evaluate the design. | Site Conceptual Model Review OU 4 |
| 4 | LF011 | 3 | 2002 | Operations and Maintenance | Discovery of blockage and break in the drain line from the treatment building to the sewer line. Possibility of additional contamination where the untreated water leaked into the surrounding soil. | Interview with Holly Renn, PM for O&M Contractor |
| 4 | LF012 | | 1945 | Historical Operations | Photos show use of Landfill 2 in the mid to late 1940's. | Site Conceptual Model Review OU 4 |
| 4 | LF012 | | 1946 | Historical Operations | Photos in the RI show activity in 1946 at Landfill 2. | Site Conceptual Model Review OU 4 |
| 4 | LF012 | | 1963 | Historical Operations | Landfill 2 officially operated between 1963 and 1965, when burning at Hill AFB was terminated and the dump was closed. "General waste" was dumped down the side of the hill and periodically burned. | Vol. 1 Report Remedial Investigation Report for Operable Unit 4, First Draft |
| 4 | LF012 | | 1982 | Remedial Investigation | Landfill 2 identified as potential hazardous site in Phase I of the IRP. | Record of Decision and Responsiveness Summary for Operable Unit 4 (IRP Sites LF11, LF12, OT20, OT41, OT42) |

Table OU 4-2

## Chronology of Site Events OU4

*2008 Five -Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 4 | LF012 | 11 | 1985 | Remedial Investigation | Groundwater monitoring was conducted from November 1985 to November 1987 during the Phase II Installation Restoration Program. In a well downgradient from Landfill 2, the concentration of TCE was 6.08 µg/L. The detection of TCE indicated that further investigation was necessary. | Technical Memorandum Second Draft Vol 1 Report Site Characteristics Summary Report, First Phase of Remedial Investigation, Operable Unit 4, Landfills 1 and 2 |
| 4 | LF012 | 6 | 1994 | NFRAP | Based on information revealed in the Remedial Investigation, Landfill 2 is noted as not being a source of contamination. The ROD is considered the NFRAP document. | Record of Decision and Responsiveness Summary for Operable Unit 4 (IRP Sites LF11, LF12, OT20, OT41, OT42) |
| 4 | OT020 | | 1972 | Historical Operations | The Spoils Area was an active disposal site from 1972 until 1989. It received construction debris such as concrete, wood, and soils from the Base. | Decision Document for Site OT20- Spoils Area |
| 4 | OT020 | 11 | 1988 | Remedial Investigation | A soil gas survey that included six sampling points at OT20 was conducted. The soil gas was tested for trichloroethane, trichloroethene, tetrachloroethene, methane, benzene, toluene, xylene, and total hydrocarbons. The soil gas survey conducted at OT20 indicated TCA, TCE and PCE at part per trillion levels. Methane was detected at part per million levels. | Decision Document for Site OT20- Spoils Area |
| 4 | OT020 | 1 | 1989 | Remedial Investigation | Initial findings of the soil gas survey were presented in the Informal Technical Information Report For Soil Gas Survey Conducted Along Perimeter Road and Spoils Area, Hill AFB, Utah. Results of the report were discussed at a 19 January 1989 meeting with representatives of USAF OEHL and Hill AFB. | Decision Document for Site OT20- Spoils Area |
| 4 | OT020 | 7 | 1989 | Groundwater Sampling | Groundwater samples were collected and analyzed for volatiles, semi-volatiles, common anions, pH, alkalinity, and selected trace elements. Analysis of groundwater samples taken from the well (U4-207) reported no compound detected at or above Federal drinking water standards. | Decision Document for Site OT20- Spoils Area |
| 4 | OT020 | 6 | 1992 | No Further Response Action Planned (NFRAP) | Conclusion: No further response action is required at site OT20 - Spoils Area. OT20 will no longer be tracked as an IRP site. | Decision Document for Site OT20- Spoils Area |
| 4 | OT041 | | 1955 | Historical Operations | North Gate Dump Areas used for solvent disposal. Specific dates are unknown. | Site Conceptual Model Review OU 4 |
| 4 | OT041 | 6 | 1994 | NFRAP | Based on information revealed in the Remedial Investigation, North Gate Dump Area is noted as not being a source of contamination. The ROD is considered the NFRAP document. | Record of Decision and Responsiveness Summary for Operable Unit 4 (IRP Sites LF11, LF12, OT20, OT41, OT42) |
| 4 | OT042 | | 1940 | Historical Operations | Munitions Dump was active from 1940 through 1946 and used to store surplus weapons above-ground. | Site Conceptual Model Review OU 4 |
| 4 | OT042 | 6 | 1994 | NFRAP | Based on information revealed in the Remedial Investigation, Munitions Dump is noted as not being a source of contamination. The ROD is considered the NFRAP document. | Record of Decision and Responsiveness Summary for Operable Unit 4 (IRP Sites LF11, LF12, OT20, OT41, OT42) |

**Notes**

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|---|---|
| AFB | Air Force Base |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CWSID | Central Weber Sewer Improvement District |
| EPA | United States Environmental Protection Agency |
| ESD | Explanation of Significant Differences |
| FS | Feasibility Study |
| HDUS | Horizontal Drain Upgrade System |
| IRP | Installation Restoration Program |
| NFRAP | No Further Response Action Planned |
| NPL | National Priority List |

Table OU 4-3

Progress Since Last Five Year Review - Status of Recommendations and Follow-Up Actions at OU 4

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Site | 2003 Five-Year Review Recommendations | Current Status | Carry over to next FYR |
|---|---|---|---|
| OU 4<br>Treatment and Containment | Thoroughly evaluate existing data and determine if additional data and/or modeling are required to develop a plume management plan that meets RAOs. | **Ongoing.** Existing data was evaluated in a Site Recommendations report for OU 4 completed in 2006 and a determination was made regarding additional investigation. The report concluded that additional investigation was required to develop a plume management plan that meets RAOs and move OU 4 toward compliance with the ROD (**MWH, 2006**). | No |
| | Evaluate clean-up levels for COCs and amend the ROD, if required, to address current ARAR levels. | **Ongoing.** The Site Recommendations report concluded the COC clean-up levels should be re-evaluated once the recommendations included in the report have been implemented. | Yes |
| | Continue to monitor wells in the plume area and if sustained trends are observed which result in an expansion of plume boundaries, an evaluation should be completed to determine if additional source area characterization is warranted. | **Ongoing.** The Site Recommendations report indicated that Landfill No.1 appears to have a continuing source; however, the source of TCE contamination has not been fully characterized. In addition, report indicates the North Gate Dump and Landfill 2 are considered to be potential source areas although both currently have NFRAP status. The report stated that additional investigations were needed in order to: address data gaps and better define the horizontal and vertical extent of TCE groundwater contamination, better define the known and suspected source areas, and move OU 4 toward compliance with the OU 4 ROD (**MWH, 2006**). The OU 4 Site Manager indicated in the 3rd FYR interview that groundwater monitoring, evaluation, monitoring well installation, etc., is planned at OU4 for 2008, including the known and potential source areas (**CH2M HILL, 2007e**). | Yes |
| | Review the PSVP in light of remedy protectiveness and achievement of RAOs and the data required to ascertain these. Update the PSVPlan, if necessary and evaluate the need to perform the PSVR in a more timely fashion than the current FFA schedule suggests. | **Ongoing.** The Site Recommendations report recommended that after completion of the site recommendations, a revised PMP, PSVPlan, and PSVReport will need to be completed for OU 4 to revise long-term monitoring objectives (**MWH, 2006**). The OU 4 Site Manager indicated in the 3rd FYR interview that the PSVReport for OU 4 is scheduled to be completed in 2009, once the additional groundwater monitoring and evaluation planned for 2008 have been completed (**CH2M HILL, 2007e**). | Yes |
| | Evaluate the existing well network to determine if it is adequate to monitor conditions within and at the distal edges of the plume and add additional monitoring locations as necessary. | **In Progress.** The Site Recommendations report indicated that the existing monitoring well network at OU 4 is insufficient to define the horizontal and vertical extent of TCE contamination in groundwater, and OU 4 is currently not in compliance with the groundwater RAOs and Landfill 1 soil RAO as stipulated in the ROD. The Site Recommendations report recommended the following additional investigations in order to determine the extent of the plume: electromagnetic induction (EMI) survey; passive soil-gas sampling; cone penetration test (CPT)/Geoprobe®; and direct-push groundwater sampling comprehensive groundwater sampling program. | Yes |
| Landfill No. 1<br>Treatment and Containment | Complete an investigation into the increase of TCE concentrations in U4-047 and closely monitor future analytical results from this location. | **In Progress.** The Site Recommendations report indicated that a continuing source may remain in Landfill 1 based on the increasing TCE concentrations at monitoring well U4-047 and high concentrations (i.e., greater than 1,000 µg/l) in numerous monitoring wells in Landfill 1. The OU 4 Site Manager stated in the 3rd FYR interview that several CPT/Hydropunch points were recently completed in 2007 along the northeastern edge of Landfill 2 looking for evidence of an additional source or sources. A summary report of the additional testing is pending | Yes |
| | Establish flow levels for implementation of the surface water collection and treatment system at the seeps. | **Deferred.** The OU 4 Site Manager indicated in the 3rd FYR interview that flow levels have not been established for implementation of the surface water collection and treatment systems, because the springs/seeps in question have been dry since the 2nd FYR. Flow levels will be addressed should the springs/seeps begin flowing again (**CH2M HILL, 2007e**). | No |
| | Complete an ESD or ROD amendment to address the bypass of the air stripper and SVE systems. | **Complete.** An ESD addressing the bypass of the air stripper and SVE systems was prepared and signed in September 2006 (**Hill AFB CEVR, 2006**). | No |
| Landfill No. 1<br>Operations and Maintenance | Protect horizontal drain lines from damage with proper soil cover. | **Complete.** Horizontal drain lines were properly covered with soil during the installation of the cleanouts in May 2003 as reported in the Horizontal Drain Upgrade System Monthly Operation Summary May 2003. During the 3rd FYR site inspection it was verified that the horizontal pipes were covered with soil (**CH2M HILL, 2007d**). In addition, the OU 4 O&M Site Manager indicated in the 3rd FYR interview that in the upper drain field, pipes that were exposed were not a part of the system. They were owned by an adjacent property owner who was using the piping to get water from the canal (**CH2M HILL, 2007f**). | No |

Table OU 4-3

Progress Since Last Five Year Review - Status of Recommendations and Follow-Up Actions at OU 4

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Site | 2003 Five-Year Review Recommendations | Current Status | Carry over to next FYR |
|---|---|---|---|
| | Install additional signage to prevent unauthorized off-Base excavation. | **Complete.** During the FYR site inspection it was observed that signs are posted at various areas of OU 4. Signs appeared in good condition. Signs note contact information and many note restrictions (such as not to dig) and/or presence of contamination (**CH2M HILL, 2007d)**. | No |
| | Evaluate the causes of reduced flows in the horizontal drain system. | **Complete.** The OU 4 Site Manager indicated in the 2nd FYR interview that the HDUS flows continue to fluctuate, including increasing at times. He believes that fluctuations are due to the passive nature of the system (gravity flow). Flows have historically been within the acceptable ranges for the system. The cause of any reduced flows has not been investigated extensively (**CH2M HILL, 2007d**). | No |
| | Complete a risk-based analysis for seep U4-308 and if risk-based levels are exceeded, institutional controls should be enforced. | **Deferred.** The OU 4 Site Manager stated in the 2008 five-year interview that a risk-based analysis of seep U4-308 has not been performed because the location has not flowed since the 2nd FYR. Risk will be evaluated and addressed when or if the seep begins to flow again (**CH2M HILL, 2007d**). | No |
| | Data from the sumps in Landfill No. 1 and the drain set flows of the HDUS system should be included in the ERPIMS database to allow for trends to be examined. All data that are required in the PSVPlan should be included in the database. If no data are available during the sampling round or if a point has been discontinued, it should be noted in the database for clarification. | **Complete**. A Basewide Monitoring and Maintenance Work Plan was prepared to document sampling, monitoring, and maintenance activities, last updated on July 2007. Upon completion of the data validation, the sampling data is submitted to the ERPIMS database (**CH2M HILL. 2007h**). In addition the CERCLA Cap System - Inspection, Operation, and Maintenance Plan was prepared for landfills a OU 1, OU 3, OU 4, and OU 7. Data collected during sample inspections is submitted to the ERPIMS database (**CH2M HILL. 2007g**). | No |

**Notes:**

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| ARARs | Applicable, Relevant, and Appropriate Requirements |
| BASAP | Basewide Air Sampling and Analysis Plan for Indoor Residential Air Sampling. |
| COCs | Chemical of Concern |
| CPT | cone penetration testing |
| ERPIMS | Environmental Restoration Program Information Management System |
| ESD | Explanation of Significant Difference |
| FFA | Federal Facilities Agreement |
| FYR | Five-Year Review |
| OU 4 | Operable Unit 4 |
| PSVP | Performance Standard Verification Plan |
| PSVR | Performance Standard Verification Report |
| RAO | Remedial Action Objective |
| ROD | Record of Decision |
| Study Recommendation | Site Recommendation |
| SVE | Soil Vapor Extraction |
| TCE | Trichloroethylene |

Table OU 4-4
## Operable Unit 4
## Five-Year Review Process

Reviewer: Victor Martinez

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| **Introduction** | The 2008 five-year review for Hill AFB has been conducted in accordance with the United States EPA's Comprehensive Five-Year Review Guidance dated June 2001 (**EPA, 2001**). Administrative and community involvement components of the five-year review are described in **Section 2.0** of this report. In addition, interviews were conducted with relevant parties, and a site inspection of OU 4 was performed. Documents reviewed for OU 4 as part of the 2008 five-year review are listed in **Appendix C**. Relevant site documents and applicable data covering the period of the five-year review were evaluated. The site interviews, site inspection, and data review are further discussed in the following sections. |
| **Interviews** | Interviews for OU 4 were conducted with Jarrod Case/75 Civil Engineering Group/ Environmental Management, Restoration Division (CEG/CEVR) site manager, Oscar Torres/ 75 CEG/CEVR O&M manager, Ray Spencer/75 CEG/CEVR O&M Manager for Landfill Caps, Steve Parkinson and Brad Thein/AEEC O&M Contractor. Copies of the Interview Record Forms are provided in **Appendix D**.<br><br>Mr. Parkinson and Mr. Thein were interviewed on September 25, 2007. They mentioned that the contaminant levels were maintained below permit levels and the flow at each drain set was monitored as meeting the performance goals. Analytical data from the landfill collection sumps and the HDUS drain set flows are included in the ERPIMS database as recommended in the 2003 five-year review. Data is collected monthly and submitted to ERPIMS quarterly. They indicated that the permitted discharge limits were increased and that the effluent is now discharged directly to the sewer without treatment in the air stripper plant and as a result the air stripper was turned off in January 2001.<br><br>Mr. Parkinson and Mr. Thein indicated that a possible cause of reduced flows in the HDUS drain sets is that some of the drain sets may be above the water table or clogged and pointed out that some of the lines are dry in the summer. Therefore, they are in the process of evaluating procedures to determine if the drain lines are clogged. Current monitoring indicates there are no restrictions in the influent lines. Mr. Parkinson and Mr. Thein mentioned that they are in the process of evaluating the system to improve flow in the drain lines.<br><br>Mr. Case provided responses via electronic mail on December 17, 2007. He mentioned that concerns were raised in the 2003 five-year review over the effectiveness of the cap in limiting the filtration and reducing contaminant leaching. He explained that this was due to an increase in TCE concentrations downgradient of the landfill monitoring location OU4-047. Mr. Case pointed out that it is unclear whether or not the landfill contents remedy (Landfill 1 cap) is performing well based on the data collected. He indicated that Landfill 1 appears to be a continuing source of contaminants to the shallow groundwater. .<br><br>Mr. Case indicated that flow levels have not been established for implementation of the surface water collection and treatment systems, because the springs/seeps in question have been dry since the 2003 five-year review. He added that they will be addressed should the springs/seeps begin flowing again. He pointed out that seep U4-308, identified in the 2003 five-year review as having an increasing TCE trend, has been dry since 2002. He explained that the risk-based analysis of seep U4-308 recommended in the 2003 five-year review has not been performed because the location has not flowed since 2002 and no additional remedial actions have or are being implemented as a result of the increased concentrations at this seep. He mentioned that a hand auger sample collected in 2007 near the location of U4-308 showed TCE at 14 µg/L, which is below the maximum value of 36.9 µg/L detected in 2001. |

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| | Mr. Case indicated that monitoring well U4-069, also identified in the 2003 five-year review as having an increasing TCE trend, has been monitored each year since the 2003 five-year review, and TCE concentrations appear to be leveling out. He added that the maximum TCE concentration detected was 556 µg/L in 2005, with the most recent sample showing 241 µg/L in 2007. Mr. Case stated several CPT/Hydropunch points were completed in 2007 along the northeastern edge of Landfill 2 looking for evidence of an additional source or sources. He indicated that to date, the 2007 monitoring and evaluation has not had any impact on remedial actions at the site.<br><br>Mr. Case also pointed out that continued operation of the horizontal drain system has resulted in additional mass (primarily TCE) being removed from the site. He added that long-term groundwater monitoring has been continued at the site since the 2003 five-year review. He indicated that fluctuations of the HDUS may be due to the passive nature of the system (gravity flow). He added that flows have historically been within the acceptable ranges for the system. He mentioned that additional groundwater monitoring, evaluation, and monitoring well installation is planned for 2008. He also indicated that the PSVReport for OU 4 is scheduled to be completed in 2009, once the additional groundwater monitoring and evaluation planned for 2008 have been completed. Mr. Case mentioned that there has been no significant progress toward achieving the remedial goals since the 2003 five-year review.<br><br>Mr. Spencer provided responses via telephone on December 13, 2007. He indicated that minimum repairs have been required since the 2003 five-year review including repairs to the fences and gates, replacing signs, cleaning culverts, and repairing animal burrows. Mr. Spencer mentioned that the landfill cap at Landfill 1 limits infiltration and land use controls are in place, therefore the remedy is functioning as expected. He added that there are no receptors present in relation to landfill contents at OU 4. Mr. Spencer pointed out Landfill 1 may not be the only source area at OU 4. No major or unexpected O&M difficulties have been encountered at OU 4 since the 2003 five-year review.<br><br>Mr. Torres was interviewed on September 25, 2007. He indicated that contaminant concentrations continue to decrease but concentrations are not at the MCLs yet. His overall impression is that the system complies with the discharge permit requirements and that there is no reason to turn the air stripper back on. Mr. Torres mentioned that the exposed upper drain field pipes found during the 2003 five-year review inspection were not part of the system. The pipes belonged to an adjacent property owner who was using them to get water from a canal. Therefore, there was no need to cover them as recommended in the 2003 five-year review. With regards to the optimization of the operation, maintenance, or sampling efforts since the 2003 five-year review, Mr. Torres mentioned that once a flow valve was replaced, the flow rate in the lower drain set was increased.<br><br>All interviewees were not aware of any community concerns about the O&M in OU 4.<br><br>Community interviews were also conducted as part of this five-year review. Interviews were conducted with Mr. Lynn Moulding/Riverdale City and Community RAB representative and Ms. Pat Crezee/Riverdale resident. A copy of the Interview Record Form is provided in **Appendix B.**<br><br>Mr. Lynn Moulding indicated that he thinks that Hill AFB has done a good job in identifying problem areas and setting forth a remedial action to deal with the problems. He also noted that it is evident that Hill AFB is monitoring the plumes in Riverdale and maintaining the system that has been put into place, and that between the newsletter and other media, there is ample opportunity for the community to educate themselves. He said that EMR has done a great job and has always addressed all his concerns.<br><br>Ms. Pat Crezee was interviewed on December 13, 2007. She indicated that she is pleased with the cleanup effort and feels well informed. She also indicated that her neighbor was curious about drilling operations that had been started but abandoned, about the variation in |

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| | contaminant concentrations in a well near her house from one event to the next, and about development of the hillside behind 1200 West. Ms. Crezee said she felt that Hill AFB has been responsible in getting information out and suggested that they distribute the RAB Web site address at the upcoming Riverdale InfoFair. She felt the indoor air program would be better if all residents participated. Overall, Hill AFB has always addressed all her concerns and been responsive. She said that she and the neighbors are concerned, however, about the contaminated groundwater coming to the surface and/or entering the neighborhood below when homes are built behind them on the hillside. |
| **Site Inspection** | The site inspection for OU 4 was conducted on September 25 and 28, 2007. The completed site inspection checklist is provided in **Appendix E**.<br><br>Based on the site inspection, OU 4 appears to be well maintained. The asphalt drive at the air stripper is in good condition. Dirt roadways up hillside and at Landfill 1 are in acceptable condition. Some rutting is present on these roads.<br><br>Access and institutional controls are currently in place at OU 4. The only portion of the site that is fenced is Landfill 1. Gates are secured. Signs are posted at various areas of OU 4. Signs appeared to be in good condition. Signs note contact information and many note restrictions (such as not to dig) and/or presence of contamination. Occasional trespassing has been reported in the past along hillside by motorbikes. Hill AFB performs an annual evaluation of the ICs in place for the Base. This includes verification of orders, leases, groundwater use restrictions, and inspections of signage, fences, and monitoring wells. An annual land-use controls report is prepared documenting the results of this work.<br><br>The landfill inspection indicates that the cap is being properly maintained. No signs of settlement, cracking, and erosion were observed in the landfill surface. The vegetative cover was properly established with no sign of stress. No bulges, wet areas/water damage, and slope instability were evident. Gas monitoring probes were properly secured/locked. Settlement monuments are protected by bollards, but they are no longer routinely surveyed, because previous monitoring has shown that settlement of the landfill cap was not an issue.<br><br>Groundwater/surface water remedies were in good condition. Pumps, wellhead plumbing, and electrical enclosures were in good condition. The system uses horizontal drains instead of pumps. Water is collected in sumps and piped to the air stripper plant. Extraction system pipelines, valves, valve boxes, and other appurtenances were located and in good condition. The air stripper is in good condition. Sampling ports are not marked, but are functional. Water is no longer treated by air stripping, but is discharged directly to the sewer. Electrical enclosures and panels, tanks, vaults and storage vessels were all in good condition. All monitoring wells but U4-011 (had a broken hinge and no well cap) were properly secured/locked and in good condition. Due to large number of wells present, not all wells were inspected.<br><br>The site inspection checklist addressed four discussion topics. These discussion topics are presented below, followed by responses and general observations based on the site inspection.<br><br>(1) Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).<br><br>The OU 4 remedy was to achieve 10 remedial action goals for contaminated groundwater, landfill contents, surface water, and air. The remedial action goals for groundwater and surface water are presented in **Table OU 4-1**. The ROD stipulated that the remedial action goals applied to areas where the MCLs were exceeded in groundwater and surface water. The remedial action goals for the landfill contents and air are presented in **Table OU 4-1**. The ROD stipulated that the remedial action goals were applicable to Landfill 1 only. The groundwater is addressed through extraction in the horizontal drains and discharged directly to the CWSID sewer. An ESD has been signed to remove the requirement to treat |

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| | the water via air stripping prior to discharge. Institutional controls are in place to restrict the use of contaminated groundwater at OU 4. The ICs implemented at OU 4 are presented in detail in the Technical Assessment section, **Table OU-4-7.**The groundwater plume is monitored as part of the Basewide groundwater monitoring program.<br><br>A landfill cap was constructed over Landfill 1 to prevent exposure to the landfill contents and minimize the infiltration of water through the landfill contents to the underlying groundwater. The SVE system was partially installed to extract and treat contaminated vapors underneath the landfill cap. Testing prior to startup of the system demonstrated that its operation was not required. The ESD also removed the requirement to operate the SVE system at Landfill 1.<br><br>The ROD stipulated that surface water collection systems would be installed once the seeps and springs generated enough water volume to operate the treatment system. To date, the springs and seeps do not flow sufficiently to warrant installation of these systems, and no surface water collection and treatment system has been installed.<br><br>Indoor air sampling and vapor mitigation is performed under the Basewide indoor air program.<br><br>Based on the site inspection, all components of the remedy appear to be functioning as designed.<br><br>(2) Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.<br><br>Operation and maintenance at the site includes maintenance of the extraction drains and associated sumps and piping, long-term monitoring of the site groundwater, water level monitoring, and O&M of the Air Stripper Building. Extracted water is currently discharged directly to the CWSID. The effluent is monitored to ensure that the discharge criteria are met. Proper inspection and maintenance procedures are in place and implemented to ensure the integrity of the remedy and to ensure the enforcement of ICs (groundwater use restrictions, land use restrictions on-site, integrity of fencing, and signage).<br><br>(3) Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.<br><br>There are no issues related to the O&M procedures (cost or scope) that would indicate the protectiveness of the remedy may be compromised in the future. Potential low flows from the horizontal drains are still not resolved. However, the flows have remained fairly constant and are currently within the acceptable range. The O&M contractor has proposed methods to investigate the low flows and improve removal rates at the drains, but this issue is not noted as a large concern at this time by CEVR staff and may be implemented at a future date.<br><br>(4) Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.<br><br>Operation and maintenance contractors regularly make recommendations to optimize performance and/or reduce costs. No optimization opportunities were identified as part of the site inspection. Removal of the air stripper from operation at the beginning of the five-year review period resulted in significant cost savings. |

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| **Data Review** | The data reviewed as part of the 2008 five-year review included groundwater samples, effluent discharge samples, surface water samples from seeps and springs, Although the OU 4 ROD stipulates quarterly groundwater sampling, semi-annual groundwater sampling of select OU 4 monitoring wells is currently being performed as part of the Basewide Groundwater Sampling Program.<br><br>In 2006, a Site Recommendation Report was completed for OU 4 to identify data gaps at OU 4, identify OU 4 ROD compliance deficiencies, provide initial recommendations for future management of the site for long-term monitoring, and present recommendations for additional investigative efforts (**MWH, 2006**). The report reviewed historical data with emphasis on data from January 2003 through June 2005. Several issues and recommendations were identified in the Site Recommendations Report and are presented in the following paragraphs.<br><br>The Site Recommendations Report stated that the Landfill 1 soil cap was designed to prevent water from infiltrating into the landfill and leaching contamination to the underlying groundwater. Based on increasing concentrations of TCE since the year 2000 in downgradient monitoring wells (specifically monitoring well U4-047), a continuing source may be present. Whether the continuing source is from infiltrating water leaching contamination to the groundwater, which would suggest that the cap is not functioning as intended, a contaminated perched water zone, and/or contamination that extends to the water table, is unknown without further investigation. Thus, the source of groundwater contamination at Landfill 1 may remain. . The Site Recommendations report indicated that TCE concentrations in groundwater near Landfills 1 and 2 and in the North Gate Dump appeared to be increasing (**MWH, 2006**).<br><br>The Site Recommendation Report indicated that since groundwater concentrations have been slowly decreasing it appears that the 30-year remediation timeframe established in the ROD will not be met. The Site Recommendation report indicated that additional investigations, sampling, and modeling will be required in order to establish a new remediation timeframe for the site (**MWH, 2006**). Currently, TCE contamination in groundwater is above the clean-up goal. Data review of groundwater samples collected from June 2003 through November 2006 indicate that several wells, (U4-021, U4-046, U4-053R, U4-054, U4-062, U4-807, and U4-809) with concentrations above the cleanup goals, have an apparent decreasing trend. The remaining wells do not show either an increasing or decreasing trend. As of November 2006, TCE concentrations at monitoring wells have been detected at concentrations below 1000 µg/L except at monitoring well U4-047, which have remained elevated (a concentration of 17,700 µg/L was reported during the November 2006 sampling event).<br><br>Groundwater removed by the HDUS is currently discharged untreated to the sanitary sewer of the CWSID. Performance goals are met by making sure contaminant levels are below the permit levels and monitoring the flow at each drain set. Analytical data from the landfill collection sumps and the HDUS drain set flows are included in the ERPIMS database as recommended in the 2003 five-year review. Data is collected monthly and submitted to ERPIMS quarterly.<br><br>The OU 4 ROD selected remedy included a component for collection and treatment of surface water from springs and seeps. This component of the selected remedy has not been implemented due to insufficient flow from springs and seeps. The OU 4 ROD stipulates quarterly surface water sampling and semi-annual surface water sampling of OU 4 springs (spring locations U4-304, U4-308, U4-309, and U4-332). However, semiannual sampling of surface water and the springs is currently performed as part of the Basewide Groundwater Sampling Program. It should be noted that the majority of OU 4 springs have been dry since at least 2002. In the summer of 2005, only four of the springs (i.e., U4-334, U4-335, U4-336, and U4-351) were flowing. Spring location U4-308 is currently the northwestern-most control point for the OU 4 plume and has had TCE concentrations as high as 20.9 µg/L during the current five-year review period (in 2002). This spring was last sampled at that time and has been dry since then. Surface water ICs are currently being maintained, with the exception of fencing of |

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| | individual springs/seeps. Currently, none of the springs are fenced; however, six springs (U4-304, U4-308, U4-309, U4-312, U4-332, and U4-336) have had TCE detected at concentrations greater than 5 µg/L, and therefore may require fencing (**MWH, 2006**).<br><br>The SVE drains are currently used to collect leachate and perched water from within the landfill. The water is collected in sumps located at the eastern end of the landfill and periodically extracted, analyzed, and treated. The infrastructure of the existing system could be evaluated and used in the future to implement SVE or groundwater extraction if further investigations warrant additional remedial activities (**MWH, 2006**).<br><br>The Site Recommendations for OU 4 report concluded that the most significant problem at OU 4 is that the current monitoring well network is insufficient to define the horizontal and vertical extent of TCE contamination in groundwater. The extent of the plume must be determined in order to be in compliance with the RAOs and move forward to future site closure. The Site Recommendations for OU 4 Report stated that Landfill 1 appears to be contributing mass to the plume. In addition, the North Gate Dump and Landfill 2 are considered to be potential source areas; however, both of these Installation Restoration Program sites currently have No Further Response Action Planned designation. Finally, the report concluded that Operable Unit 4 is currently not in compliance with the groundwater RAOs and Landfill 1 soil RAO as stipulated in the OU 4 ROD. The TCE concentrations in both on- and off-Base monitoring wells are greater than the MCL and TCE concentrations near Landfills 1 and 2 and the North Gate Dump have been increasing through time. Groundwater concentrations do not appear to be attenuating such that the 30-year remediation timeframe will be met. |

Table OU 4-5

## Chemicals of Concern and Remediation Goals at OU 4

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Media | Chemical of Concern | Remediation Goal | Units |
|---|---|---|---|
| Groundwater/ Surface Water | 1,1-Dichloroethene (1,1-DCE) | 7 | ug/L |
| | 1,2-Dichloroethane (1,2-DCA) | 5 | ug/L |
| | cis 1,2-Dichloroethene (cis 1,2-DCE) | 70 | ug/L |
| | trans 1,2-Dichloroethene (trans 1,2-DCE) | 100 | ug/L |
| | Arsenic | 10** | ug/L |
| | Barium | 2,000 | ug/L |
| | Benzene | 5 | ug/L |
| | Boron* | *2,700* | ug/L |
| | Chloroform | 100 | ug/L |
| | Methyl Ethyl Ketone* | *830* | ug/L |
| | Nickel* | *100* | ug/L |
| | Selenium | 50 | ug/L |
| | Tetrachloroethylene (Perchloroethylene, PCE) | 5 | ug/L |
| | Toluene | 1,000 | ug/L |
| | Trichloroethene (TCE) | 5 | ug/L |
| | xylenes (total) | 10,000 | ug/L |
| Air | Trichloroethene (TCE)* | *5* | ug/m^3 |

Notes:

* Remediation goals for these chemicals are risk-based levels

** - Remediation goal revised to reflect change to the MCL (see Appendix F)

Unless otherwise specified, the concentrations for ground and surface water are maximum contaminated levels (MCLs) established under the Safe Drinking Water Act and/or Utah Primary Drinking Water Standards

ug/L = micrograms per liter

ug/m^3 = micrograms per cubic meter

Table OU 4-6

## OU 4 System Effluent Discharge Limits for Discharge to the Central Weber Sewer Improvement District

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Analyte | Discharge Limit | Units |
|---|---|---|
| Total VOCs | 2.13 | mg/L |
| Arsenic | None | |
| Nickel | 4.1 | mg/L |
| Lead | 1.14 | mg/L |
| Zinc | 4.57 | mg/L |
| pH | 5.0-11.0 | |
| Temperature | <140 | °F |

Notes:

mg/L milligrams per liter

VOCs = volatile organic compounds

Permit Dates: August 16, 2003 through September 1, 2006 and September 1, 2006 through September 1, 2010.

Table OU 4-7
# Operable Unit 4
# Five-Year Review Technical Assessment

Reviewer: Victor Martinez

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| **Introduction** | The five-year review must determine whether the remedy at a site is protective of human health and the environment. The EPA guidance (**EPA, 2001**) describes three questions used to provide a framework for organizing and evaluating data and information and to ensure all relevant issues are considered when determining the protectiveness of a remedy. These questions are assessed for OU 4 in the following sections. The implementation of ICs is also described. At the end of this table is a summary of the technical assessment. |
| **Question A.** | **Is the remedy functioning as intended by the decision documents?**<br><br>No. The documents that detail the remedial decisions for OU 4 are the 1994 ROD (**Hill AFB EMR, 1994**) and the 2006 Final ESD for OU 4 (**Hill AFB CEVR, 2006**). Based on the data review, site inspection, technical evaluation, and interviews, the remedial actions selected for OU 4 generally appear to have been implemented; however, they are not functioning as intended by the ROD and ESD. While groundwater concentrations have been slowly decreasing, it appears that the 30-year remediation timeframe established on the ROD will not be met (**MWH, 2006)**.<br><br>The groundwater remedy includes the installation of a passive groundwater extraction system. Horizontal drains were initially installed in 1993 and upgraded in 1997. The HDUS includes an air stripper to pre-treat the extracted groundwater prior to discharge to the CWSID, if necessary. Groundwater removed by the HDUS is currently discharged untreated to the sanitary sewer of the CWSID. The groundwater is not being treated by an air stripper due to low VOC concentrations relative to the CWSID permit limits. No vertical extraction wells have been installed at OU 4. Landfill No.1 was capped in 1996 and pipes were placed beneath the cap as part of the planned SVE system. The SVE system has not been fully installed to date because analysis of soil gases demonstrated that concentrations are too low to justify completing the installation. The collection system for the surface water remedy has not been installed due to insufficient flow from springs and seeps. However, the OU 4 springs and seeps are monitored on a regular basis as part of the Basewide Groundwater Sampling Program. Indoor air was to be addressed with a no-action alternative that was to include semi-annual air monitoring in residential basements that overlie the groundwater plume. Currently, residential indoor air sampling is being addressed through the Basewide Indoor Residential Air Sampling Program. Institutional controls for these components of the selected remedy were put in place to restrict access and remove potential exposure pathways. The ICs include fencing, groundwater use restrictions, easements, leases, and signs (**MWH, 2006**).<br><br>An SVE pilot study was conducted to determine appropriate design parameters. The SVE system was not completed because analysis of the SVE pilot study concluded that gas concentrations were too low to justify operation of the system (**Hill AFB CEVR, 2006**).<br><br>Semi-annual air monitoring has not been conducted because no homes are located within the boundaries of the groundwater plume. Hill AFB has developed a Basewide Indoor Air Sampling Program to identify and mitigate vapor intrusion in all affected off-Base areas. Air monitoring at OU 4 will be addressed under the Basewide Indoor Air Sampling Program. Following this sampling plan represents a significant difference from the semi-annual indoor air monitoring included in the ROD (**Hill AFB CEVR, 2006**).<br><br>According to the ROD, extracted groundwater from OU 4 required pre-treatment at the OU 4 ASTP before being sent on to a POTW for final treatment. In August 2000, a permit change in VOC limits in the CWSID allowed for concentrations up to 2,130 µg/L total VOCs in the |

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| | effluent discharged to the CWSID. The OU 4 air stripper was subsequently taken off line in January 2001 due to consistent untreated influent concentrations well below the current discharge limit. The fact that extracted ground water at OU 4 was no longer being pre-treated by the air stripper constitutes a significant, but not fundamental, difference to the selected remedy outlined in the ROD. Because the SVE system was never installed, a significant difference existed from the landfill contents remedy outlined in the ROD. Completion of this component of the selected remedy does not hinder the effectiveness of the cleanup remedy. An ESD describing these changes was prepared and signed in September 2006 (**Hill AFB CEVR, 2006**).<br><br>Opportunities for Optimization:<br><br>Operation and maintenance contractors regularly make recommendations to optimize performance and/or reduce costs. No new optimization opportunities were identified as part of the site inspection. Removal of the air stripper from operation at the beginning of the 2008 five-year review period resulted in significant cost savings.<br><br>Early Indicators of Potential Remedy Problems:<br><br>The TCE concentration at monitoring well U4-047 has remained high. The Landfill 1 soil cap was designed to prevent water from infiltrating into the landfill and leaching contamination to the underlying groundwater. Based on increasing TCE concentrations since the year 2000 in downgradient monitoring well U4-047, a continuing source may be present. In addition, the Site Recommendations for OU 4 Report identified the North Gate Dump and Landfill 2 as potential source areas for the OU 4 plume. Both IRP Sites currently have NFRAP status (**MWH, 2006**). |
| **Question B.** | **Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?**<br><br>Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics:<br><br>No. Some of the toxicity values used to develop cleanup levels for COCs have become more stringent since the signing of the ROD. Oral reference doses for Toluene have become more stringent. The inhalation reference dose for 1,1-Dichloroethene (1,1-DCE), 1,2-Dichloroethane (1,2-DCA), trans 1,2-Dichloroethene (trans 1,2-DCE), TCE, and Benzene has become more stringent. In addition the inhalation slope factor (SFi) for Benzene has become more stringent. The RfDo for 1,2- DCA, Barium, and Boron has become less stringent. The oral slope factor for Benzene, 1,1-Dichloroethene, and Trichloroethene have become less stringent. The RfDi for Chloroform, Methyl Ethyl Ketone, and xylenes (total) have become less stringent.<br><br>Changes in Applicable or Relevant and Appropriate Requirements:<br><br>The five-year review for OU 4 included identification and evaluation of changes in the ROD-specified ARARs and To Be Considereds to determine whether such changes may affect the protectiveness of the selected remedy. Chemical-specific and action-specific ARARs were reviewed and were all determined to still be applicable, relevant and appropriate, or To Be Considereds, as presented in **Appendix G**. |
| **Question C.** | **Has any other information come to light that could call into question the protectiveness of the remedy?**<br><br>Yes. Currently, none of the springs/seeps are fenced. The only means of protection to the public and the environment is that most of the seeps/springs have not been flowing since 2002. In previous years, when the springs were flowing, some of the springs have had concentrations detected above the PRG. |

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| **Institutional Controls** | Institutional controls are generally defined as non-engineered instruments such as administrative and legal tools that do not involve construction or physically changing the site, and that help minimize the potential for human exposure to contamination and/or protect the integrity of a remedy by limiting land and/or resource use (**EPA, 2005**). Institutional controls can be used for many reasons including restriction of site use, modifying behavior, and providing information to people (**EPA, 2000**). Institutional controls may include deed notices, easements, covenants, restrictions, or other conditions on deeds, and/or groundwater and/or land use restriction documents (**EPA, 2001**). The following paragraphs describe ICs implemented at OU 4, the potential affect of future land use plans on ICs, and any plans for changes to site contamination status.<br><br>Types of ICs in Place at the Site:<br><br>Access and ICs are currently in place at OU 4. The only portion of the site that is fenced is Landfill 1. Gates are secured. Signs are posted at various areas of OU 4. Signs appeared to be in good condition. Signs note contact information and many note restrictions (such as not to dig) and/or presence of contamination. Hill AFB performs an annual evaluation of the ICs in place for the Base. This includes verification of orders, leases, groundwater use restrictions, and inspections of signage, fences, and monitoring wells. An annual LUC Assessment report is prepared documenting the results of this work. Detail information of the annual LUC Assessment report is presented in **Section 2.7**. Based on review of the most recent LUC Assessment report, four recommendations were made for OU 4 regarding warning sign that provides current contact information at the off-Base air stripper treatment building and the Lower, Middle, and Upper Horizontal Drains (**Hill AFB CEVR, 2007b**).<br><br>Effects of Future Land Use Plans on ICs:<br><br>No effects on ICs due to future land use were identified during this five-year review for OU 4.<br><br>Plans for Changes to Site Contamination Status:<br><br>No changes to site contaminant status at OU 4 are anticipated in the near future. |
| **Summary of the Technical Assessment** | The technical assessment, based on the data review, site inspection, technical evaluation, and interviews indicates that the remedial actions selected for OU 4 generally appear to have been implemented; however, they are not functioning as intended by the ROD and ESDs. Data review of groundwater concentrations since 2002 suggest that progress toward achieving remedial goals is not taking place as expected. Although groundwater concentrations have been slowly decreasing, it appears that the 30-year remediation timeframe established on the ROD will not be met (**MWH, 2006)**. Additional investigations, sampling, and modeling will be required in order to establish a new remediation timeframe for the site.<br><br>Groundwater removed by the HDUS is currently discharged untreated to the sanitary sewer of the CWSID. Performance goals are met by making sure contaminant levels are below the permit levels and monitoring the flow at each drain set. All OU 4 effluent discharge samples from 2003 through March 2007 were within the permitted limits as presented in **Table OU 4-6**.<br><br>Sampling of surface water and springs is currently performed as part of the Basewide Groundwater Sampling Program. However, the majority of OU 4 springs have been dry since at least 2002 (**MWH, 2006)**. Access and ICs are currently in place at OU 4. The only portion of the site that is fenced is Landfill 1. Surface water ICs are currently being maintained, with the exception of fencing of individual springs/seeps The ROD for OU 4 states that ICs will be enacted, including water rights restrictions, easements and leases from monitoring and installing equipment and fencing seeps (**Hill AFB EMR, 1994**). |

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| | The SVE drains are currently used to collect leachate and perched water from within the landfill. The infrastructure of the existing system could be evaluated and used in the future to implement SVE or groundwater extraction if further investigations warrant additional remedial activities (**MWH, 2006)**.<br><br>Based on information provided in the Site Recommendations report for OU 4, the current monitoring well network at OU 4 is insufficient to define the horizontal and vertical extent of TCE contamination in groundwater. The extent of the plume must be determined in order to be in compliance with the RAOs and move forward to future site closure. The Site Recommendation Report concluded that the groundwater RAOs and Landfill 1 soil RAOs are not being met as stipulated in the OU 4 ROD. The report indicated that TCE concentrations in both on- and off-Base monitoring wells are greater than the MCL, and TCE concentrations near Landfills 1 and 2 and in the North Gate Dump have been increasing over time (**MWH, 2006)**. |

Table OU 4-8
## Operable Unit 4
## Technical Assessment Summary for OU 4

Reviewer: Victor Martinez

| Site ID | Remedy Description | Technical Assessment | | | Protectiveness | Next Five-Year Review |
|---|---|---|---|---|---|---|
| | | Question A* | Question B* | Question C* | | |
| LF011 | Landfill Cap, Horizontal Drain Upgrade System (HDUS), seep/spring control, air monitoring | No | No | Yes | Protective in the short-term | 2013 |
| LF012 | NFRAP | NA | NA | NA | NA (This IRP site has been identified as a potential source area for the OU 4 plume. Further investigation will be required) | 2013 |
| OT020 | NFRAP | NA | NA | NA | NA | NA |
| OT041 | NFRAP | NA | NA | NA | NA (This IRP Site has been identified as a potential source area for the OU 4 plume. Further investigation will be required) | 2013 |
| OT042 | NFRAP | NA | NA | NA | NA | NA |
| OU 4 | Landfill Cap, groundwater extraction, surface water and groundwater use restrictions, site access restrictions | No | No | Yes | Protective in the short term | 2013 |

*Question A: Is the remedy functioning as intended by the decision documents?
Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objective (RAOs) used at the time of the remedy still valid?
Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
NA = Not Applicable

Table OU 4-9
## Operable Unit 4
## Five-Year Review Issues, Recommendations and Follow-Up Actions, and Protectiveness Statement

Reviewer: Victor Martinez

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| **Issues** | Operation and maintenance activities are ongoing at OU 4. Based on the document review, data review, site inspection, interviews, and the technical assessment, it appears the remedy has been implemented as planned but is not functioning as intended by the decision documents. To ensure continued protectiveness, six issues are identified in the 2008 five-year review for OU 4, as described below. These issues do not currently affect the protectiveness of the remedy, although they need to be addressed to ensure continued protectiveness.<br><br>1) The 2003 five-year review included a recommendation that cleanup levels be reevaluated and the ROD amended, if required, to address current ARAR. Since the ROD was signed, the EPA has published revised toxicity factors that could potentially affect COC cleanup levels at OU 4. The Site Recommendations for OU 4 Report, completed in 2006, recommended that the reevaluation of cleanup levels be completed once the investigations recommended in the report are completed.<br><br>2) The Site Recommendations for OU 4 Report indicated that Landfill No.1 appears to have a continuing source of TCE contamination to groundwater; however, the source has not been fully characterized. High concentrations of TCE detected since 2000 in downgradient monitoring wells, specifically Monitoring Well U4-047, has raised concern about the effectiveness of the landfill cap in limiting infiltration and reducing the contaminant leaching (**MWH, 2006**). In addition, based on the Site Recommendations for OU 4 Report, the North Gate Dump and Landfill 2 are now considered to be potential source areas for the OU 4 plume. Both IRP sites currently have NFRAP status (**MWH, 2006**). The OU 4 site manager stated in the 2008 five-year review interview that it was unclear whether or not the landfill contents remedy is performing well based on the data collected. Cone penetration testing and direct-push groundwater sampling was performed in 2007 as recommended in the Site Recommendation Report to provide data to address these issues (**CH2M HILL, 2007e**).<br><br>3) The 2003 five-year review recommended a review of the Performance Standard Verification Plan (PSVPlan) in light of remedy protectiveness and achievement of RAOs and the data required to determine these goals. Performance of this review is underway. This review is not yet complete, and revision to the PSVPlan is not yet complete.<br><br>4) The 2003 five-year review recommended evaluation of the existing well network to determine if it was adequate to monitor conditions within and at the distal edges of the plume. This evaluation was completed and documented in the Site Recommendations for OU 4 Report. The Site Recommendations for OU 4 Report indicated that that the existing groundwater monitoring network does not provide adequate definition of the horizontal and vertical extent of TCE contamination in groundwater. The leading edge of the OU 4 TCE groundwater plume is currently monitored and defined using data primarily from seeps and springs that are often dry (**MWH, 2006**). |

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| | 5) The Site Recommendations for OU 4 Report stated that the majority of the seeps and springs (that have had detectable concentrations of TCE) are not perennial and do not issue from the same location each year, which makes fencing of individual springs difficult (**MWH, 2006**). The ROD states that ICs will be enacted, including water rights restrictions, easements and leases form monitoring and installing equipment and fencing seeps (**Hill AFB EMR, 1994**). Surface water ICs are currently being maintained, with the exception of fencing of individual springs/seeps. Currently, none of the springs are fenced (**MWH, 2006**).<br><br>6) The air stripper at OU 4 is no longer used to treat groundwater, since concentrations in groundwater have consistently been below discharge limits. It is still in place, however, and maintenance of the off-line stripper is not included in the O&M plan (**Hill AFB CEVR, 2007a**). If operation of the air stripper was necessary, there is no guarantee that it would operate appropriately because it is not regularly tested. |
| **Recommendations and Follow-Up Actions** | As described in the previous section, six issues were identified in the 2008 five-year review for OU 4. To address these issues, the following recommendations and follow-up actions have been defined.<br><br>1) Because toxicity factors are likely to change again, site closure is not anticipated for many years, and the remedy is still considered protective because exposure pathways are incomplete as a result of enforcement of institutional controls (ICs), no action at this time is recommended. While modifications based on toxicity values are not currently recommended because current ICs ensure protectiveness, if circumstances change and exposure pathways become complete, risk and clean up goals will need to be reevaluated at that time<br><br>2) Conduct additional investigations as recommended in the Site Recommendations for OU 4 Report to define the horizontal and vertical extent of TCE groundwater contamination and to determine if point source locations exist in either Landfills No. 1, 2, or the North Gate Dump and if further investigation or additional remedial actions are warranted. Once these investigations are completed, the NFRAP status for Landfill No. 2 and the North Gate Dump should be reassessed based on the results. CEVR has noted that as additional information is gathered and understanding of the Conceptual Site Model for OU 4 improves, impacts to site management should be evaluated.<br><br>3) A revised project monitoring plan (PMP), PSVPlan, and PSVReport will be required, after completion of future site investigations at OU 4, to revise long-term monitoring objectives.<br><br>4) Install monitoring wells along the leading edge of the plume to monitor and better define the OU 4 groundwater plume as recommended in the Site Recommendations for OU 4 Report.<br><br>5) To provide increased protectiveness to human health and the environment, access should be controlled, or warning signs posted, as stipulated in the ROD, in the general areas of springs that are known to be contaminated (i.e., spring locations U4-308, U4-309, and other springs in the northwest quadrant of the plume). Some landowners, however, have declined access controls. Because the ROD states that fencing of springs/seeps is required, this issue should remain until a ROD amendment or ESD removes the requirement. In addition, annual inspection of the springs/seeps performed as part of the basewide groundwater monitoring program should include the identification of any evidence of trespassing, or the likelihood of trespassing, at those springs/seeps that are not fenced.<br><br>6) The O&M plan needs to be updated to include procedures to maintain the air stripper on a regular schedule to ensure that it functions if, at some future point, operation of the air stripper becomes necessary due to increased contaminant concentrations or lowered discharge permit limits. |

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| **Remedial Timeframe** | **Table 3-3** in **Section 3.1.4** presents the remedial timeframe estimates for OU 4. The remedial timeframe for the groundwater, surface water and landfill cap is indefinite. |
| **Protectiveness Statement** | **The protectiveness of the remedy for OU 4 cannot be determined until additional information is obtained.** However, enforcement of ICs already implemented at OU 4, including groundwater restrictions, provide protectiveness in the short-term pending further assessment of the remedy. ICs and land-use controls are assessed annually. The current well network does not provide an adequate definition of the horizontal and vertical extent of TCE contamination in groundwater. The evaluation and enhancement of the OU 4 monitoring network should be completed during calendar year 2009. Because the extent of the TCE plume is not completely defined, capture of TCE contamination cannot be determined with certainty. The Site Recommendations for OU 4 identified the North Gate Dump and Landfill 2 has potential source areas for the OU 4 plume. The majority of OU 4 springs/seeps have been dry since at least 2002. However if this condition changes, springs that had detectable concentrations of TCE in the past could potentially impact human health and the environment. The selected remedy will continue to be protective in the short-term if ICs are enforced and the recommendations and follow-up items identified in this five-year review are addressed. |
| **Next Five-Year Review** | Remedial actions at OU 4 will be reviewed in the next five-year review for Hill AFB to be completed during or before September 2013. |

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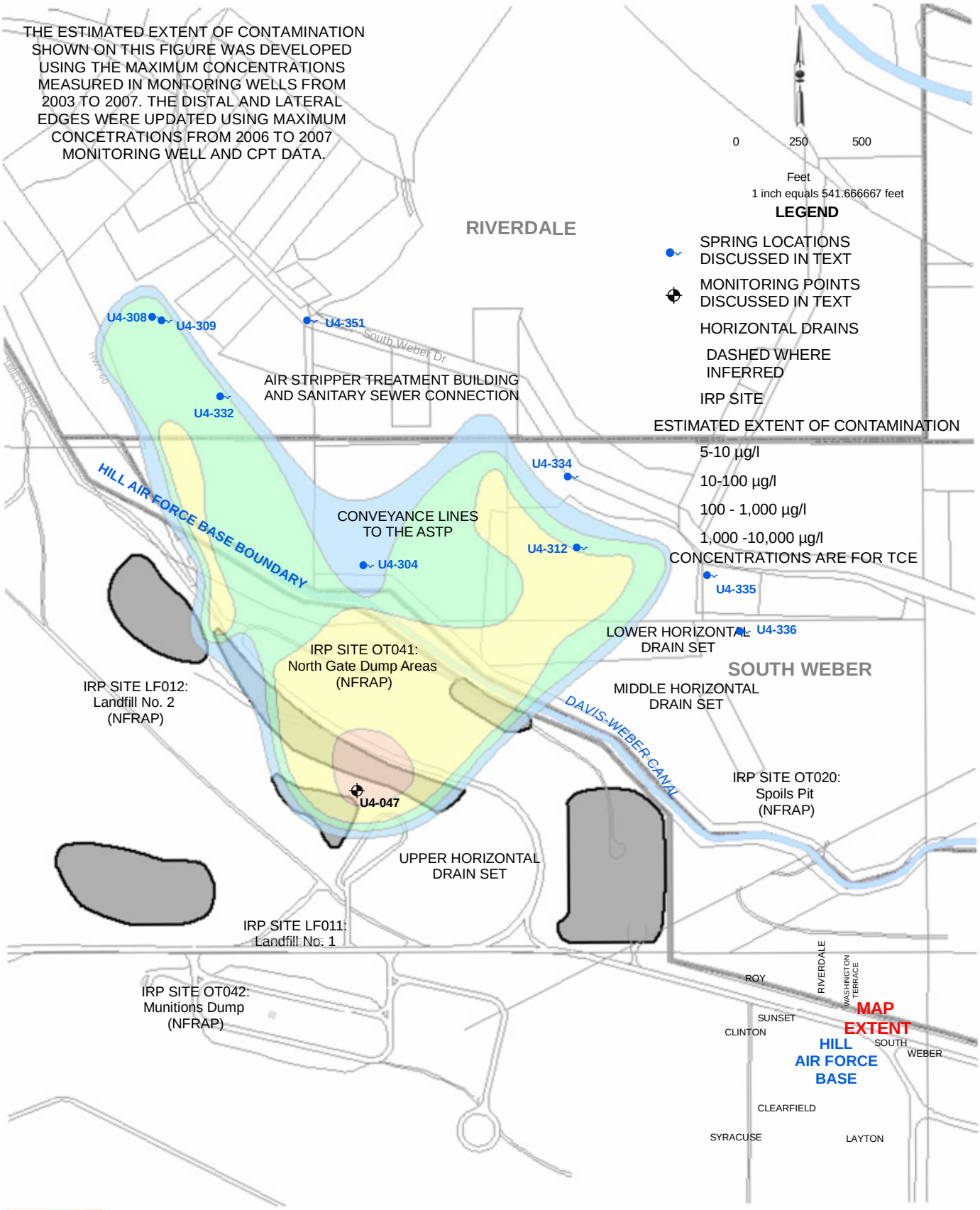


75th AIR BASE WING

FIGURE OU 4 - 1
**SITE FEATURES OF OPERABLE UNIT 4**
3RD FIVE-YEAR REVIEW, 2008
IRP SITES: LF012, OT041, OT020, LF011, OT042
HILL AIR FORCE BASE, UTAH

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Table OU 5-1
# Operable Unit 5
# Background Information

Reviewer: Victor Martinez

**Introduction**

Operable Unit 5 is located on the northwestern boundary of Hill AFB. Operable Unit 5 is currently composed of two active Installation Restoration Program (IRP) sites to address contaminated groundwater and soil. These two IRP Sites are: (1) the Tooele Army Rail Shop (TARS), and (2) the Zone 16 Complex (**Figure OU 5-1**). A third IRP site, Bamberger Pond, has been removed from further investigations because arsenic in groundwater was determined to be naturally occurring. The Bamberger Pond was accepted by the EPA and the UDEQ as a closed CERCLA site with no further action required in September 2000. The RI for OU 5 identified three suspected sources of contamination: the TARS, the Zone 16 Complex, and possibly the former on-Base Wastewater Treatment Plant (WWTP). Trichloroethene was identified as the primary groundwater contaminant at OU 5. A small area of arsenic-contaminated soil was found on Base within the TARS. In addition to soil contamination, two separate groundwater plumes, identified as the TARS and Zone 16 plumes, have been identified at OU 5. The plumes extend off-Base into the Cities of Sunset, Clinton, and Roy, Utah, and have migrated approximately 5,400 and 9,400 feet from their respective sources as depicted in **Figure OU 5-1**. The selected remedy at OU 5 addressed these groundwater plumes and on-Base soil contamination. The components of the selected remedy for the TARS groundwater plume include (a) operation of existing interim remedial actions that include the Phase I Aeration Curtain and Phase III Groundwater Containment System; (b) implementation of institutional controls; and (c) groundwater monitoring for VOCs. The components of the selected remedy for TARS soil include access restrictions and ICs. For the Zone 16 plume, the components of the selected remedy for groundwater include: (a) groundwater monitoring for VOCs and related natural attenuation parameters to monitor for continued plume attenuation; and( b) implementation of ICs (**MWH, 2006**).

A list of the documents reviewed for OU 5 as part of the 2008 five-year review is provided in **Appendix C**.

| IRP Identification | IRP Site Name | Status |
|---|---|---|
| SD016 | Bamberger Pond | No Further Response Action Planned (NFRAP) |
| SS017 | U.S. Army Tooele Rail Shop | Remediation ongoing |
| SS091 | Zone 16 | Remediation ongoing |

**Site Chronology**

Provided separately. See **Table OU 5-2**.

**Background**

**Physical Characteristics.** The on-Base portion of OU 5 is located in the northwestern quadrant of Hill AFB. The subsurface stratigraphy in OU 5 consists of interbedded and laterally discontinuous silty sands, sandy silts, silt, and clay. In general the silt content increases with depth and often grades into a transition zone, consisting of predominantly silt with fine sand layers, which is underlain by a low-permeability clayey silt (**MWH, 2003)**. The OU 5 area slopes to the west with elevations of 4,650 feet on-Base in the Zone 16 area and 4,370 feet off-Base at the toe of the Zone 16 plume. The water table beneath OU 5 varies from approximately ground surface in off-Base seeps and springs to approximately 80 feet bgs on-Base. The regional groundwater flow direction in this area of the Base is predominantly from east to west, with local flow directions toward the northwest, particularly on-Base within the Zone 16 plume (**MWH, 2006**).

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| | **Land and Resource Use.** The on-Base areas of OU 5 are used primarily for munitions storage and disposal, with industrial areas along the Hill AFB railroad spur. Land use varies from residential, commercial, and agricultural use in the off-Base areas of OU 5. The off-Base areas at OU 5 include the cities of Sunset, Clinton, and Roy. Over the past 10 years, these cities have experienced a rapid residential and commercial growth, and agricultural land use has declined. The future land use for the on-Base portion of OU 5 is most likely industrial, but may also become commercial and or residential (**MWH, 2006**). No land use changes were observed on-Base or off-Base during the 2008 Five-Year Review Site Inspection (**CH2M HILL, 2007a**). However, there are plans to turn over property along the western portion of the Base to a private commercial developer(s) to redevelop this portion of the Base for various uses. Development will most likely consist of commercial and light industrial, but no heavy industrial. It is anticipated that most will be commercial office space with the idea of a technology park as the center of the development and supporting restaurants and hotels, but plans are still being developed (**Loucks, M., 2007**). |
| | **History of Contamination.** OU 5 has had a diverse number of uses through the years. The TARS was constructed in 1942 to support the Ogden Arsenal, and upgraded in 1944 to service railroad engines for the military. Degreasing solvents were used in the TARS area for maintenance operations. Approximately 50 to 60 locomotives were removed from active service and stored at the TARS until they were removed from the site in the 1970s. The TARS source of contamination is believed to be the terminus of the drain line system where wastewater from operations at the TARS was collected and discharged directly into the ground. A Base housing area was shown on a 1943 map east of the TARS area. This housing area did not show up in a 1945 map, which suggested that the housing buildings had been removed. East of the housing area was the Zone 16 area, which included the West Fuze Plant and East Fuze Plant. Building 1607 was located within the West Fuze Loading Plant area and served originally as a Small Arms Repair Warehouse. Building 1607 later became the Loading and Assembly Line Building in 1944 (or later). Building 11647 was located within the East Fuze Loading Plant area and originally operated as a Debooster Barricade. The source of the Zone 16 plume is believed to be within the Zone 16 Complex, which was the West Fuze Plant in the 1940s. A former WWTP was identified north of the housing area, as shown on maps from the 1940s. The WWTP appears to have been removed by the mid-1950s based on aerial photographs. The former WWTP may have been an additional source for the Zone 16 plume. Remnants of the former WWTP are visible at ground surface. The Missile Assembly Maintenance and Storage (MAMS)-II area was located to the north of the Zone 16 area. This area contained the 37-mm Magazine Area and the West Loading Plant. (**MWH, 2006**). |
| | **Initial Response.** Early remedial actions were implemented to contain groundwater contamination at OU 5 before the ROD was signed. The remedial actions were implemented in three phases and included: (1) Phase I, construction of an Aeration Curtain; (2) Phase II, construction of a Groundwater Extraction System; and (3) Phase III, construction of a Groundwater Containment System. The Phase I System was constructed in 1997 and consists of an air sparging system located on Main Street in Sunset.<br><br>The Phase II Groundwater Extraction System, also installed in 1997, consisted of five extraction wells and was located approximately 400 feet west of the Phase I System. As of October 2002, a cumulative TCE mass of approximately 5 pounds had been removed by the Phase II Groundwater Extraction System. The mass removal was becoming asymptotic due to the reduction in influent TCE. The average discharge rate for the Phase II Groundwater Extraction System was 1.1 gpm, a rate insufficient to contain groundwater with TCE concentrations of 100 µg/L or greater. The system was not meeting its cleanup goal by achieving containment of groundwater with TCE concentrations of 100 µg/L and higher. Operation of the Phase II Groundwater Extraction System was discontinued in 2003 with the approval of the EPA and UDEQ due to poor mass removal and low discharge rates. |

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| | The Phase III Groundwater Containment System was installed in 2003 and is located along the Clinton/Sunset boundary. The Phase III Groundwater Containment System consists of an extraction trench and slurry wall to limit additional contamination migration beneath the City of Clinton. Institutional controls were also incorporated as part of remedial actions. The objectives of these ICs are to prevent access or use of shallow groundwater until cleanup levels are met and restrict the use of or contact with contaminated soil. Domestic use of shallow groundwater within all areas of OU 5 is restricted. The restrictions are enforced by the State of UDWR, in coordination with Hill AFB. Hill AFB has also incorporated ICs to restrict land use in areas with contaminated soil (**MWH, 2006**). |
| | **Basis for Taking Action.** A Baseline Risk Assessment (BRA) was prepared to evaluate the risks to human health in relation to contamination at OU 5. On-Base workers, construction workers (on-Base and off-Base), off-Base residents, and recreational visitors were considered under current land uses. There were no current human health risks that required remediation. Arsenic in soil in the TARS area on-Base was estimated to have a cancer risk of 20 in 1 million for a site worker. Hypothetical future land uses including potable use of the shallow aquifer and residents living on-Base were also evaluated in the BRA. The evaluation of these scenarios concluded that the shallow aquifer was not an acceptable source of potable water and would pose unacceptable risks if used for this purpose. An Ecological Risk Assessment was prepared as part of the BRA to evaluate the risks to the environment in relation to contamination at OU 5. The ecological risk assessment considered aquatic and terrestrial habitats within OU 5. The risk assessment determined that constituents in the aquatic habitats do not pose a significant risk to wildlife or the environment (**MWH, 2003**). The purpose of the response actions conducted at the OU 5 are to protect public health and welfare of the environment from actual or threatened releases of hazardous substances into the environment. Remedial actions were implemented within OU 5 in an effort to reduce potential future risks to off-Base receptors and minimize potential migration of contaminants. The ROD addresses groundwater and soil contamination at OU 5 through various response actions that have already been implemented. The selected remedy for OU 5 incorporates or adds on to these initial response actions which will continue as part of this remedy (**MWH, 2006**). |
| **Remedial Actions** | **Remedy Selection (ie. ROD/ Explanation of Significant Difference [ESDs])**. In July 2006, a ROD was signed for OU 5. The selected remedy for OU 5 addressed the threat to human health and the environment by containing and treating the source area and the contaminated groundwater, surface water, and air. The OU 5 selected remedy consists of implementation of the following: (1) the TARS groundwater plume remedy consists of continued operation of the Phase I Aeration Curtain and Phase III Groundwater Containment Systems; (2) MNA of the dissolved-phase TCE contaminated Zone 16 groundwater plume; and (3) the TARS soil remedy which includes access restrictions and institutional controls. The OU 5 ROD also prescribed a program of performance monitoring and evaluation to assess the performance of the remedy (**MWH, 2006**). |
| | **Remediation Goals.** Remedial action objectives and remediation goals were established to address potential future unacceptable risk scenarios. RAOs associated with each medium of concern at OU 5 are presented below (**MWH, 2006**).<br><br>**Groundwater RAOs**. The RAOs for remediation of groundwater are: to restore groundwater to contaminant concentrations below the State and Federal MCLs for drinking water within a reasonable time frame (approximately 20 to 40 years); to prevent further migration of the plume to the extent practicable; and prevent unacceptable human exposure to contaminated groundwater.<br><br>**Soil RAOs**. The RAO for remediation of on-Base TARS soil is as follows: prevent human exposure to contaminated soil above the risk-based exposure concentration of 50.9 mg/kg for arsenic. |

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| | **Remedy Implementation.** Remedial actions implemented at OU 5 to address both on-Base and off-Base contamination includes: Phase I Aeration Curtain, Phase III Groundwater Containment System, Groundwater MNA, and ICs. The Phase I Aeration Curtain was implemented in 1997 and consists of an air sparging system located on Main Street in Sunset, Utah. The Phase II Groundwater Extraction System consisted of five extraction wells and was located approximately 400 feet west of the Phase I Aeration Curtain. The Phase II Groundwater Extraction System was also installed in 1997 to provide capture of contaminated groundwater downgradient of the Phase I system. The Phase II Groundwater Extraction System was abandoned in 2003. The Phase III Groundwater Containment System is located along the Clinton/Sunset boundary and consists of an extraction trench and slurry wall to limit additional contamination migration beneath the City of Clinton. The Phase III Containment System was installed in 2003 (**MWH, 2003)**.<br><br>As part of the Indoor Air Program, a drain system was installed at a residence in the city of Sunset, Utah beginning June 13, 2006 to reduce the level of groundwater that underlies the basement. The reduction in groundwater level was required to increase the vadose zone such that a vapor removal system could be installed and work more effectively (**SES, 2006**). |
| | **Operations and Maintenance (O&M).** General tasks conducted during O&M activities at OU 5 for Phase I Remedial Action Aeration Curtain consist of: (1) System Performance Evaluation and Reporting, systematic inspection and monitoring is required to ensure that system components are functioning properly—individual system components are inspected for flaws; (2) Systems Operation Tasks are performed on a regular basis to achieve proper system function and optimal operation; (3) System Maintenance Tasks take place to ensure smooth operation and minimize system downtime—these task include: routine inspection and housekeeping, preventive maintenance and corrective maintenance; (4) Answering Alarms and System Troubleshooting; (5) Groundwater Sampling; (6) Air Sampling; (7) Groundwater Elevation Measurement; and (8) System Operational Data Collection (**CH2M HILL, 2007b**).<br><br>Operations and maintenance activities at OU 5 for Phase III Groundwater Containment System include but are not limited to: (1) O&M of sumps, piezometers, monitoring wells, pumps, and all associated piping, electrical wirings, and electrical controls (operating conditions should be adjusted to ensure capture while minimizing potential for settlement of off-Base location); (2) collection of monitoring data, including flow rates and flow volumes, groundwater samples for analysis, water levels measurements, and settlement marker measurements; (3) maintaining visual appearance of the site (this maintenance includes maintenance and watering of the landscaping adjacent to the sidewalk on the northern section of the property, and trimming, watering, and controlling vegetation in the remaining areas of the property); (4) maintenance of the building and building facilities, including housekeeping, to ensure a comfortable and safe working environment; (5) maintenance and operation of security systems (fence, door locks, intrusion alarms, etc.) to limit public exposure to contaminated groundwater (**URS, 2003b**).<br><br>Institutional controls have been implemented across the OU 5 area to restrict the use of shallow groundwater. The UDWR, in coordination with Hill AFB, has restricted the domestic use of shallow groundwater within all areas of OU 5. This restriction provides for the UDWR to restrict use of shallow groundwater within OU 5, including disallowing installation of any new water supply wells (**MWH, 2006**). The types of ICs implemented at OU 5 are described in detail in section **Table OU 5-7**. |
| | Contaminant monitoring is performed by sampling groundwater monitoring wells located upgradient and downgradient of the treatment trench to document the progress of groundwater remedial activities. Groundwater monitoring is also performed to provide evidence of attenuation on a plume wide basis (**Hill AFB CEVR, 2007a)**. Groundwater and surface water monitoring have been conducted as specified by the 2006 PSVPlan. The results of these monitoring activities are reported in annual Treatment System Operation Reports and Inspection, Monitoring, and Maintenance Reports for both the Phase I Aeration Curtain and the Phase III Groundwater Containment System. |

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| | **Progress Since Initiation of Remedial Action.** All remedial actions specified by the ROD are in place. As of September 30, 2007, 6.32 pounds of TCE have been removed using the Phase III Groundwater Containment System, and approximately 45,248,662 gallons of groundwater have been extracted since the start of operations (**AEEC, 2007a**). As of September 30, 2007, 89.95 pounds of TCE have been removed using the Phase I Aeration Curtain and approximately 43,632,224 gallons of groundwater have been treated since the start of operation of the system (**AEEC, 2007b**). Monitoring and data analysis has been conducted at OU 5 as specified in the 2006 PSVPlan. |
| **Progress Since Last FYR** | Five issues were identified during the 2003 five-year review that could affect the protectiveness of the selected remedies at OU 5. Recommendations to address these five issues were included in the 2003 five-year review. Recommendations and follow up actions of all issues identified at OU 5 are presented in **Table OU 5-3** along with the current status of each recommendation.<br><br>Current Status: All remedial actions specified by the ROD are in place. Operation and maintenance of the implemented remedies is ongoing and performance goals are met. Operable Unit 5 is currently in the remedial action phase of the CERCLA process. The RI Report for OU 5 was finalized and presented to the public in September 2003. The RI concluded that contamination at OU 5 is from three suspected sources: the TARS, the Zone 16 Complex, and the former WWTP (**MWH, 2003)**. Following completion of the OU 5 RI, Hill AFB performed a FS as part of the CERCLA process, which was presented to the public in May 2004. The ROD for OU 5 was signed in September 2006. The selected remedy for OU 5 addresses the principal threats posed by the site by minimizing or preventing direct contact with contaminated groundwater and soil through implementation of institutional controls. The selected remedy also includes active remedial components for the removal of contaminant mass through air sparging and extraction and treatment of groundwater contamination for the TARS Plume. A PSVPlan for OU 5 was prepared in November 2006.<br><br>The Phase I Aeration Curtain appears to significantly impact the TCE concentrations in the TARS plume. Based on past operation and analytical results, monitoring wells immediately downgradient of the Phase I Aeration Curtain have significantly lowered TCE concentrations as compared to upgradient wells. From January 1998 through May 2006, the overall TCE removal efficiency ranged from 76 to 98 percent (**Hill AFB CEVR, 2007a**).<br><br>The objective of the Phase III Groundwater Containment System is to prevent further migration of the OU 5 TARS dissolved-phase groundwater plume. The system includes a groundwater extraction trench, soil bentonite cutoff wall, and groundwater collection sump with pumps. The Phase III Groundwater Containment System began operation on May 2003 and has operated continuously since start-up, aside from short periods for maintenance or due to power outages. Effluent collected from the Phase III Groundwater Containment System is pumped from the sump to a sanitary sewer. Final treatment of TCE-contaminated groundwater is performed at the North Davis Sewer District (NDSD) POTW (**Hill AFB CEVR, 2007a**).<br><br>For the Zone 16 plume, a combination of ICs to restrict access to contaminated groundwater, groundwater sampling, and collection of MNA parameters to monitor MNA processes and their impact on contaminant concentrations will be implemented (**Hill AFB CEVR, 2007a**).<br><br>Institutional controls have been implemented within OU 5 to restrict the domestic use of shallow groundwater in excess of the MCLs and contaminated on-Base soils. The restrictions prohibit the installation of any new water supply wells. Additional on-Base ICs implemented through enforcement of AFI 32-7020 states that no construction or other activity will disturb groundwater or soil in restricted areas (**Hill AFB CEVR, 2007a**). Warning signs and contact information are posted within the TARS restricted areas of arsenic contaminated soils (**CH2M HILL, 2007b**). |

Table OU 5-2

## Chronology of Site Events OU 5

*2008 Five -Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 5 | OU5 | | 1986 | Remedial Investigation | Field work was conducted at the Tooele Army Rail Shop and Bamberger Pond as part of the Installation Restoration Program (IRP). | Remedial Investigation Report Operable Unit 5 Sites SS17, SD16 Volume 1 - Text |
| 5 | OU5 | | 1987 | Hill AFB placed on the National Priorities List (NPL) | The U.S. EPA placed Hill AFB on the NPL under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). | MWH Americas, 2006a. Final Record of Decision for Operable Unit 5, Hill Air Force Base, Utah. July, 2006 |
| 5 | OU5 | | 1987 | Remedial Investigation | Trace quantities of trichloroethene and 1,1,1-trichloroethane were found in two residential wells and a spring located off-Base. The wells and spring were located in the cities of Sunset and Clinton approximately 1 mile west of the Base. Monitoring wells were installed and soil and groundwater samples were collected at these sites from 1989 through 1991. This would become Site SS017. | Remedial Investigation Report Operable Unit 5 Sites SS17, SD16 Volume 1 - Text |
| 5 | OU5 | 1 | 1988 | Remedial Investigation | The IRP Phase II Confirmation/Qualification Stage 2 was completed. It identified the Tooele Army Rail Shop area and Bamberger Pond as potential sources of contamination. | Action Memorandum Operable Unit 5, Hill AFB |
| 5 | OU5 | | 1992 | Remedial Investigation | OU 5 Remedial Investigation activities commenced for Sites SS017 and SD016. | Draft Conceptual Model for Operable Unit 5, May 2001 |
| 5 | OU5 | 8 | 1994 | Engineering Evaluation/Cost Analysis | Final Environmental Assessment, Operable Unit 5, Sites SS017, SD016 discussed the environmental impacts of the OU 5 aeration curtain treatability study, the feasibility study pumping test, and the Engineering Evaluation Cos Analysis removal actions. No environmental impacts were expected from these activities. | Action Memorandum Operable Unit 5, Hill AFB |
| 5 | OU5 | 12 | 1994 | Engineering Evaluation/Cost Analysis | The Final Engineering Evaluation and Cost Analysis for Operable Unit 5 was completed. This document outlined five early actions to be implemented in phases at OU 5. The fourth (pertaining to an area now part of Zone 16) and fifth (having to do with Bamberger Pond) phases were not implemented. | Engineering Evaluation/Cost Analysis Operable Unit 5 |
| 5 | OU5 | 2 | 1995 | Remedial Investigation | The Final Baseline Risk Assessment. Operable Unit 5, Sites SS017, SD016 was issued. This Risk Assessment will be superseded or have an addendum in 2003 which will address the additional areas (Zone 16 plume) discovered and addressed under the reopened Remedial Investigation. | Baseline Risk Assessment Operable Unit 5 Sites SS17, SD16 Executive Summary |
| 5 | OU5 | 5 | 1995 | Remedial Investigation | The Final Remedial Investigation Report for OU5, Sites SS017 and SD016 completed. Although this Remedial Investigation is titled 'Final' it was reopened in 1999 due to the discovery of further contamination (Zone 16 plume). | Remedial Investigation Report Operable Unit 5 Sites SS17, SD16 Volume 1 - Text |
| 5 | OU5 | 3 | 1996 | Interim Action | Final Action Memorandum Operable Unit 5 completed. This document provides support and justification for implementing the early removal actions described in the Engineering Evaluation Cost Analysis. | Action Memorandum Operable Unit 5, Hill AFB |
| 5 | OU5 | 5 | 1996 | Feasibility Study | The Draft Final Feasibility Study, Operable Unit 5 was completed. This feasibility study will be superseded by the Remedial Investigation and Feasibility Study, which was reopened in 1999 and is still ongoing. | Draft Final Feasibility Study, Operable Unit 5 |
| 5 | OU5 | 9 | 1998 | First Five Year Review | The first Five-Year Review for OU 9 stated that the remedies selected for the site remain protective of human health and the environment. | Five-Year Review Report, First Five-Year Review Report for Hill Air Force Base, Utah. |
| 5 | OU5 | 1 | 1999 | Remedial Investigation | The OU 5 RI was reopened. Investigations performed throughout OU 9 between 1996 and 1998 identified the existence of a volatile organic compound groundwater plume substantially larger than that addressed in the 1995 RI. This plume became IRP site SS091, also known as the Zone 16 plume. | Draft Conceptual Model for Operable Unit 5, May 2001 |
| 5 | OU5 | 10 | 2001 | Remedial Investigation | Final Conceptual Model for Operable Unit 5 completed. This document presents a conceptual model for the fate and transport of contaminants in groundwater at OUs 5 and 12. | Final Conceptual Model for Operable Unit 5, Oct. 2001 |
| 5 | OU5 | 10 | 2001 | Transfer to Another OU | A northern groundwater contamination plume within OU 5 was discovered and split from OU 5 to make OU 12. This plume was discovered during additional environmental investigations in 2000. | Final Operable Units 5 and 12 Historic Site and Source Area Review, March 2002 |
| 5 | OU5 | 1 | 2002 | Engineering Evaluation/Cost Analysis | Final Engineering Evaluation and Cost Assessment Addendum for Operable Unit 5 completed. It addresses changes in Phase III of the original Engineering Evaluation Cost Analysis and deleted Phases IV and V from actions to be completed.. | Engineering Evaluation and Cost Assessment (EE/CA) Addendum For Operable Unit 5 |

Table OU 5-2

## Chronology of Site Events OU 5

*2008 Five -Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 5 | OU5 | 9 | 2003 | Five-Year Review | The second Five-Year Review stated that activities at OU 5 are protective of human health in the short-term, due to restrictions on the use of contaminated groundwater beneath the current plumes. The RAOs for OU 5 are not intended to protect overall human health and the environment but are directed toward slowing migration of contamination until a permanent remedy can be installed. | Final CERCLA Five-Year Review Report, Second Five-Year Review Report for Hill Air Force Base, Utah. |
| 5 | OU5 | 9 | 2003 | Remedial Investigation | Remedial Investigation Report for OU 5 published. The RI concluded that contamination at OU 5 is from three suspected sources: the TARS, the Zone 16 Complex, and the former WWTP. | Final Remedial Investigation Report for Operable Unit 5, Hill Air Force Base, Utah. September, 2003. (MWH Americas, 2003) |
| 5 | OU5 | 1 | 2004 | Feasibility Study | Feasibility Study for OU 5 was published. The FS presented the RAOs for soil and groundwater at OU5. The RAOs for groundwater are: (1) Prevent human exposure to contaminated groundwater above preliminary remediation goals (PRGs); and (2) Achieve PRGs in a reasonable time frame. The RAO for soil is: (1) Prevent human exposure to contaminated soil above PRGs. | Final Feasibility Study Report for Operable Unit 5, Hill Air Force Base, Utah. (MWH Americas, 2004) |
| 5 | OU5 | 11 | 2004 | Operation and Maintenance | In 2004, vents were installed and fan repairs were completed in the aeration curtain building to improve ventilation. | Operable Unit 5 Phase I Aeration Curtain Monthly Operation Summary. November 2004 |
| 5 | OU5 | 1 | 2006 | Operation and Maintenance | The curtain sparge modules were cleaned in February 2006 | Operable Unit 5 Phase I Aeration Curtain Monthly Operation Summary. January 2006 |
| 5 | OU5 | 6 | 2006 | Residential Dewater Project | A drain system was installed at a residence in the city of Sunset, Utah beginning June 13, 2006 to reduce the level of groundwater that underlies the basement. The reduction in groundwater level was required to increase the vadose zone such that a vapor removal system (VRS) could be installed and work more effectively. | Basement Dewater Project at the Nordberg Residence, Hill Air Force Base, Utah. November, 2006. |
| 5 | OU5 | 9 | 2006 | Record of Decision | The Record of Decision (ROD) for Operable Unit 5 was signed. ROD established RAOs and preliminary remediation goals for the OU 5 site. | Final Record of Decision for Operable Unit 5, Hill Air Force Base, Utah. July, 2006. (MWH Americas, 2006) |
| 5 | OU5 | 11 | 2006 | PSVPlan | Performance Standard Verification Plan (PSVPlan) for OU 5 completed. The PSVPlan defines the tools and procedures necessary to demonstrate that systems are operating correctly,<br>the geosystem is responding as expected, and that the RAOs specified in the ROD are being achieved. | Operable Unit 5 Performance Standard Verification Plan, Hill Air Force Base, Utah. November, 2006. (MWH Americas, 2006) |
| 5 | OU5 | 3 | 2007 | Operation and Maintenance | The curtain sparge modules were cleaned in March 2007 | Operable Unit 5 Phase I Aeration Curtain Monthly Operation Summary. March 2007 |
| 5 | OU5 | 4 | 2007 | Operation and Maintenance | American Environmental and Engineering Consultants (AEEC) was contracted in April 1, 2007 to perform engineering services/system evaluation and provide recommendations of the aeration curtain. | |
| 5 | OU5 | 9 | 2007 | Operations and Maintenance | Operations and maintenance (O&M) activities as well as groundwater sampling continued through September 2007. | |
| 5 | SD016 | 6 | 2000 | No Further Response Action Planned (NFRAP) | The Bamberger Pond No Further Response Action Planned Action Memorandum was completed. The document indicates that the State agreed, stating that the Bamberger Pond site requires no further remedial action. | Bamberger Pond NFRAP Action Memorandum |
| 5 | SD016 | 6 | 2000 | Remedial Investigation | Final Fate and Analysis of Arsenic and Manganese in the Vicinity of Bamberger Pond completed. This document analyzes arsenic and manganese in the vicinity of Site SD016 and provides evidence that elevated concentrations of both are a result of naturally occurring processes. | Final Fate and Analysis of Arsenic and Manganese in the Vicinity of Bamberger Pond |
| 5 | SS017 | | 1991 | Remedial Investigation | Soil-gas survey performed at the Tooele Army Rail Shop. As a result, two underground fuel storage tanks at Building 1705 at the Tooele Army Rail Shop were removed and limited petroleum hydrocarbon contamination in soil was removed. | Remedial Investigation Report Operable Unit 5 Sites SS17, SD16 Volume 1 - Text |
| 5 | SS017 | 5 | 1997 | Interim Action | Installation of Aeration Curtain completed and operation begins. The air sparge curtain is Phase I of five phases recommended in the original Engineering Evaluation Cost Analysis as early actions. | Engineering Evaluation and Cost Assessment (EE/CA) Addendum For Operable Unit 5 |
| 5 | SS017 | 9 | 1997 | Interim Action | The Phase II Groundwater Extraction System is installed. The Groundwater Extraction System is Phase II of five phases recommended in the original Engineering Evaluation Cost Analysis as early actions. Operation began in November 1997. | Engineering Evaluation and Cost Assessment (EE/CA) Addendum For Operable Unit 5 |
| 5 | SS017 | | 1999 | Operation and Maintenance | Sparge lines and gravel pack for the Phase I Aeration Curtain were cleaned. The system was experiencing operational problems with the sparge blowers due to excessive backpressure from the sparge lines due to sediment in the trench. | Draft Conceptual Model for Operable Unit 5, May 2001 |

Table OU 5-2

## Chronology of Site Events OU 5

*2008 Five -Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 5 | SS017 | 10 | 2001 | Performance Standard Verification Plan for Phase III EE/CA, Operable Unit 5 completed. | Defines the tools and procedures necessary to demonstrate progress towards or attainment of performance objectives established for the Phase III early action, consisting of a groundwater extraction trench, which was installed October 2002 through April 2003. | Performance Standard Verification Plan For Phase III EE/CA, Operable Unit 5 |
| 5 | SS017 | | 2003 | Operation and Maintenance | Phase II Groundwater Extraction System operations ceased. Operation of the Phase II GES was discontinued in 2003 with the approval of the EPA and UDEQ due to poor performance. | Final Remedial Investigation Report for Operable Unit 5, Hill Air Force Base, Utah. September, 2003. (MWH Americas, 2003) |
| 5 | SS017 | 3 | 2004 | Operation and Maintenance | The Phase II Groundwater Extraction System was decommissioned. Operation of the Phase II GES was discontinued in 2003 with the approval of the EPA and UDEQ due to poor performance. | Final Record of Decision for Operable Unit 5, Hill Air Force Base, Utah. July, 2006. (MWH Americas, 2006) |
| 5 | SS091 | | 1998 | Remedial Investigation | The Zone 16 Plume was discovered. Investigations performed throughout OU 9 between 1996 and 1999 identified a volatile organic compound groundwater plume in OU 5 larger than that originally identified in the 1995 remedial investigation. This became known as the 'Zone 16' plume and was labeled site SS091. | Final Conceptual Model for Operable Units 5 and 12 |

**Notes**

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| AFB | Air Force Base |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| EPA | United States Environmental Protection Agency |
| FS | Feasibility Study |
| IRP | Installation Restoration Program |
| NFRAP | No Further Response Action Planned |
| NPL | National Priority List |
| O&M | Operations and Maintenance |
| OU 5 | Operable Unit 5 |
| PRGs | Preliminary Remediation Goals |
| PSVPlan | Performance Standard Verification Plan |
| PSVReport | Performance Standard Verification Report |
| RAOs | Remedial Action Objectives |
| RI | Remedial Investigation |
| ROD | Record of Decision |
| SVE | Soil Vapor Extraction |
| TCE | Trichloroethylene |
| UDEQ | Utah Department of Environmental Quality |
| WWTP | Wastewater Treatment Plant |
| µg/l | microgram per liter |

Table OU 5-3

Progress Since Last Five Year Review - Status of Recommendations and Follow-Up Actions at OU 5

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Site | 2003 Five-Year Review Recommendations | Current Status | Carry over to the next FYR |
|---|---|---|---|
| **OU 5** | Evaluate the life expectancy of the aeration curtain system and, if necessary, replace the blowers with air compressors. | **Complete.** The life of the aeration curtain is anticipated to be 2019, when it will need to be replaced. Additional treatment studies in the source area to extend the life of the aeration curtain are currently being considered. Flow rates are also being evaluated, along with other ways to increase the life expectancy of the system (**CH2M HILL, 2007c**). | No |
| | Clean the air sparge lines and develop a preventive maintenance process to prevent unplanned system shutdowns in the future. | **Complete.** The curtain sparge modules were cleaned in January 2006 and in March 2007. American Environmental and Engineering Consultants was contracted in April 1, 2007 to perform engineering services/system evaluation and provide recommendations of the aeration curtain. In the FYR interview, the OU 5 Site Manager stated that a procedure was implemented for regular maintenance of the heat exchanger at the aeration curtain. This maintenance has kept it operating with no more overheating issues in the blowers. The blowers operated without any problems during the last summer, which was unusually hot (**CH2M HILL, 2007c**). These procedures have been incorporated into the OU 5 Phase I Remedial Action Aeration Curtain, Operation and Maintenance Manual as Standard Operation Procedures (**Hill AFB CEVR, 2007b**). | No |
| | Increase ventilation in the aeration curtain system building. | **Complete**. As stated in the OU 5 FYR interview with the Site Manager, vents were installed and fan repairs were completed in the building to improve ventilation in 2004 (**CH2M HILL, 2007a**). | No |
| | Shut down the Phase II system. | **Complete.** The OU 5 ROD states that operation of the Phase II system was discontinued with the approval of EPA and UDEQ in 2003 due to poor mass removal and low discharge (**MWH, 2006**) | No |
| | Continue all institutional controls, primarily groundwater restrictions on the shallow aquifer sites SS017 and SS09. | **Ongoing.** Hill AFB performs an annual evaluation of the ICs in place for the Base. This includes verification of orders, leases, groundwater use restrictions, and inspections of signage, fences, and monitor wells. An annual land-use controls report is prepared documenting the results of this work (**Hill AFB CEVR, 2007d**). | No |

Table OU 5-4
# Operable Unit 5
# Five-Year Review Process

Reviewer: Victor Martinez

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| **Introduction** | The 2008 five-year review for Hill AFB has been conducted in accordance with the EPA's Comprehensive Five-Year Review Guidance dated June 2001 (**EPA, 2001**). Administrative and community involvement components of the five-year review are described in **Section 2.0** of this report for the overall five-year review. In addition, interviews were conducted with relevant parties. A site inspection of OU 5 was performed. Documents reviewed for OU 5 as part of the 2008 five-year review are provided in **Appendix C**. Relevant site documents and applicable data covering the period of the five-year review were evaluated. The site interviews, site inspection, and data review are further discussed in the following sections. |
| **Interviews** | Interviews for OU 5 were conducted with Oscar Torres/75 CEG/CEVR site O&M project manager, Mark Roginske/75 CEG/CEVR site manager, Steve Parkinson/AEEC O&M technician, and Brad Thein/AEEC O&M project manager. All interviews were conducted in person on September 26, 2007. Copies of the Interview Record Forms are provided in **Appendix D**.<br><br>In Mr. Roginske and Mr. Torres' interview, it was mentioned that signs at the arsenic-contaminated soil area have been installed, but no fences have been installed per remedial action specified in the ROD. The Phase II groundwater extraction system was decommissioned. The system was not removing enough water or contamination, and therefore, it was no longer cost effective. Mr. Parkinson mentioned that he is in charge of 90 percent of the O&M. The Phase III Groundwater Containment System is visited once per week while the O&M at the aeration curtain varies. O&M at the aeration curtain can be as frequent as once a day in the summer.<br><br>In Mr. Roginske and Mr. Torres' interview, it was also mentioned that the effects of continued remedial operations have been positive. The aeration curtain operates at approximately 95 percent removal efficiency, and the Phase III Groundwater Containment System is containing contaminated groundwater and preventing it from moving further into the City of Clinton.<br><br>In addition, it was mentioned that there is containment at the Phase III Groundwater Containment System and the aeration curtain meets performance goals. Mr. Parkinson and Mr. Thein added that the operation of the Phase III Groundwater Containment System has been problem free. They indicated that remedy is performing as expected since the concentrations at the Phase III Groundwater Containment System are decreasing.<br><br>Mr. Roginske and Mr. Torres indicated that the data collected since the 2003 five-year review indicates progress toward achieving remedy goals, and the clean-up time is projected at 30 to 40 years. Mr. Parkinson and Mr. Thein agreed with that. They pointed out they have seen one concentration increase at the aeration curtain but overall, the TCE concentrations dropped significantly in most monitoring points.<br><br>Mr. Torres stated that current O&M procedures include the implementation of regular maintenance of the heat exchanger at the aeration curtain. This maintenance has kept it operating with no more overheating issues in the blowers, which operated without any problems during the last summer. Mr. Parkinson and Mr. Thein mentioned that an acid cleaning procedure for the aeration curtain has been implemented and adjusted for cleaning the lines twice a year. A pH of 1 is now achieved, and the acid is left in the pipe longer, thus improving the cleaning and operation. They added that recommendations to improve the aeration curtain will continue to be submitted.<br><br>Mr. Roginske and Mr. Torres mentioned that since the 2003 five-year review, performance |

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| | monitoring plans were developed as part of the PSVPlan. The PSVPlan establishes the expectations and goals for performance for OU 5 systems, presents an optimized monitoring well sampling schedule, and provides methods for evaluating the behavior of the plume. Since the 2003 five-year review, Mr. Parkinson and Mr. Thein mentioned that the air flow into individual submodules of the aeration curtain is measured to provide better data on the flow and performance.<br><br>With regards to the failure of the blowers in the site SS017 Phase I Aeration Curtain and the sporadically clogged sparge pipes pointed out in the 2003 five-year review, Mr. Roginske and Mr. Torres noted that the life of the aeration curtain was anticipated to be 2019, when its replacement will be evaluated. Therefore, they are currently looking into performing additional treatment studies in the source area to extend the life of the aeration curtain. Also, the O&M contractors have been tasked to optimize the system in place and make recommendations for any improvements. Ways to increase air flow rates are being evaluated, along with other ways to increase the life expectancy of the system. They are looking at the overall performance and evaluating the entire operation of the aeration curtain. Mr. Parkinson and Mr. Thein added that better maintenance programs of the blowers and heat exchanger have been implemented as well as the use of better acid treatment procedures.<br><br>All interviewees mentioned that vents were installed in the site SS017 Phase I Aeration Curtain blower building to improve ventilation and prevent overheating in the summer, which was causing the system to periodically shut down.<br><br>All interviewees mentioned that no major or unexpected O&M difficulties or costs have been encountered in OU 5 since the 2003 five-year review. Mr. Roginske and Mr. Torres pointed out unexpected contamination has not been found outside the capture zone. All interviewees were not aware of any ongoing community concerns with regards to the O&M or any other issues at OU 5.<br><br>Community interviews were also conducted as part of this five-year review. Interviews were conducted with Mr. Chad Bangerter/Sunset City Council, Mickey Hennessee/Sunset City RAB representative and Mr. Dennis W. Cluff/Clinton City Manager. A copy of the Interview Record Form is provided in **Appendix B**.<br><br>Mr. Chad Bangerter was interviewed on December 14, 2007. He indicated that as a council member, he said he feels more informed and is impressed with the effort and appreciates what is being done to remedy the problem; however, as a resident, he does not see as much information about the cleanup as he did several years ago. He said site operations have had very little impact on the community. His concerns focused on the use of tax-payer dollars, health concerns of citizens, and the inconvenience of quarterly indoor air sampling.<br><br>Mr. Mickey Hennessee was interviewed on December 12, 2007. He indicated that he is very satisfied with the current efforts conducted by the Air Force. The environmental team and contractors associated with the cleanup effort are aware and sensitive to the communities needs, concerns and are always striving to keep the public informed of the cleanup process and its progress. The use of the internet and websites in public notification/communication has drastically improved getting the word out. He did indicate that he would like current contact information on field supervisors and personnel associated with contractors and sub-contractors as notification about current activities is not as thorough as previous years.<br><br>Mr. Dennis W. Cluff, Clinton City Manager submitted interview question responses via electronic mail on December 12, 2007. He indicated that his overall impression of the cleanup effort is a positive one. As more contamination areas were found, these were pursued with the same openness. No cover-up antics have been observed. He indicated that site operations have brought some paranoia for certain citizens, at least until their concerns have been voiced and dealt with by the "group." He mentioned that concerns regarding the cleanup fall into two categories: length of time it takes to clean-up the plumes and general uncertainty of long-term effects of the plume. Mr. Cluff added that he personally feels well informed about the cleanup program's activities and progress. Mr. Cluff also believes that more "calming" information |

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| | should go out to the public dealing with the concentrations of the plumes, their depths, volatility, and what it would take for people to be sufficiently exposed to TCE to cause harm, particularly under the current plume circumstances. |
| **Site Inspection** | The site inspection for OU 5 was conducted on September 26, 2007. The completed site inspection checklist is provided in **Appendix E**.<br><br>Based on the site inspection, OU 5 appears to be well maintained. Roads and parking areas at both systems are in good condition.<br><br>Access and ICs are currently in place at OU 5. Only the Phase III Groundwater Containment System is fenced. Fencing is in good condition. Signs are posted at the arsenic contaminated soils area and at the Aeration Curtain Building and Phase III Groundwater Containment System. All signs are in good condition. Doors for Phase I Aeration Curtain and the Phase III Groundwater Containment System are kept locked and are in good condition. No signs of vandalism were evident. No changes were observed on land use onsite and offsite. Hill AFB performs an annual evaluation of the ICs in place for the Base. This includes verification of orders, leases, ground water use restrictions, and inspections of signage, fences, and monitoring wells. An annual land-use controls report is prepared documenting the results of this work.<br><br>Settlement was not evident in the vertical barrier walls. Performance monitoring was conducted. Water levels are monitored at the cutoff wall by the O&M contractor. No evidence of breaching or bypass was noted.<br><br>Groundwater remedies were in good condition. Pumps, wellhead plumbing, and electrical were in good condition. Phase III Groundwater Containment System uses a dewatering trench to remove groundwater. Extraction system pipelines, valves, valve boxes, and other appurtenances were located and in good condition. Spare parts and equipment are readily available and in good condition. The aeration curtain is in good condition, but needs some O&M since one of the air blowers appeared to be leaking some oil. Sampling ports were properly marked and functional. The sampling/maintenance log was displayed and up to date. All equipment is properly identified. Electrical enclosures, panels, tanks, vaults, and storage vessels are in good condition. Treatment building is in good condition, and chemicals and equipment are properly stored. Due to large number of wells present, not all were inspected. All wells that were inspected were properly secured/locked and in good condition.<br><br>The site inspection checklist addressed four discussion topics. These discussion topics are presented below, followed by responses and general observations based on the site inspection.<br><br>(1) Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).<br><br>The OU 5 remedy was to achieve four remedial action objectives (RAOs) for contaminated groundwater and soils (**Table OU 5-1)**. The ROD states that remediation of contaminated groundwater in on-Base source areas will not occur within the timeframe due to the presence of ongoing sources.<br><br>The groundwater TARS plume is addressed through operation of the aeration curtain near the base boundary, which reduces contaminant concentrations by approximately 90 percent. Further downgradient, the cutoff wall and Phase III Groundwater Containment System inhibits the further flow of groundwater and extracts contaminated groundwater. The extracted water is discharged directly to the NDSD for treatment under permit. The groundwater Zone 16 plume is addressed through monitored natural attenuation. Institutional controls are in place to restrict the use of contaminated groundwater at OU 5. The groundwater plumes are monitored as part of the Basewide groundwater monitoring program.<br><br>Institutional controls in the form of signs and land use controls have been implemented to restrict future access to contaminated soils at OU 5. A list of the ICs implemented at OU 5 are presented in detail in the Technical Assessment section, **Table OU-5-7**. |

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| | Indoor air sampling and vapor mitigation is performed under the Basewide indoor air program. The ROD for OU 5 does not specifically address indoor air issues.<br><br>There are currently plans to eventually implement a PRB treatability study for the TARS plume. This study is currently on hold pending resolution of performance issues for the PRB at OU 12.<br><br>Based on the site inspection, all components of the remedy appear to be functioning as designed<br><br>(2) Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.<br><br>Operation and maintenance at the site includes maintenance of the aeration curtain and Phase III Groundwater Containment System and associated sumps and piping, long-term monitoring of the site groundwater, and water level monitoring. Extracted water is currently discharged directly to the NDSD. The effluent is monitored to ensure that the discharge criteria are met. Proper inspection and maintenance procedures are in place and implemented to ensure the integrity of the remedy and to ensure the enforcement of ICs (groundwater use restrictions, land use restrictions on-site, integrity of fencing, and signage).<br><br>(3) Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.<br><br>There are no issues related to the O&M procedures (cost or scope) that would indicate the protectiveness of the remedy may be compromised in the future. Significant O&M changes for the aeration curtain have resolved the operational issues identified during the 2003 five-year review. The O&M contractor and CEVR staff expressed that the existing systems were operating as designed and results were satisfactory.<br><br>(4) Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.<br><br>Operation and maintenance contractors make recommendations to optimize performance and/or reduce costs. No optimization opportunities were identified as part of the site inspection. Removal of the Phase II System from operation during 2004 resulted in significant cost savings. |
| **Data Review** | The data reviewed as part of the 2008 five-year review included groundwater samples and effluent discharge samples. Groundwater data were collected on a annual, semiannual and quarterly basis at monitoring wells during the review period.<br><br>The OU 5 ROD established RAOs for groundwater and soils. For groundwater, the remediation goals were set at the MCLs established under the SDWA and the UDEQ. The Phase III Groundwater Containment System remediation goal is to capture and extract shallow contaminated groundwater in order to prevent groundwater contaminated with TCE at concentrations greater than 100 µg/L from reaching the Clinton residential area. Based on the document and data review, it appears that the Phase III Groundwater Containment System has achieved its remediation goal by preventing groundwater with TCE concentrations greater than 100 µg/L from migrating beyond the containment system. However, groundwater with TCE concentrations less than 10 µg/L has continued to flow past the northern end of the Groundwater Containment System and into Clinton. The PSVPlan states that modeling indicates that TCE migrating past the system to the north will have little effect on plume migration, and the plume will continue to decrease in concentration through time. Groundwater extracted from the Phase III Groundwater Containment System is sent to the sanitary sewer for treatment at the NDSD's WWTP in accordance with the agreement between Hill AFB and the District. All OU 5 effluent discharge samples from 2004 through 2006 were within the |

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| | permitted limits as presented in **Table OU 5-6**. Remediation goals and effluent discharge limits are presented in **Tables OU 5-5** and **OU 5-6**. The Phase III Groundwater Containment System was below the acceptable pumping range of 18 gpm, which is the lower value of the system's ability to contain the TCE plume, from July through September 2005. The system was also above the acceptable pumping rate of 22 gpm, a flow rate that can cause excessive drawdown and may result in differential settlements, during three reporting periods and below acceptable range during two reporting periods. As of September 30, 2007, 6.32 pounds of TCE have been removed using the Phase III Groundwater Containment System and approximately 45,248,662 gallons of groundwater have been extracted since the start of operations (**AEEC, 2007a)**.<br><br>The PSVPlan indicates that the performance objective of the Aeration Curtain is to maintain the overall TCE removal efficiency of the Phase I Aeration Curtain at or above the historically calculated mean value of 90 percent. Removal efficiency of the Phase I Aeration Curtain System was below the acceptable range (currently 90 percent removal efficiency as stated in the PSVPlan) during the third quarter of 2005 and during the second and third quarters in 2006. The Phase I Aeration Curtain System was shutdown on several occasions in 2005, and on one occasion in 2006 due to high temperature as a result of problems with a heat exchanger. Temperatures were drastically lowered once a procedure was implemented for regular maintenance of the heat exchanger at the aeration curtain. Based on past operation and analytical results, the Phase I Aeration Curtain appears to substantially impact TCE concentrations in the TARS Plume. Monitoring wells immediately downgradient of the Phase I Aeration Curtain have significantly lower TCE concentrations as compared to upgradient wells. As of September 30, 2007, 89.95 pounds of TCE have been removed using the Phase I Aeration Curtain and approximately 43,632,224 gallons of groundwater have been treated since the start of operation of the system (**AEEC, 2007b**). Monitoring and data analysis has been conducted at OU 5 as specified in the 2006 PSVPlan.<br><br>The PSVPlan indicates that the primary performance objective for the Zone 16 Plume is to demonstrate that natural attenuation of TCE is occurring in the groundwater at on- and off-Base locations. Meeting this objective requires long-term monitoring for VOCs, as well as additional monitoring for parameters and degradation products indicative of natural attenuation of VOCs. The PSVPlan states that performance objectives of the MNA are based on two assumptions: (1) the on-Base plume source area is decaying and continues to contribute progressively less TCE mass flux to the plume and that no other sources exist; and (2) TCE throughout the plume is naturally attenuating through degradation, dilution, dispersion, and volatilization. The PSVPlan states that both of theses assumptions are supported by historical TCE trends, TCE degradation products, and MNA indicator compounds. Evaluation of natural attenuation indicates that the mass of TCE in the Zone 16 dissolved-phase plume is decreasing over time at a rate of approximately 2.46 kg/ year. Groundwater sampling results indicate that TCE concentrations are being lowered by reductive dehalogenation in limited areas; however, the rate at which it is occurring is very slow, due to the carbon-limiting conditions found in the shallow aquifer. The decreasing mass trend has been apparent over the last 5 years and results in an estimated clean-up timeframe of 2050s (**Hill AFB CEVR, 2007a**).<br><br>Perchlorate has been identified as an emerging contaminant for OU 5. A review of historical perchlorate sample results for the period 1998 to 2006 was performed. Based on this review, perchlorate was identified in on-Base groundwater at OU 5 at concentrations exceeding the United States Air Force (USAF) action level of 24 µg/L. Neither the EPA nor the UDEQ have established an MCL for perchlorate. The USAF action level is based on an EPA reference dose level for perchlorate of 0.0007 milligrams per kilogram per day, which translates to a drinking water equivalent level of 24.5 µg/L. Additional sampling was performed in 2006, and based on the data, the perchlorate concentrations exceeding the USAF action level are confined to the on-Base portion of the OU 5 plume downgradient of the source of the Zone 16 Plume and upgradient of the source of the TARS Plume (**MWH, 2007**). Monitoring for perchlorate in groundwater at OU 5 has been implemented.<br><br>Institutional controls, in the form of groundwater and land use controls, have been implemented |

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| | to restrict future access to contaminated soils and groundwater at OU 5. Indoor air vapor intrusion at OU 5 is currently under investigation under a Basewide program as described in the Final Action Memorandum for the Time-Critical Removal Actions for Indoor Air (**Hill AFB, 2003**). Under that program, indoor air mitigation systems are installed in residences in which contaminant concentrations in indoor air have exceeded mitigation action levels (**Hill AFB CEVR, 2007a**).<br><br>Based on document and data review and interviews performed, remedies implemented at OU 5 are meeting the performance objectives specified in the PSVPlan. CEG/CEVR site O&M project manager and site manager indicate that containment at the Groundwater Containment System is taking place, and the aeration curtain is meeting its performance goals. |

Table OU 5-5

## Chemicals of Concern and Remediation Goals at OU 5

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Media | Chemical of Concern | Remediation Goal | Units |
|---|---|---|---|
| Groundwater | 1,1-Dichloroethene (1,1-DCE) | 7 | ug/L |
| | 1,1,1-Trichloroethane (1,1,1-TCA) | 200 | ug/L |
| | Carbon Tetrachloride | 5 | ug/L |
| | cis 1,2-Dichloroethene (cis 1,2-DCE) | 70 | ug/L |
| | Tetrachloroethylene (Perchloroethylene, PCE) | 5 | ug/L |
| | Trichloroethene (TCE) | 5 | ug/L |
| | Vinyl Chloride | 2 | ug/L |
| Soil | Arsenic* | 50.9 | mg/kg |

Notes:

* Remediation goals for these chemicals are risk-based levels

Unless otherwise specified, the concentrations for ground and surface water are maximum contaminated levels (MCLs) established under the Safe Drinking Water Act and/or Utah Primary Drinking Water Standards

ug/L = micrograms per liter

mg/kg = milligrams per kilogram

Table OU 5-6

## OU 5 System Effluent Discharge Limits for Discharge to the North Davis Sewer District

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Analyte | Discharge Limit | Units |
|---|---|---|
| Total VOCs | 2.13 | mg/L |
| Arsenic | 0.1 | |
| Nickel | 0.6 | mg/L |
| Zinc | 1.5 | mg/L |
| pH | 6.5-11.0 | |
| Temperature | <140 | °F |

Notes:

mg/L milligrams per liter

VOCs = volatile organic compounds

Permit dates: November 1, 2004 through December 31, 2008

Table OU 5-7
# Operable Unit 5
# Five-Year Review Technical Assessment

Reviewer: Victor Martinez

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| **Introduction** | The five-year review must determine whether the remedy at a site is protective of human health and the environment. The EPA guidance describes three questions used to provide a framework for organizing and evaluating data and information and to ensure all relevant issues are considered when determining the protectiveness of a remedy (**EPA, 2001**). These questions are assessed for OU 5 in the following sections. The implementation of ICs is also described. At the end of this table is a summary of the technical assessment. |
| **Question A.** | **Is the remedy functioning as intended by the decision documents?**<br><br>Yes. The document that details the remedial decisions for OU 5 is the 2006 *Final Record of Decision* (**Hill AFB CEVR, 2007a**).<br><br>Remedial actions implemented at OU 5 to address both on-Base and off-Base contamination includes: Phase I Aeration Curtain, Phase III Groundwater Containment System, Groundwater Monitoring for Natural Attenuation, and Institutional Controls. The Phase I Aeration Curtain was implemented in 1997 and consists of an air sparging system located on Main Street in Sunset, Utah. The Phase III Groundwater Containment System was installed in 2003 and is located along the Clinton/Sunset boundary. The Phase III Groundwater Containment System consists of an extraction trench and slurry wall to limit additional contamination migration beneath the City of Clinton.<br><br>Opportunities for Optimization:<br><br>Site manager in conjunction with O&M contractors have developed performance monitoring plans as part of the PSVPlan, which establishes the expectations and goals for performance for the OU 5 systems, provides an optimized monitoring well sampling schedule, and provides methods for evaluating the performance of the plume<br><br>A procedure was implemented for regular maintenance of the heat exchanger at the aeration curtain. This maintenance has kept it operating with no more overheating issues in the blowers. The blowers operated without any problems during the last summer, which was unusually hot.<br><br>Early Indicators of Potential Remedy Problems:<br><br>No Potential Remedy problems were identified during this five-year review. |
| **Question B.** | **Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?**<br><br>Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics:<br><br>There have been no changes in exposure pathways for OU 5 since the ROD was signed. No new contaminants or routes of exposure have been identified for the OU 5 as part of this five-year review.<br><br>Changes in Applicable or Relevant and Appropriate Requirements:<br><br>The five-year review for OU 5 included identification of and evaluation of changes in the ROD-specified ARARs and To Be Considereds to determine whether such changes may affect the protectiveness of the selected remedy. Chemical-specific and action-specific ARARs were reviewed and were all determined to still be applicable, relevant and appropriate, or To Be Considereds, as presented in **Appendix G**. |

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| **Question C.** | **Has any other information come to light that could call into question the protectiveness of the remedy?**<br><br>Examples of other information that might call into question the protectiveness of the remedy include potential future land use changes in the vicinity of the site or other expected changes in site conditions or exposure pathways.<br><br>Plans are being evaluated to turn over property along the western portion of the Base to a private commercial developer(s) to redevelop that portion of the Base for various uses. No residential development will be allowed that would be in conflict with the privatized housing. Development will most likely consist of commercial and light industrial, but no heavy industrial. |
| **Institutional Controls** | Institutional controls are generally defined as non-engineered instruments such as administrative and legal tools that do not involve construction or physically changing the site, and that help minimize the potential for human exposure to contamination and/or protect the integrity of a remedy by limiting land and/or resource use (**EPA, 2005**). Institutional controls can be used for many reasons including restriction of site use, modifying behavior, and providing information to people (**EPA, 2000**). Institutional controls may include deed notices, easements, covenants, restrictions, or other conditions on deeds, and/or groundwater and/or land use restriction documents (**EPA, 2001**). The following paragraphs describe ICs implemented at OU 5, the potential affect of future land use plans on ICs, and any plans for changes to site contamination status.<br><br><u>Types of ICs in Place at the Site:</u><br><br>Institutional controls, in the form of signs and land use controls, have been implemented to restrict future access to contaminated soils at OU 5. In addition ICs are in place to restrict the use of contaminated groundwater at OU 5. Hill AFB performs an annual evaluation of the ICs in place for the Base. This includes verification of orders, leases, groundwater use restrictions, and inspections of signage, fences, and monitoring wells. An annual land-use controls report is prepared documenting the results of this work. Detailed information of the annual Land Use Controls Assessment report is presented in **Section 2.7**. Based on review of the most recent Land Use Controls Assessment report, one recommendation was made for OU 5 regarding signage at the Groundwater Extraction Trench (**Hill AFB CEVR, 2007d**).<br><br><u>Effects of Future Land Use Plans on ICs:</u><br><br>There are plans for redevelopment on the west side of the Base. This is currently in the planning phase. It is anticipated that a private developer will be allowed to use portions of the western area of the Base for commercial redevelopment.<br><br><u>Plans for Changes to Site Contamination Status:</u><br><br>No changes to site contaminant status at OU 5 are anticipated in the near future. |

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| **Summary of the Technical Assessment** | The technical assessment, based on the data review, site inspection, technical evaluation, and interviews indicates that the remedial actions selected for OU 5 generally appears to have been implemented and are functioning as intended by the ROD.<br><br>The OU 5 ROD established RAOs for groundwater and soils. For groundwater, the remediation goals were set at the MCLs established under the SDWA and the UDEQ. Based on document and data review, it appears that the GCS has achieved its remediation goal by capturing groundwater with TCE concentrations greater than 100 µg/L. However, groundwater with TCE concentrations less than 10 µg/L has continued to flow past the northern end of the GCS and into the city of Clinton. Groundwater extracted from the GCS is sent to the sanitary sewer for treatment at the NDSD's WWTP in accordance with the agreement between Hill AFB and the District. All OU 5 effluent discharge samples from 2004 through 2006 were within the permitted limits as presented in **Table OU 5-6**. As of December 31, 2007, 6.32 pounds of TCE have been removed using the GWET system, and approximately 45,248,662 gallons of groundwater have been extracted since the start of operations (**AEEC, 2007a**).<br><br>The performance objective of the Aeration Curtain is to maintain the overall TCE removal efficiency of the Aeration Curtain at or above the historically calculated mean value of 90 percent. Based on past operation and analytical results, the Aeration Curtain appears to substantially impact TCE concentrations in the TARS Plume. Monitoring wells immediately downgradient of the Aeration Curtain have significantly lower TCE concentrations as compared to upgradient wells. As of September 30, 2007, 89.95 pounds of TCE have been removed using the Aeration Curtain and approximately 43,632,224 gallons of groundwater have been removed since the start of operation of the system (**AEEC, 2007b**).<br><br>The PSVPlan indicates that the primary performance objective for the Zone 16 plume is to demonstrate that natural attenuation of TCE is occurring in the groundwater at on- and off-Base locations. The typical anaerobic reductive dehalogenation products of TCE are DCE isomers (e.g., cis-1,2-DCE, trans-1,2-DCE, and 1,1-DCE). Isomers of DCE have been detected in the Zone 16 plume and vinyl chloride (VC) has been detected in limited areas in the Zone 16 plume. Meeting this objective requires long-term monitoring for VOCs, as well as additional monitoring for parameters and degradation products indicative of natural attenuation of VOCs (**Hill AFB CEVR, 2007a**).<br><br>Institutional controls, in the form of groundwater and land use controls, have been implemented to restrict future access to contaminated soils and groundwater at OU 5. Indoor air vapor intrusion at OU 5 is currently under investigation under a Basewide program as described in the Final Action Memorandum for the Time-Critical Removal Actions for Indoor Air (**Hill AFB, 2003**). Under that program, indoor air mitigation systems are installed in residences in which contaminant concentrations in indoor air have exceeded mitigation action levels (**MWH, 2006**).<br><br>Based on document and data review and interviews performed, remedies implemented at OU 5 are meeting the performance objectives specified in the PSVPlan. The CEG/CEVR site O&M project manager and site manager indicate that containment at the Groundwater Containment System is taking place, and the aeration curtain is meeting its performance goals. |

Table OU 5-8
## Operable Unit 5
## Technical Assessment Summary for OU 5

Reviewer: Victor Martinez

| Site ID | Remedy Description | Technical Assessment | | | Protectiveness | Next Five-Year Review |
|---|---|---|---|---|---|---|
| | | Question A* | Question B* | Question C* | | |
| SD016 | Not required, No Further Response Action Planned (NFRAP) site | NA | NA | NA | NA | Not required |
| SS017 | Phase I: aeration curtain and groundwater use restrictions | Yes | Yes | Yes | Protective | 2013 |
| SS017 | Phase II: groundwater extraction system. Use discontinued in 2003 with agency approval | NA | NA | NA | NA | NA |
| SS017 | Phase III: groundwater extraction trench (not operational at this time) and groundwater use restrictions | Yes | Yes | Yes | Protective | 2013 |
| SS091 | Monitored natural attenuation of groundwater plume. Groundwater use restrictions in place | Yes | Yes | Yes | Protective | 2013 |
| OU 5 | Aeration curtain, groundwater extraction and groundwater use restrictions | Yes | Yes | Yes | Protective | 2013 |

*Question A: Is the remedy functioning as intended by the decision documents?
Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objective (RAOs) used at the time of the remedy still valid?
Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
NA = Not Applicable

Table OU 5-9

# Operable Unit 5
# Five-Year Review Issues, Recommendations and Follow-Up Actions, and Protectiveness Statement

Reviewer: Victor Martinez

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| **Issues** | Operation and maintenance activities are ongoing at OU 5. Based on the document review, data review, site inspection, interviews, and the technical assessment, it appears the remedy has been implemented as planned and is functioning as intended by the decision documents in the short-term. To ensure continued protectiveness, one issue was identified in the 2008 five-year review for OU 5 as described below. This issue does not currently affect the protectiveness of the remedy, although it needs to be addressed to ensure continued protectiveness.<br>1) The OU 5 site manager indicated in the 2008 Five-Year Review Interview that that the life of the aeration curtain is anticipated to be 2019, when it will need to be replaced (CH2M HILL, 2007c). Additional treatment studies in the source area to extend the life of the aeration curtain are currently being considered. Flow rates are also being evaluated, along with other ways to increase the life expectancy of the system. There are currently no plans in place to replace the aeration curtain once it can no longer be effectively or efficiently operated. |
| **Recommendations and Follow-Up Actions** | As described in the previous section, one issue was identified in the 2008 five-year review for OU 5. To address this issue, the following recommendation/followup action has been defined.<br>1) To address the possibility of extending the life of the aeration curtain beyond its current life expectancy of 2019, complete planned treatment studies. Make adjustments to the aeration curtain if studies conducted indicate a positive impact in continuing to achieve remedial action objectives (RAOs). Perform a study of remedial action to be considered as replacements for the aeration curtain before the system reaches its life cycle. |
| **Remedial Timeframe** | **Table 3-3** in **Section 3.1.4** presents the remedial timeframe estimates for OU 5. The remedial timeframe for the TARS plume and soils is indefinite. Remediation associated with the Zone 16 plume is estimated to be complete sometime during 2050's. |
| **Protectiveness Statement** | **The remedial actions implemented at OU 5 are considered protective of human health and the environment.** The Phase III Groundwater Containment System is containing contaminated groundwater and preventing it from moving further into the City of Clinton, and the aeration curtain is operating effectively as expected. Exposure to contaminants in indoor air is addressed through the IAP, and ICs to restrict groundwater use are currently in place. ICs and land-use controls are assessed annually. Monitoring indicates that the Zone 16 groundwater plume is naturally attenuating. The selected remedy will continue to be protective if the recommendations and follow-up items identified in this five-year review are addressed. |
| **Next Five-Year Review** | Remedial actions at OU 5 will be reviewed in the next five-year review for Hill AFB to be completed during or before September 2013. |

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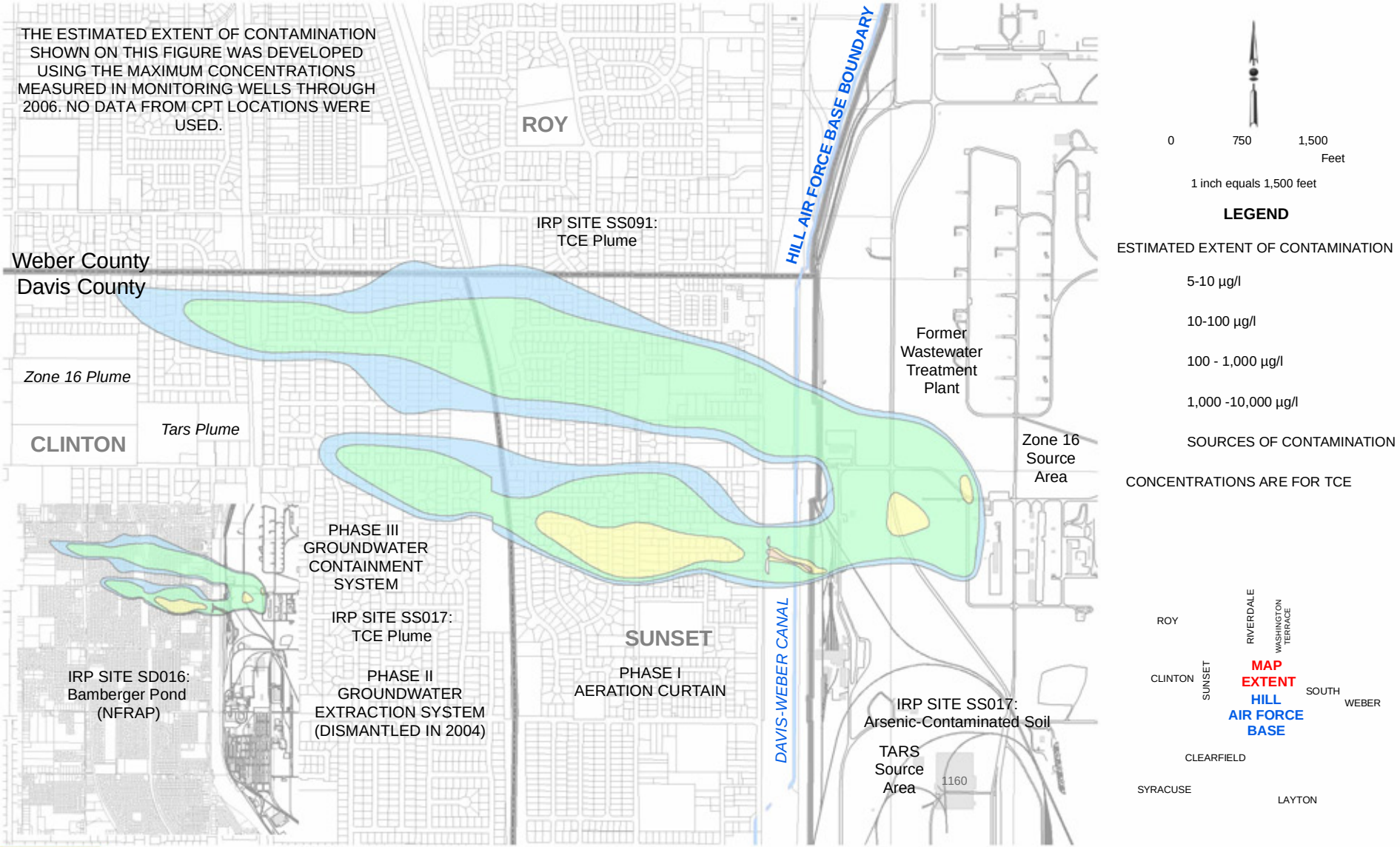


75th AIR BASE WING

FIGURE OU 5 - 1

**SITE FEATURES OF OPERABLE UNIT 5**

2008 FIVE-YEAR REVIEW

IRP SITES: SS091, SS017, SD016

HILL AIR FORCE BASE, UTAH

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Table OU 6-1
# Operable Unit 6
# Background Information

Reviewer: Kelly Taylor

<table>
<tr><td>Introduction</td><td>
Operable Unit 6 is located on the northern boundary of Hill AFB and consists of two IRP sites: the Building 1915 Sump Leach Field (ST022) (west TCE groundwater plume) and the Asphalt Pad (OT026) (east TCE groundwater plume and subsurface contamination); and a third site, the Building 1946 Evaporation Pond (designated locally as SD40B) (Figure OU 6-1). The Building 1946 Evaporation Pond (SD40B) received wash water from a propellant testing laboratory and was designated as a NFRAP site in 1997 and will not be discussed further.<br><br>
OU 6 is defined by two distinct TCE-contaminated groundwater plumes, namely the west plume and the east plume. The Building 1915 Sump Leach Field is believed to be the source of the west plume which is wholly contained on Base and underlies the area in the vicinity of Zone 19 Building Complex. The east plume underlies the on-Base areas extending from Zone 20 Building Complex north to the existing Base Construction Debris Landfill and off-Base areas under the Craigdale and Farr subdivisions of Riverdale, Utah. The source of the east plume is located in the Zone 20 Building Complex and may originate from several small undocumented point releases, a leaky underground storage tank that contained solvents, and possibly from a former dry cleaning operation. Subsurface soils associated with the on-Base portion of the east plume are also contaminated with 1,1- DCE. The soil area of concern (approximately 2,500 square feet) is in the immediate vicinity of the two former USTs near the former buildings 2007 and 2008 (MWH, 2006).<br><br>
The west plume is being monitored for natural attenuation and appears to be naturally attenuating based on current and historical data. The east plume is being continuously monitored and remediated with on- and off-Base groundwater extraction and treatment systems. Exposure to receptors in the area of 1,1-DCE-contaminated sub-surface soil, which is limited to the on-Base source area for the east plume, is controlled through implementation of institutional controls.<br><br>
A list of the documents reviewed for OU 6 as part of the 2008 five-year review is provided in Appendix C.
<table>
<tr><th>IRP Identification</th><th>IRP Site Name</th><th>Status</th></tr>
<tr><td>ST022</td><td>Building 1915 Sump Leach Field</td><td>LTO/LTM</td></tr>
<tr><td>OT026</td><td>Asphalt Pad</td><td>LTO/LTM</td></tr>
<tr><td>SD40B</td><td>Building 1946 Evaporation Pond</td><td>NFRAP</td></tr>
</table>
</td></tr>
<tr><td>Site Chronology</td><td>Provided separately. See Table OU 6-2.</td></tr>
<tr><td>Background</td><td>
Physical Characteristics. OU 6 includes buildings and adjacent land in the 1900 and 2000 areas, as well as portions of the Craigdale and Farr subdivisions of the City of Riverdale, Utah. The 2000 area, along with buildings in the 2100 and 2200 areas, comprises a security area known as the MAMS area. The on-Base buildings within OU 6 are occupied and operated by the Silo-Based ICBM Program Office. Important features within the OU are the Roy Gate Pond, the Davis-Weber Canal, the Class IV landfill, the active Electrical Substation No. 2, and the privately owned off-Base pond (also known as Cooley’s Pond). Cooley’s Pond is a small pond, fed by Cooley’s Spring (U6-303) (Hill AFB CEVR, 2007a and URS, 2003).<br><br>
Separating the on-Base portion of OU 6 from the off-Base portion is a steep, terraced, north-
</td></tr>
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| | facing escarpment that forms the south wall of the Weber River Valley. There are over 200 feet of relief between Hill AFB and the valley below. The Davis-Weber Canal is located off Base and is situated about one-third the way down the escarpment (**Radian, 1997**). |
| | **Land and Resource Use.** Land use on Base at OU 6 is military industrial and immediately off-Base is mostly residential with some agricultural use. There are no hospitals, retirement or nursing homes, schools, nurseries, or daycare centers currently located within OU 6. The nearest daycare or school is 1.3 miles from contamination associated with the site (**Radian, 1997**).<br><br>Groundwater in the shallow aquifer is currently not used as a source of drinking water, but off-Base water has historically been used for irrigation of lawns and gardens and as water for pets and livestock (**URS, 2003**). Land within OU 6 is not located within the 100-year floodplain. There are no jurisdictional wetlands, as regulated by the United States Army Corps of Engineers, within OU 6. Apart from deeper groundwater for drinking water, there are no uses or known occurrences of commercially valuable natural resources within the OU 6 area (**Radian, 1997**). |
| | **History of Contamination.** During 1988, investigative activities began in the area now designated as OU 6 when the Air Force conducted water sampling in the Craigdale subdivision area. Results of this sampling effort indicated that shallow groundwater and surface water contained chlorinated solvents (primarily TCE). On the basis of the suspected direction of shallow groundwater flow through the area, Hill AFB began investigative activities in the northern portion of the Base to determine the source of the contamination (**Radian, 1997**).<br><br>Although buildings in areas now designated as OU 6 have been in use for various purposes since the 1940s, it is believed that the use of operations-related solvent and fuel began in the 1960s when several buildings were modified to support the Bomarc missile testing and maintenance activities. Historically, hazardous wastes generated by the industrial operations were disposed of at the Base IWTP, in chemical disposal pits, in waste disposal ponds, or in landfills.<br><br>As discussed above in the introduction, the sources of the OU 6 groundwater contamination have never been documented, as this area did not have historical disposal pits, ponds, or waste landfills. However, the source of the west plume is believed to be the Building 1915 Sump Leach Field while the source of the east plume is thought to be various undocumented point releases. The best estimate at this time is that the contamination associated with the east plume was introduced to the soils from infrequent, small volume disposals in floor drains, from leaking USTs or merely from wastes being dumped in the sandy areas between buildings. The primary contaminants of concern at OU 6 are TCE in groundwater and 1,1-DCE in sub-surface soil (**URS, 2003, Hill AFB CEVR, 2007a,** and **Radian, 1997).** |
| | **Initial Response**. Efforts conducted prior to the 1997 *Record of Decision* include: (1) providing an alternate source of clean irrigation water to two homes known to be affected by shallow groundwater contamination, (2) collecting and treating contaminated water from springs and field drains and discharging treated water to a storm sewer, and (3) extracting and treating contaminated groundwater in the off-Base area as part of a removal action (**Radian, 1996**, and **Radian 1997**). |
| | **Basis for Taking Action.** Results of the risk assessments performed for OU 6 indicated that contaminants released from OU 6 may present an imminent and substantial endangerment to public health, welfare, or the environment **(Radian, 1997**). Remedial action at OU 6 is warranted on the basis of potential future risks to human health and the environment (i.e., to prevent a significant risk to residents). Also, remedial action is generally warranted when MCLs are exceeded. Trichloroethene associated with domestic groundwater use accounts for the majority of the risk by ingestion, inhalation, and dermal pathways (**Radian, 1997**). Using the RME concentration, scenarios with unacceptable cancer risk include future off-Base adult and child residents and future hypothetical on-Base adult residents. The majority of risk is a |

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| | result of exposure to soil and water (**Radian, 1997**). |
| **Remedial Actions** | **Remedy Selection (i.e. ROD/ESDs).** A final ROD was issued in 1997 (**Radian, 1997**). The remedies selected for OU 6 under this ROD include: (1) continued operation of an off-Base groundwater pump and treat system at the main arm of the off-Base east plume where extracted groundwater is treated in a low profile air stripper and then discharged to the storm sewer; (2) installation and operation of an on-Base groundwater pump and treat system at the main arm of the on-Base east plume where extracted groundwater is treated in a low profile air stripper and then discharged into the shallow aquifer via a subsurface drain field with the option of discharging the treated water to the NDSD POTW; (3) treatment of the springs and field drains (Cooley's Spring and the water in Cooley's Pond will be treated by an activated carbon or air stripping treatment systems, field drain outfall U6-603/604 will be treated by volatilization in a piped channel; and field drain U6-606 will be treated in an air stripper if contaminated flow remains five years after startup of the off-Base treatment system); (4) natural attenuation of groundwater from the west plume and the off-Base north arm of the east plume; (5) continued groundwater monitoring; (6) implementation of institutional controls including water rights restrictions, easements and leases for monitoring and installing equipment and fencing to restrict access to exposure areas; and (7) provisions of alternate water supplies, if needed, to any residents who are using spring or field drain water for irrigation (**Hill AFB CEVR, 2007a**).<br><br>Remedial Action Objectives for OU 6 as defined in the ROD (**Radian, 1997**) include: (1) restore the groundwater aquifer and seeps and springs, and the Cooley's Pond water to TCE concentrations of 5 µg/L or less (i.e., the drinking water standard), which results in a risk that is protective of human health; (2) prevent access to contaminated groundwater, that is groundwater with TCE concentrations above 5 µg/L; (3) stop plume migration in off-Base areas; (4) remove concentrated portion of off-Base plume; (5) stop east plume migration to off-Base area; (6) remove contaminant in on-Base east plume; and (7) prevent human exposures to 1, 1-DCE in subsurface soil that lead to a total excess cancer risk for 1,1-DCE greater than 10-6—this corresponds to a concentration of 26 µg/kg or lower.<br><br>In the Fall of 2001, the storm sewer was completely lined during commercial development making previous Class II Groundwater Protection Standards (R317-6-4) irrelevant. Because consistent untreated influent TCE concentrations were well below the discharge limit for the Weber River (81 µg/L, established by R317-2-14), the off-Base OU 6 air stripper was subsequently taken off line in November 2002 with EPA and UDEQ concurrence. In 2007, an ESD for OU 6 was issued (**Hill AFB CEVR, 2007a**). The ESD addresses: (1) removal of the requirement to treat the extracted groundwater from the off-Base system in an air stripper prior to discharge; and, (2) provides for discharge of water collected in the Cooley's Spring into the existing surface water collection drains for discharge as part of the off-Base system. Currently, LGAC is used to treat this water. There are plans to bypass the LGAC unit by installation of a drain line from the Cooley's Spring U6-303 to Spring U6-305. Also, the ESD removes the requirement to treat water from Cooley's Spring using an air stripper or carbon adsorption. |
| | **Remedy Implementation.**<br><br>Construction on the off-Base Craigdale pump and treat system began in August of 1995 and was completed in July 1996. In September 1996, the off-Base Craigdale pump and treat system began operation and LTO/LTM began. In 1998, extraction well (U6-214) was recommended for decommissioning because it was determined that plume capture could be maintained without the use of one extraction well (**URS, 2001**). Early in the Summer of 1998, each well was upgraded with an automated high/low float system to help ensure water levels are kept at the right depth to ensure capture (**Hill AFB, 1998**).<br><br>The Cooley's Pond Treatment System has been operational since December of 1997 (**URS, 2001**). According to the 1998 five-year review, the Cooley's Pond Treatment System was originally completed as a removal action under the Basewide Seeps and Springs EE/CA |

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| | (**Hill AFB, 1998**). This treatment system has been modified over time to improve efficiency. Initially, a carbon adsorption system, housed in a separate shed, was used to treat water from the Cooley's Spring and treated water was discharged to the pond. An air stripper, housed in a separate locked building, was used to treat the pond water and the treated water was discharged to the pond drain pipe. Residents complained about the noise. In 1998, a quieter air stripper was installed and the building was heavily insulated. To further reduce noise, system operation was changed from 24 hours to 16 hours per day (**URS, 2001**). In September of 2002, regulators approved bypass of the Craigdale and Cooley's Pond Air Strippers due to low influent concentration. In 2005, the air stripper was decommissioned (**SES, 2006**). Cooley's Spring concentration increased in September 2005. As a result, activated carbon treatment was installed in October 2006.<br><br>In 1998, the on-Base pump and treat system was designed and operation of the system began in July of 1999 (**URS, 2001**).<br><br>During the summer of 2006 the groundwater pump and treat system was rehabilitated (**AEEC, 2007a**). A phone call-out system was also installed to notify operators when the system shuts down (**CH2M HILL, 2007b**).<br><br>**Progress Since Implementation.**<br><br>According to the Final Annual Off-Base Craigdale System Cost and Performance Report, at the conclusion of March 2007 a cumulative volume of approximately 124,768,929 gallons of groundwater has been extracted at the OU 6 off-Base Craigdale pump and treat system since September 1996 (**AEEC, 2007c**). Approximately 18.78 pounds of TCE have been removed from the extracted groundwater since September 1996.<br><br>According to the Final Annual On-Base System Cost and Performance Report, at the end of the reporting period (March 2007), a cumulative volume of approximately 92,411,295 gallons of groundwater has been extracted and treated at the OU 6 on-Base pump and treat system since October 1999 (**AEEC, 2007b**). Approximately 46.80 pounds of TCE have been removed from the extracted groundwater since October 1999. |
| | **Operations and Maintenance**. During the beginning of this review period, the treatment systems were operated by Radian, however, sometime after 2005, the O&M contractor changed to AEEC. The treatment systems are currently operated by AEEC in accordance with the Hill AFB issued Statement of Work for Operations, Maintenance, and Optimization at OU 6 on-Base Groundwater Containment System and the OU 6 off-Base Craigdale pump and treat system Groundwater Containment System (SOW) dated March 2006. In addition, the OU 6 Cooley's Spring (U6-303) Liquid Phase Granular Activated Carbon Treatment System is also operated by AEEC.<br><br>According to the O&M Plan for the on-Base Groundwater Containment System (or pump and treat system), O&M tasks are delegated to the O&M contractor, AEEC (**Hill AFB CEVR, 2007d**). Specific contractor O&M responsibilities include: (1) ensuring the contaminant removal efficiency of the pump and treat system shall remain above 99 percent; (2) minimizing total system downtime to not exceed 5 consecutive days without the permission of Hill AFB CEVR management; (3) minimizing extraction well downtime not to exceed 5 consecutive days without the permission of Hill AFB; and (4) meeting current regulatory limits specified in the Utah Groundwater Quality Protection Rules (R317-6-4.5) for treatment building effluent. The contractor conducts the following general tasks during O&M of the on-Base pump and treat system: (1) system operation task, (2) system maintenance tasks, (3) answering alarms and system troubleshooting, (4) groundwater sampling, (5) groundwater elevation measurement, (6) system operational data collection, and (7) system performance evaluation and reporting.<br><br>According to the O&M Plan for the Craigdale pump and treat system, O&M tasks are |

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| | delegated to the O&M contractor, AEEC (**Hill AFB CEVR, 2007c**). The O&M contractor shall ensure that the following conditions are met: (1) the air stripper contaminant removal efficiency of the pump and treat system shall remain above 99 percent (note that this requirement is only applicable when treatment by the air stripper is required); (2) system downtime shall be minimized and shall not exceed 5 consecutive days without the permission of Hill AFB CEVR management; (3) extraction well water levels shall be maintained within the target water level ranges; (4) treatment building effluent shall meet current regulatory limits specified in the Utah Groundwater Quality Protection Rules (R317-6-4.5). Contact the CEVR project manager for current effluent limits. The contractor conducts the following general tasks during O&M of the Craigdale pump and treat system: (1) system operation task, (2) system maintenance tasks, (3) answering alarms and system troubleshooting, (4) groundwater sampling, (5) groundwater elevation measurement, (6) system operational data collection, and (7) system performance evaluation and reporting.<br><br>According to the O&M Plan for Cooley's Garage, the operational activities for the LGAC system are to be performed on a weekly basis in conjunction with the standard Craigdale pump and treat system data collection events (**AEEC, 2006**). Weekly system checks and data collection activities include: (1) general system check of all equipment including check for leaks, hose integrity, piping integrity, LGAC drum integrity, or any other notable or unusual conditions, (2) check heater functionality during winter months, (3) exercise all valves on the LGAC system, and (4) monitor and record the various LGAC system parameters. In addition, monthly sampling for TCE from the Cooley's LGAC system is required.<br><br>A system performance and baseline evaluation was performed by AEEC for OU 6 to assess the effectiveness of the groundwater PTS and develop recommendations for system improvements and modifications. Recommendations were made to improve associated O&M manuals including the Craigdale pump and treat system and on-Base manuals (**AEEC, 2007a**).<br><br>Operation and Maintenance Plans are maintained and updated online through the CEVR Dynamic Documents System and O&M procedures follow the most current version of the O&M Plans for the on-Base PTS (**Hill AFB CEVR, 2007d**), the Craigdale PTS (**Hill AFB CEVR, 2007c**), and the Cooley's Pond System (**AEEC, 2006**). |
| **Progress Since Last FYR** | The last five-year review was conducted in 2003 (**URS, 2003**). Recommendations based on this review are presented in **Table OU 6-3** along with the status of each recommendation.<br><br>**Current Status:** The system is still in the verification stage after the O&M improvements that were implemented in 2006. Target water levels are now a performance goal for operation of the system, and these targets are now met. New pumps were installed in the wells to increase pumping rates and achieve target drawdown (**CH2M HILL, 2007b**). The Craigdale treatment system untreated influent TCE concentrations remain below the discharge limit of 30 µg/L (**Hill AFB CEVR, 2007a**). The TCE concentrations have consistently been below previous and current Weber River discharge limits since the air stripper was taken off line and have decreased over time. Based on TCE concentrations in monitoring wells in the off-Base north arm of the east plume, it appears that TCE concentrations are not declining and remediation may not be taking place at a rate that will meet cleanup goals (**MWH, 2006**). It should be noted that according to an interview with Mark Roginske and Oscar Torres (75 CEG/CEVR), the north arm of the plume was eliminated through additional verification work because it was considered part of the main plume and is considered one continuous plume (**CH2M HILL, 2007a**). The ability of the current Craigdale pump and treat system to address this portion of the plume is currently being assessed (**MWH, 2007c**).<br><br>Additional work including soil and air sampling has been conducted since the last five-year review. Since 2000, 53 homes have had air testing performed and four have had vapor removal systems installed (**SES, 2006,** and **MWH, 2005**). Additional air sampling efforts may be required, however, after the plume is fully delineated. |

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| | Surface soil sampling was conducted at OU 6 in the MAMS II area to determine if soils in the area contained SVOCs or metals above screening levels. Leveling and grading operations east of Maple Lane exposed soil that appeared to contain incinerated debris, which prompted the sampling event. Soils contained SVOCs at trace levels and elevated metals, in particular arsenic, lead, barium, chromium, cadmium, and silver. Arsenic was the only analyte to exceed its respective RBC though RBCs were not available for all analytes, specifically lead (**CH2M HILL, 2006**). However, it should be noted that background concentrations of arsenic are generally high at Hill AFB and these data do not necessarily indicate site related contamination (**CH2M HILL, 2001**).<br><br>A document and data review was conducted by MWH in 2006 (**MWH, 2006**). This review indicates that OU 6 is out of compliance for the following reasons: (1) groundwater and surface water contamination levels remain greater than MCLs and the preliminary restoration timeframes stipulated in the OU 6 ROD have not been met; (2) TCE contamination levels in the northern arm of the off-Base east plume remain greater than the MCL; and (3) based on TCE concentrations in off-Base monitoring and extraction wells, it appears the east plume may be continuing to migrate off-Base at concentrations greater than MCLs. High priority recommendations based on this review include: (1) developing a work plan for installation of additional monitoring wells; (2) resurveying various wells where previous survey data are uncertain; (3) installing monitoring wells and piezometers at the on-Base and Craigdale PTSs; (4) conducting cone penetration tests and direct push groundwater sampling; (5) collecting baseline static and monthly water level measurements; (6) performing additional groundwater sampling to augment the basewide effort; (7) revising the Performance Standard Verification Plan (PSVPlan); (8) evaluating remedial options for the north arm of the off-Base east TCE plume; and (9) potentially sampling at Cooley's Pond on a quarterly basis as opposed to semiannually.<br><br>A system performance and baseline evaluation was performed in 2006 by AEEC for OU 6 to assess the effectiveness of the groundwater PTS and develop recommendations for system improvements and modifications (**AEEC, 2007a**). This effort supports concerns that arose as part of the 2003 Five-Year Review. During the summer of 2006 the pump and treat systems were rehabilitated (**AEEC, 2007a**). Due to the rehabilitation and system optimization efforts, average monthly flow rates for the entire OU 6 site increased by 122 percent. Trichloroethene mass removal rates for the entire site increased by 183 percent. Average increase in drawdown in nearby piezometers for Craigdale pump and treat system and on-Base PTS was 2.5 feet and 1.6 feet, respectively. Based on the available data, the Craigdale and on-Base pump and treat systems have been effective at limiting off-Base migration along the eastern and center portions of the plume. The systems have not been as effective along the western edge of the plume because of poor historical operations and maintenance or deficiencies of the systems. Several high priority recommendations were presented in this report for site-wide processes and individual systems which would result in optimization of the process. The most significant factor which affected the performance of the OU 6 systems prior to rehabilitation was system fouling. Resources should be allocated towards the on-Base system over the Craigdale system as any remaining source and higher TCE concentrations are located on-Base with the exception of near U6-221. The currently proposed operational strategy to focus on maximum steady state drawdown and extraction well flow rates to determine the full capabilities of the system should be shifted to focus on mass removal after the plume has been collapsed and any remaining source isolated by shutting down wells where the TCE MCL has been attained (**ACEE, 2007a**).<br><br>According to the 2006/2007 Cost and Performance report of the on-Base system, based on the plume area, TCE concentration, and groundwater elevation information currently available, the on-Base system is successful at preventing plume migration off-Base along the currently understood eastern and center plume area (**AEEC, 2007b**). However, there is low certainty as to the extent of plume containment along the western edge of the plume. The primary limiting factor for mass removal and plume containment along the eastern edge of the plume is the |

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| | submersible pump rate capacity. Along the western edge of the plume, the primary limiting factor in mass removal and plume containment is poor extraction well productivity due to aquifer characteristics on the western edge of the plume and the orientation of the wells. Continued monitoring of piezometers, extraction wells, and monitoring wells following the August 2006 rehabilitation (as discussed above) and further delineation of the plume will allow for greater certainty as to whether the system is attaining the Treatment System Performance Objectives.<br><br>According to the Cost and Performance report of the Craigdale system, based on the plume area, TCE concentration, and groundwater elevation information currently available, the off-Base Craigdale system is successful at preventing plume migration to currently unaffected residents and at supporting and enhancing the overall OU 6 remediation strategy along the eastern and center areas of the currently understood plume (**AEEC, 2007c**). Except for Extraction Well U6-221, extraction well TCE concentrations display a decreasing trend toward the MCL. While capture is being attained along the eastern and center areas of the TCE plume, there is low certainty as to the extent of plume containment along the northwestern edge of the plume. Recommendations based on this report include: (1) maximizing production at U6-221 while others wells are optimized and decommissioned once TCE concentrations reach the MCL; (2) conducting additional monitoring and interpretation of the northwestern edge of the plume; and (3) creating an updated plume map (**AEEC, 2007c**).<br><br>The OU 6 TCE contaminant plume map was updated in 2007 along with groundwater monitoring recommendations (**MWH, 2007b**). Based on review of the available data, it was recommended that additional monitoring wells be included in the monitoring program to provide additional data for plume definition, that some monitoring locations be removed from the program, and that the monitoring frequency of some locations be modified. Additionally, nine regional piezometer/monitoring wells will be installed throughout the off-Base area at OU 6 to better define and monitor the OU 6 TCE contaminated groundwater plume according to the Final Field Work Investigation Work Plan Phase III (**MWH, 2007a**).<br><br>In 2008, after completion of additional phases of investigation, an update to the conceptual site model and risk assessment will be completed. In addition, a ROD amendment and/or an ESD may be completed in 2008 (**MWH, 2007c**). The PVSPlan is expected to be completed in 2008 with a PVSReport completed in 2014. |

Table OU 6-2

## Chronology of Site Events for Operable Unit 6

*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 6 | OU 6 | 7 | 1987 | National Priorities List (NPL) | The Base was put on the Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA) NPL list. | Record of Decision (ROD) OU 6 Sites ST022, OT026, SD40B |
| 6 | OU 6 | | 1988 | Remedial Investigation | Investigation of the off-Base shallow groundwater and surface water east-northeast of Hill AFB boundary was performed by Hill AFB EMR between 1988 and 1993. 23 locations sampled periodically for volatile organic compounds volatile organic compounds (VOCs). TCE was the main contaminant detected. | Remedial Investigation Report Operable Unit 6 Sites ST22, OT26 Volume 1 Text |
| 6 | OU 6 | | 1989 | Remedial Investigation | A soil gas investigation was performed along the Perimeter Road by Radian and included an approximately one-mile stretch along Hill AFB's northern boundary through what is now known as OU 6. Results indicated elevated VOC concentrations east and northeast of the Waste Asphalt Pile, but show no "significant concentration" (two orders of magnitude above background concentration). | Remedial Investigation Report Operable Unit 6 Sites ST22, OT26 Volume 1 Text |
| 6 | OU 6 | | 1990 | Remedial Investigation | Site evaluation study to determine whether on-Base areas are the source of contaminants (primarily TCE) detected in the off-Base area. Completed between 1990 - 1992, performed by Radian. Detected on-Base TCE concentrations were approximately an order of magnitude lower than off-Base concentrations. No definitive TCE source area identified at the site. Investigators theorized source may consist of several areas of small-scale surface spills. | Remedial Investigation Report Operable Unit 6 Sites ST22, OT26 Volume 1 Text |
| 6 | OU 6 | 4 | 1991 | FFA | Hill AFB entered into a Federal Facilities Agreement with Utah Department of Environmental Quality (UDEQ) and Environmental Protection Agency. Agreement entered on 4/1/1991. | Record of Decision Operable Unit 6 Sites ST022, OT026, SD40B |
| 6 | OU 6 | 10 | 1993 | Remedial Investigation | Two groundwater contaminant plumes identified at the site: one entirely on Base and one extending to the Craigdale subdivision in the off-Base area. The approximate source areas were defined. Risk assessment determined possible future exposures associated with domestic use of groundwater containing TCE and 1,1-dichloroethene (DCE) might pose an unacceptable cancer risk. | Action Memorandum Operable Unit 6 |
| 6 | OU 6 | 7 | 1995 | Remedial Investigation | Conducted 1993-1995. The RI determined the nature and extent of contamination. Identified two groundwater plumes, west plume entirely on-Base, east plume extends off Base. TCE and methylene chloride are the only organic contaminants present in concentrations greater than their maximum contaminant levels (MCLs) for drinking water. The maximum concentration of methylene chloride was 7 ug/L, and results above the MCL were not reproducible. | Remedial Investigation Report Operable Unit 6 Sites ST22, OT26 Volume 2 Appendices |
| 6 | OU 6 | 12 | 1996 | Interim Action | Action Memorandum signed to implement removal action at OU 6. Included: Phase I & II: pump & treat systems in the Craigdale subdivision; Phase III: relining Davis-Weber Canal requires more study; Phase IV: on-Base plume should be contained, type of treatment will be selected after treatability study to evaluate in-situ air sparging/SVE and in-situ UVB technologies; Phase V: delay pump and treat system for northern portion of the off-Base plume until effectiveness of Phase II to IV can be evaluated, monitor TCE concentration in the interim. | Action Memorandum Operable Unit 6 |
| 6 | OU 6 | | 1997 | Post-ROD Study | Hill AFB conducted a treatability study testing the concept of allowing "soil wells" in the suspected source area (Building 2007 and 2008 vicinity) to naturally vent volatilized contaminants to the atmosphere. | Hill AFB. 1998. Five Year Review. September. |
| 6 | OU 6 | 9 | 1998 | Removal Action | July to September 1998. Removal action addressed under the Toxic Substances Control Act. Contaminated soil was excavated and site was backfilled with clean soil. Electrical substation still active. | Interim PCB Contaminated Soil Removal Report for Electrical Substation No. 2 |
| 6 | OU 6 | 9 | 1998 | 1998 Five-Year Review | OU 6 was not reviewed as part of this effort. | Hill AFB Five Year Review. September 1998. |
| 6 | OU 6 | 11 | 2001 | PSVPlan | Performance Standard Verification Plan completed. Documents the long-term monitoring plan for OU 6. | Performance Standard Verification Plan Operable Unit 6 |
| 6 | OU 6 | 9 | 2003 | 2003 Five-Year Review | Remedies at ST022 were considered protective; however, protectiveness at OT26 could not be determined. | Final CERCLA Five-Year Review. September 2003. |
| 6 | OU 6 | 10 | 2006 | Operations and Maintenance | TCE concentrations in Cooley's Spring rebounded to greater than the MCL. Contaminated water from the spring has been treated with a temporary activated carbon treatment system since October 2006 to a concentration of <2.0 µg/L. | Final Explanation of Significant Difference. |
| 6 | OU 6 | | 2006 | Operations and Maintenance | Rehabilitation of PTS occurred. The rehabilitation was performed during the summer months of 2006. | Final System Performance and Baseline Evaluation Report For Support of Operable Unit 6. |
| 6 | OU 6 | 4 | 2007 | Operations and Maintenance | System Performance and Baseline Evaluation completed. Assessed the effectiveness of the groundwater pump and treat systems (PTS) and develop recommendations for system improvements and modifications. | Final System Performance and Baseline Evaluation Report For Support of Operable Unit 6. |

Table OU 6-2

## Chronology of Site Events for Operable Unit 6

*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 6 | OU 6 | 8 | 2007 | Explanation of Significant Difference (ESD) | The ESD addresses: (1) removal of the requirement to treat the extracted groundwater from the off-Base system in an air stripper prior to discharge; and, (2) provides for discharge of water collected in the Cooley's Spring into the existing surface water collection drains for discharge as part of the off-Base system. Currently, LGAC is used to treat this water. There are plans to bypass the LGAC unit by installation of a drain line from the Cooley's Spring U6-303 to Spring U6-305. Also, the ESD removes the requirement to treat water from Cooley's Spring using an air stripper or carbon adsorption. | Explanation of Significant Difference For Operable Unit OU 6 |
| 6 | OT026 | | 1988 | Remedial Investigation | U.S. Air Force conducted water sampling in Craigdale subdivision area and found chlorinated solvents, primarily trichloroethene (TCE), in shallow groundwater and surface water. | Record of Decision Operable Unit 6 Sites ST022, OT026, SD40B |
| 6 | OT026 | | 1993 | Interim Action | Interim actions include alternate irrigation water sources, seep/spring water and groundwater recovery and treatment, alternative groundwater treatment technology evaluation. These actions have been incorporated as part of the final actions. | Hill AFB Environmental Restoration Management Action Plan - 2001 |
| 6 | OT026 | | 1993 | Interim Action | 1993-1996. Provided an alternate source of clean irrigation water to two homes affected by shallow groundwater contamination. Collected and treated contaminated water from springs and field drains, and discharged treated water to a storm drain. Extracted and treated contaminated groundwater in the off-Base area as part of a removal action described in the Action Memorandum | ROD OU 6 Sites ST022, OT026, SD40B |
| 6 | OT026 | 10 | 1994 | Engineering Evaluation/Cost Analysis | The EE/CA proposed to implement remedial action at OU 6 in 5 phases. | Action Memorandum Operable Unit 6 |
| 6 | OT026 | 10 | 1994 | Engineering Evaluation/Cost Analysis | The OU 6 EE/CA (Oct 1994) initiated Phase 2 of the removal action to construct the pump and treat system for the off-base portion of the plume | Hill AFB Five-Year Review, September 1998 |
| 6 | OT026 | 9 | 1996 | Interim Action | Construction of Craigdale PTS was completed under the Action Memorandum (Dec 1996). This was Phase 1 and 2 of the remedial action. Technology used is air stripping. Construction period Aug/1995 – July/1996 | Hill AFB Five-Year Review, September 1998 |
| 6 | OT026 | 10 | 1997 | Record of Decision | ROD signed 10/1/1997. OT026 site requires active treatment, NFRAP for SD40B, natural attenuation for ST022. | Hill AFB Environmental Restoration Management Action Plan - 2001 |
| 6 | OT026 | 12 | 1997 | Remedial Action | The Cooley's Pond Treatment System was originally completed as a removal action under the basewide seeps and springs EE/CA. (Final Basewide Engineering Evaluation/Cost Analysis for Contaminated Seeps and Springs, Hill AFB (Montgomery Watson, 1994). This treatment system has been modified over time to improve efficiency. Initially, a carbon adsorption system, housed in a separate shed, was used to treat water from the Cooley's Spring U6-303 and treated water was discharged to the pond. An air stripper, housed in a separate locked building, was used to treat the pond water and the treated water was discharged to the pond drain pipe. Resident complained about the noise. In 1998, a quieter air stripper was installed and the building was heavily insulated. To further reduce noise, system operation was changed from 24 hours to 16 hours per day. | Hill AFB Five-Year Review, September 1998 |
| 6 | OT026 | 3 | 1998 | Remedial Design | Design of the On-Base pump and treat system. | Hill AFB Environmental Restoration Management Action Plan - 2001 |
| 6 | OT026 | 6 | 1999 | Remedial Action | Construction of the On-Base pump and treat system with 6 extraction wells and one air stripper. | FYR Site List |
| 6 | OT026 | 7 | 1999 | Operations and Maintenance | The Davis-Weber Canal failed downstream (west, northwest) from where the OU 6 east plume crosses to the Cooley and Craigdale systems. The systems were not impacted by the failure. | Mark Loucks, Personal Communication 3/18/03, Davis-Weber Canal Information |
| 6 | OT026 | 6 | 2000 | Remedial Action | The Davis-Weber Canal was relined. This corresponds to Phase III of the removal action. The canal company constructed an enclosed concrete culvert from a point east of the OU 6 plume to a point west of the plume. | Oscar Torres, Personal communication 1/30/2003, Davis-Weber Canal Information |
| 6 | OT026 | 11 | 2000 | Operations and Maintenance | The Cooley's residence house burned on 11/18/2000 and was not rebuilt. Garage remains and still in use as of 2003. Water collected in the foundation drain was piped to Cooley's seep, which was piped to the Craigdale system. The foundation drain was destroyed when the house burned. | 2008 FYR Interview with Oscar Torres |
| 6 | OT026 | 8 | 2002 | Operations and Maintenance | Air stripper at Cooly's Pond was taken off-line, but monthly groundwater sampling continues. Garage sump and air stripper influent TCE concentrations remained below the MCL of 5.0 ug/L in August, November, and December 2002.<br>Basis for shutdown: In 2002, Air stripper influent TCE levels were not detectable in May, June, and August, while in February, March, and July TCE levels were 0.7 ug/L or lower. April had the highest concentration of 1.50 ug/L of TCE. | Operable Unit 6 Cooley's Pond Treatment System Monthly Operation Summary, January - August 2002 |
| 6 | OT026 | 11 | 2002 | Operations and Maintenance | Craigdale air stripper bypassed. System now extracts groundwater and discharges to the storm drain. After the storm drain was completely lined in fall 2001, the discharge limit was governed by the Surface Water Quality Protection rule (R317-2-14, Table 2.14.6) instead of the Groundwater Quality Protection rule (R317-6-4). The TCE discharge limit for the Craigdale treatment system was changed from 1/4 MCL (1.25 ug/L) to 81 ug/L. Acceptance by regulatory agencies was given on 9/26/2002. | 2008 FYR 'Interview with Oscar Torres |

Table OU 6-2

## Chronology of Site Events for Operable Unit 6

*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 6 | OT026 | | 2005 | Operations and Maintenance | Air strippers decommissioned because TCE concentrations were less than action levels. | Environmental Restoration Management Action Plan For 2007, Hill Air Force Base, Utah. |
| 6 | SD40B | | 1962 | Historical Operations | The Building 1946 Evaporation pond held waste water from the propellant testing laboratory between 1962 and 1992. | RI Report OU 6 Sites ST22, OT26 Volume 1 Text |
| 6 | SD40B | | 1993 | Remedial Investigation | Preliminary assessment/site investigation of Building 1946 evaporation pond was performed by ERM-Rocky Mountain, Inc. Concluded that past discharges to the evaporation pond have deposited some explosives in the surface soils and sediments within the dimensions of the pond and low levels of TCA in the shallow groundwater. | Remedial Investigation Report Operable Unit 6 Sites ST22, OT26 Volume 1 Text |
| 6 | ST022 | | 1950 | Historical Operations | Contamination was introduced at the drainfield between the late 1950s and mid-1985. Building 1915 was used to test Bomarc missile ramjet packages, which are the missiles' fuel delivery system. The drain field received flow from floor drains in Building 1915, and the former locations of a fuel tank and a waste fuel tank which were located between 65 and 95 feet north of the building. | Remedial Investigation (RI) Report OU 6 Sites ST22, OT26 Volume 1 Text |
| 6 | ST022 | | 1988 | Remedial Investigation | Site Evaluation of Building 1915 Area and Roy Gate Pond performed. TPH found in soils at the former site of an underground fuel storage tank. No contamination observed in solids around location of former subsurface drain field. Following sediment and surface water sampling, no further action recommended at Roy Gate Pond. Report: Chen-Northern, Inc. 1989. Building 1915 Site Evaluation Report, Hill Air Force Base, Ogden, Utah. | Remedial Investigation Report Operable Unit 6 Sites ST22, OT26 Volume 1 Text |

**Notes**

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|---|---|
| AFB | Air Force Base |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| DCE | dichloroethene |
| EE/CA | Engineering Evaluation/Cost Analysis |
| EPA | United States Environmental Protection Agency |
| ESD | explanation of significant difference |
| MCL | maximum contaminant level |
| NPL | National Priorities List |
| O&M | Operations and Maintenance |
| OU | Operable Unit |
| PSVPlan | Performance Standard Verification Plan |
| PTS | pump and treat system |
| RI | remedial investigation |
| ROD | Record of Decision |
| SVE | soil vapor extraction |
| TCE | trichloroethene |
| UDEQ | Utah Department of Environmental Quality |
| ug/L | microgram per liter |
| VOC | volatile organic compounds |

Table OU 6-3

## Progress Since Last Five Year Review - Status of Recommendations and Follow-Up Actions at OU 6

*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Site | 2003 Five-Year Review Recommendations | Current Status | Carry Over to Next FYR? |
|---|---|---|---|
| ST022 and OT026 (east and west groundwater plumes) | Continue the long-term monitoring plan as described in the Performance Standard Verification Plan (PSVPlan). Monitoring at Cooley's Pond could be reduced if data indicate surface water is not being affected by contaminated groundwater. | **Ongoing.** The long-term monitoring plan has been updated based on Phase I site verification fieldwork (2006) presented in Updated Plume Map and Groundwater Monitoring Recommendations for Operable Unit (OU) 6 (**MWH, 2007b**). Treatment systems evaluation results are reported in System Performance and Baseline Evaluation Report for Support of OU 6 (**AEEC, 2007a**). The Cooley's Spring activated carbon treatment system was installed in October 2006 because trichloroethylene (TCE) concentrations at Cooley's Spring increased to over the Maximum Contaminant Level (MCL) (**Hill AFB CEVR, 2006**). Consequently, reduced monitoring should not be implemented in the immediate future as concentrations in samples from this spring and Cooley's Pond here are good indicators of system performance. | No |
| | Continuing sampling to monitor plume stability and evaluate long-term data to determine if the remedy is preventing plume migration, determine the remedial progress, and update the estimated remedial timeframe | **Ongoing.** Much additional work has been conducted to determine the extent of the plume and plume stability. Efforts include a system performance and baseline evaluation **(AEEC, 2007a) a**nd an updated contaminant plume map **(MWH, 2007b).** Much progress has been made in understanding the plume boundaries but additional monitoring wells were recommended for installation to monitor the edges of the plume **(MWH, 2007b).** Well installation locations are presented in the Final Field Investigation Work Plan **(MWH. 2007a).** | Yes |
| | Evaluating the need for active treatment in the northern arm of the off-Base contamination plume, as required by the Record of Decision (ROD). | **In Progress.** The OU 6 TCE contaminant plume map was updated in 2007 along with groundwater monitoring recommendations (**MWH, 2007b**). The north arm is now considered part of the main plume (**CH2M HILL, 2007a**). In 2008, after completion of additional phases of investigation, an update to the conceptual site model and risk assessment will be completed. In addition, a ROD amendment and/or an Explanation of Significant Differences (ESD) may be completed in 2008 (**MWH, 2007c**). Active remediation of the northern arm of the plume should be evaluated as part of the ESD or ROD amendment. | Yes |
| | Continuing operation and maintenance (O&M) of the extraction and discharge components of the off-Base system and discontinuing anti-scaling addition in the off line stripper | **Complete.** Operation and maintenance activities are conducted as required by the Craigdale O&M Plan (**HILL AFB CEVR, 2007c**). Based on a review of this plan, no indication of the addition of anti-scaling agents is recommended | No |
| | Continuing O&M of the extraction and discharge components of the on-Base system and evaluating the treatment system to determine why target levels at the extraction wells have not been achieved | **Complete.** Operation and maintenance activities are conducted as required by the On-Base O&M Plan (**Hill AFB CEVR, 2007d**). Target water levels at extraction wells were not achieved due to reduced system function as a result of fouling (**Hill AFB CEVR, 2007d**). The system was rehabilitated in 2006 and system performance has improved significantly. Based on an interview with the AEEC O&M contractors (**CH2M HILL, 2007b**), target water levels are now met and new pumps were installed in the wells to increase pumping rates and achieve target drawdown. | No |
| | Developing a long-term maintenance strategy to monitor bio-fouling at the extraction wells and to ensure that adequate treatment is implemented | **Ongoing.** Plans written to address this issue include "Methods and Procedures for Evaluating Specific Capacity for Extraction Wells December 2005" and "Procedures for Chemical and Mechanical Redevelopment of Extraction Wells January 2006". Both reports were prepared by MWH. In addition, on-Base treatment system evaluation results are reported in System Performance and Baseline Evaluation Report (**AEEC, 2007a**). This information has not been included in the PSVReport. | Yes |
| | Continuing all Institutional Controls (ICs) and perform routine inspection of locks, fences, and treatment facilities | **Complete.** Conducted per requirements of the ROD and reported annually in the Land Use Controls Report (**Hill AFB CEVR, 2007a**). | No |
| | Re-evaluating all indoor air data, and if necessary, obtain additional air samples, to determine if the new action level for TCE (0.43 ppbv) in indoor air would warrant additional mitigation measures in off-Base residential areas. If additional indoor air samples are needed, they should be collected during winter months when vapor intrusion will reach its maximum. | **Complete.** The Basewide Indoor Air Program currently uses this updated action level to assess risk based on exposure to TCE in indoor air. Since 2000, 53 homes have had air testing performed and four have had vapor removal systems installed (**SES, 2006**, and **MWH, 2005**). Additional air sampling efforts may be required, however, after the plume is fully delineated. | No |
| | Human health risks should be re-evaluated at Operable Units (OUs) 1 through 8. | **Ongoing.** Human health risks were re-evaluated in a recent technical memorandum (**Hill AFB CEVR and SES, 2007**). Based on this evaluation, no actions are currently recommended at OU 6. However, a review of toxicity values and remediation goals indicated that more stringent toxicity factors for arsenic and newly issued toxicity factors for 2-methylnaphthalene may affect cleanup levels by becoming more stringent. However, toxicity factors for alpha-BHC (Reference Dose), bis(2-ethylhexyl)phthalate (Slope Factor - SF), chloroform (SF), chloromethane (SF), and 1,1-dichloroethene (SF) have been withdrawn resulting in the cleanup levels listed in the ROD for these compounds to be overprotective. While toxicity values and remediation goals have changed, the remedy is still considered protective due to the enforcement of ICs and the incomplete exposure pathways. | Yes |

**Notes**
AFB = Air Force Base
IC = institutional control
ESD = explanation of significant difference
FYR = Five-Year Review
MCL = maximum contaminant level
O&M = operation and maintenance
OU = operable unit
PSVPlan = Performance Standard Verification
ROD = Record of Decision
TCE = trichloroethylene

Table OU 6-4
## Operable Unit 6
## Five-Year Review Process

Reviewer: Kelly Taylor

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| **Introduction** | This 2008 five-year review for Hill AFB has been conducted in accordance with the EPA's Comprehensive Five-Year Review Guidance dated June 2001 (**EPA, 2001**). Administrative and community involvement components of the five-year review are described in **Section 2.0** of this report for the overall five-year review. In addition, interviews were conducted with relevant parties. A site inspection of OU 6 was performed. Relevant site documents and applicable data covering the period of five-year review were evaluated. The site interviews, site inspection, and data review are further discussed in the following sections. |
| **Interviews** | Interviews for OU 6 were conducted with Mark Roginske/75 CEG/CEVR, Oscar Torres/75 CEG/CEVR, Steve Parkinson/ O&M contractor with AEEC, and Brad Thein/ O&M contractor for AEEC. Copies of the Interview Record Forms are provided in **Appendix D**.<br><br>Mark Roginske and Oscar Torres were interviewed on September 26, 2007. The interviewees indicated that there have been significant improvements in mass removal and flow rate increases since August 2006 when the system was rehabilitated. Prior to rehabilitation of the system, fouling was a significant issue. Addressing fouling in the wells has been included as a standard operating procedure (SOP) in the O&M Manual. The PSVPlan is still not at the level necessary to monitor this, and it will need to be modified in 2008.<br><br>The interviewees also noted that there were noticeable increases in TCE concentrations in Cooley's spring since the 2003 five-year review. These increases led to the thought that containment had been lost at the on-Base system. The overall result is that there have been improvements in operation of the OU 6 system, but it may require the installation of additional extraction wells. The plume boundaries are not well understood but are being looked at based on recommendations from the 2003 five-year review to the north arm of the plume. Additional verification work has been performed and is currently being finished up. The north arm of the plume was eliminated as a separate plume through this additional verification work. The plume is now known to be one continuous plume. This was not unexpected. Groundwater contamination has been found to extend farther to the south in the Source Area (2000 Area). There are plans to further evaluate the Source Area in 2010. There are also community concerns related to planned development offsite. The concern is that if trees are removed, this may result in more seeps and springs flowing and cause migration of the contamination. Hill AFB will be responsible for managing the contaminants, but the developer will be responsible for monitoring the water. No neighbors are alarmed, and everyone seems pleased with what Hill AFB is doing.<br><br>Steve Parkinson and Brad Thein of AEEC were also interviewed on September 26, 2007. They indicated that there have been monumental improvements in the operations since the last five-year review, and the remedy is performing as expected though the system is still in the verification stage after the O&M improvements that were implemented in 2006. Flow rates and mass removal have been increased through maintenance improvements and well rehabilitations. There have been improvements in pump operations, and a phone callout system has been installed to notify operators when the system shuts down. Additionally, the LGAC system was installed to treat the water from Cooley's seep instead of using air stripping. Continued remedial operations at the |

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| | site have had positive effects. Operations of the off-Base system have improved and flow and concentrations in the Cooley's Spring have decreased.<br><br>Community interviews were also conducted as part of this five-year review. Interviews were conducted with Mr. Lynn Moulding/Riverdale City and Community RAB representative, and Ms. Pat Crezee/Riverdale resident Copies of the Interview Record Forms are provided in **Appendix B.**<br><br>Mr. Lynn Moulding indicated that he thinks that Hill AFB has done a good job in identifying problem areas and setting forth a remedial action to deal with the problems. He also noted that it is evident that Hill AFB is monitoring the plumes in Riverdale and maintaining the system that has been put into place, and that between the newsletter and other media, there is ample opportunity for the community to educate themselves. He said that EMR has done a great job and has always addressed all his concerns.<br><br>Ms. Pat Crezee was interviewed on December 13, 2007. She indicated that she is pleased with the cleanup effort and feels well informed. She also indicated that her neighbor was curious about drilling operations that had been started but abandoned, about the variation in contaminant concentrations in a well near her house from one event to the next, and about development of the hillside behind 1200 West. Ms. Crezee said she felt that Hill AFB has been responsible in getting information out and suggested that they distribute the RAB Web site address at the upcoming Riverdale InfoFair. She felt the indoor air program would be better if all residents participated. Overall, Hill AFB has always addressed all her concerns and been responsive. She said that she and the neighbors are concerned, however, about the contaminated groundwater coming to the surface and/or entering the neighborhood below when homes are built behind them on the hillside. |
| **Site Inspection** | The site inspection for OU 6 was conducted on September 26, 2007. The completed site inspection checklist is provided in **Appendix E**.<br><br>Based on the site inspection, the site appears to be well maintained with the exception of structures associated with Cooley's Spring, which are privately owned and not maintained by HAFB. Buildings owned or maintained by Hill AFB are in good condition. Fencing at the on-Base pump and treat system is in good condition, with the exception of one fence around a well that has been recently damaged by landfill operations equipment. Onsite O&M staff indicated that this happens occasionally, and that the fencing will be repaired. The infiltration gallery fence and fence around the off-Base air stripper plant was in good condition. The fencing around Cooley's Pond was in poor condition. Cooley's Garage, where the spring is located, is in poor condition; the back room, where the spring collection system is located, is not stable. The O&M contractor had to shore up the ceiling to maintain the safety of this room. All monitoring wells that were inspected appeared to be in good condition. All extraction wells that were inspected inside the vaults were in good condition. The pump in well U6-227 requires frequent replacement. The vault for U6-225 contains sediment in the bottom. Some vaults required holes to be drilled in the bottom to allow water to drain out of the vault. Vault 1 (leak detection vault) frequently fills with surface water and requires pumping. Several vault lids associated with the north line of extraction wells at the on-Base system need seals in the lid tops.<br><br>The site inspection checklist addressed four discussion topics. These discussion topics are presented below, followed by responses and general observations based on the site inspection.<br><br>(1) Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.). |

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| | The OU 6 remedy was to achieve two remediation goals for contaminated groundwater, surface water, and soils. The remediation goal for groundwater and surface water is to restore groundwater, seeps, springs, and Cooley's Pond to TCE concentrations less than the MCL. The remediation goal for soil is to prevent human exposures to 1,1-DCE in subsurface soil that lead to a total excess cancer risk greater than $1x10^{-6}$. This risk corresponds to a 1,1-DCE concentration in soil of 26 µg/kg or less.<br><br>The east groundwater plume is addressed through operation of an on-Base and off-Base pump and treat system. Off-Base surface water is collected. The Cooley's Spring is treated using an LGAC system and discharged to the pond. Other field drains and seeps are collected and discharged into the off-Base P&T system. Groundwater extracted from the off-Base pump and treat system is discharged directly to the City of Riverdale storm sewer and bypasses the existing air stripper. The air stripper remains onsite. The on-Base system extracts groundwater, treats it in an air stripper, and discharges the water through an upgradient drain field. The west groundwater plume is completely contained on-Base and is being addressed through natural attenuation. Institutional controls are in place to restrict the use of contaminated groundwater at OU 6. The groundwater plumes are monitored as part of the basewide groundwater monitoring program.<br><br>Institutional controls, in the form of signs and land use controls have been implemented to restrict future access to contaminated soils at OU 6.<br><br>Indoor air sampling and vapor mitigation is performed under the basewide indoor air program. The ROD for OU 6 does not specifically address indoor air issues.<br><br>An ESD for OU 6 has been signed. The ESD addresses: (1) removal of the requirement to treat the extracted groundwater from the off-Base system in an air stripper prior to discharge; and, (2) provides for discharge of water collected in the Spring U6-303 into the existing surface water collection drains for discharge as part of the off-Base system. Currently, LGAC is used to treat this water. There are plans to bypass the LGAC unit by installation of a drain line from the Spring U6-303 to Spring U6-305. Also, the ESD removes the requirement to treat water from Spring U6-303 using an air stripper or carbon adsorption.<br><br>OU 6 has had numerous operational issues, especially related to O&M of the on-Base system. Additional investigation efforts into the groundwater conditions existing at OU 6 have been and are currently being performed to provide an updated CSM for the site. As a result of this work, it was determined that the on-Base system was most likely not completely capturing the east plume at the site boundary. This resulted in the increase in TCE concentrations in the Spring U6-303 and the need to reinstitute treatment at this location (concentrations in the spring had decreased to below the MCL). In addition, wells and piping at the on-Base system had suffered from fouling and efficiency problems. The O&M contractor and CEVR staff have worked diligently in 2006 and 2007 to resolve these issues and implement changes and improvements to O&M of the on-Base system.<br><br>Based on the site inspection, all components of the remedy appear to be functioning as designed.<br><br>(2) Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.<br><br>Operation and maintenance at the site includes maintenance of the on-Base and off-Base pump and treat systems and the Spring U6-303 System, LTM of the site |

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| | groundwater, and water level monitoring. Extracted water from the off-Base System and surface water collection systems is discharged directly to the storm sewer. The Spring U6-303 system discharges to the pond. The on-Base system treated water is discharged via a drain field back into the aquifer up-gradient of the system. The effluent is monitored to ensure that the discharge criteria are met. Proper inspection and maintenance procedures are in place and implemented to ensure the integrity of the remedy and to ensure the enforcement of ICs (groundwater use restrictions, land use restrictions on-site, integrity of fencing, and signage).<br><br>(3) Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.<br><br>There are some indications that the East Plume is not completely captured by the on-Base System. The CEVR and the O&M contractor have worked to optimize the system to improve performance. Additional site investigation work is being performed to better understand the CSM at OU 6 as well as plume extent. The north arm of the off-Base plume has been verified to be a part of the plume as a whole. It was anticipated that this arm would attenuate over time, which has not occurred. After investigations are completed, plans will be made to address these issues. The effect of the drain field on aquifer conditions is not well understood.<br><br>(4) Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.<br><br>Operation and maintenance contractors make recommendations to optimize performance and/or reduce costs. Various improvements to overall system performance, especially the on-Base System, have been made. Changes are also ongoing. The off-Base air stripper was taken offline near the beginning of the five-year review period. Several components that were still operating, including an air compressor, have been removed from operation also. These activities have worked to reduce costs and/or improve overall system performance. |
| **Data Review** | The data reviewed as part of the 2008 five-year review included groundwater sampling, water level data, effluent sampling, capture zone data, and soil data. Groundwater sampling to evaluate the on-Base pump and treat system is conducted semiannually at 11 monitoring wells and biennially at 6 extraction wells. The depth to groundwater is measured on a monthly basis from 6 extraction wells, 33 monitoring wells, and 15 piezometers at the OU 6 on-Base system. Effluent concentrations from the on-Base system are measured monthly at U6-907. Groundwater sampling to evaluate Craigdale pump and treat system performance was conducted at 15 locations semiannually during the review period while field drain U6-606 was sampled annually to determine if treatment in Craigdale pump and treat system is required. Sampling at the storm water outfall (U6-905) was discontinued in 2005. Water from Cooley's Spring (U6-303) was sampled quarterly and pond water (U6-401) and effluent from the treatment system (U6-402) were sampled monthly so system parameters could be optimized continuously. However, sampling at U6-402 was stopped after the air strippers were abandoned. Soil data were collected at the on-Base MAMS II area to evaluate an area that appeared to contain incinerated debris.<br><br>The ROD established remediation goals for groundwater, surface water, and soils at OU 6. For groundwater, the remediation goals were set at the MCLs established under the SDWA and the UDEQ. Remediation goals for 1,1-DCE in soil were risk-based. Remediation goals and discharge limits are presented in **Tables OU 6-5** and **OU 6-6**. |

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| | Groundwater data collected to assess the source area from 2003 through 2007 indicate that TCE is remaining stable or decreasing. This suggests that the source area is not a continuing source to the groundwater plume.<br><br>Data from 2003 through 2007 were reviewed for the on-Base pump and treat system. TCE concentrations in monitoring wells generally remained stable or decreased. The treated effluent from the discharge of the air stripper was sampled monthly for TCE concentrations during the review period with the exception of during rehabilitation efforts. Effluent from the on-Base system (U6-907) is discharged to shallow groundwater and was continually below the limit of 1.25 µg/L. Since the rehabilitation, TCE concentrations in the influent were removed by the air stripper with 100 percent efficiency and the effluent TCE concentrations were non-detect. TCE concentrations from extraction wells U6-225 and U6-226 had decreased to historically low levels in 2002; however, in 2005 and 2006 TCE concentrations increased. Groundwater elevation monitoring results indicate that the dominant groundwater flow direction at OU 6 on-Base is to the north/northwest, trending to the northeast at the northern edge of the Hill AFB property. Based on the current monitoring data, the on-Base pump and treat system has been successful at reducing concentrations and therefore capturing and preventing plume migration off-Base along the eastern and center portions of the plume. However, uncertainty exists as to the extent of plume containment along the western edge of the plume.<br><br>Monitoring data associated with the Craigdale pump and treat system were reviewed. In general, TCE concentrations in groundwater were found to be stable or decreasing. However, TCE concentrations in extraction well U6-224 appear to be increasing slightly over historical concentrations and have exceeded the MCL during the last three sampling events. Concentrations of TCE in Extraction Wells U6-212, U6-213, and U6-215 have decreased during the review period while TCE concentrations in U6-221 and U6-223 have remained stable. Drain Field U6-606 was evaluated, and TCE concentrations were non-detect during the review period. Samples collected downgradient of the PTS from U6-025 and U6-026 were either non-detect or contained TCE at concentrations less than MCLs. The TCE concentration in residential sump U6-610 has decreased from 106 µg/L in 1994 to 24.90 µg/L in 2006. Extracted water from the Craigdale system meets the discharge criteria for the Weber River prior to treatment. This water is discharged to the City of Riverdale storm sewer, which flows to the Weber River. Groundwater elevation monitoring results indicate that the dominant groundwater flow direction at OU 6 off-Base is to the east/northeast. Based on the current monitoring data, the off-Base Craigdale pump and treat system has been successful at reducing concentrations and therefore capturing and preventing plume migration to currently unaffected residents along the currently understood eastern and center portions of the plume. The continued area of concern is along the northwestern edge of the plume where plume containment is of low certainty and TCE concentrations are highest.<br><br>Monitoring data associated with the Cooley's Pond Treatment System were reviewed. The Cooley's Spring effluent (U6-303) continues to exceed the MCL, with a recent concentration of 22 µg/L in June 2007 though during the review period it was consistently less than the Weber River discharge limits (**Table OU 6-6**). Trichloroethene concentrations in the spring during the review period were consistently increasing and indicated that the on-Base system was not achieving containment prior to rehabilitation efforts in August 2006. Pond water (U6-401) generally contained TCE concentrations that were less than MCLs, though samples collected in March and July of 2006 exceeded MCLs. No samples collected since the rehabilitation efforts have exceeded MCLs, suggesting that the rehabilitation efforts have improved system function. |

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| | A review of soil data collected at MAMS II area in June 2006 indicate that soils contained SVOCs at trace levels and elevated metals, in particular arsenic, lead, barium, chromium, cadmium, and silver. Arsenic was the only analyte to exceed its respective RBC though RBCs were not available for all analytes, specifically lead (**CH2M HILL, 2006)**. It should be noted, however, that the arsenic background for Hill AFB is elevated (**CH2M HILL, 2001**) and this may not indicate the presence of site-related contamination. No additional evaluation was conducted. |

Table OU 6-5

# Chemicals of Concern and Remediation Goals at OU 6

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Media | Chemical of Concern | Remediation Goal | Units |
|---|---|---|---|
| Groundwater/Seeps and Springs | Trichloroethene | 5 | µg/L |
| Soil | 1,1-Dichloroethene* | 0.026 | mg/kg |

**Notes:**

* Remediation goals for these chemicals are risk-based levels
the concentration for ground and surface water are maximum
contaminated levels (MCLs) established under the Safe Drinking Water Act and/or Utah Primary
Drinking Water Standards
µg/L = micrograms per liter
mg/kg = milligrams per kilogram

Table OU 6-6
OU 6 Off-Base and On-Base System Effluent Discharge Limits for Discharge to the Weber River
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Analyte | Discharge Limit | Units |
|---|---|---|
| *Off-Base Discharge to Weber River* | | |
| TCE | 30 | µg/L |
| *On-Base Discharge to Shallow Groundwater* | | |
| TCE | 1.25 | µg/L |

**Notes:**
µg/L = micrograms per liter

Table OU 6-7
# Operable Unit 6
# Five-Year Review Technical Assessment

Reviewer: Kelly Taylor

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| **Introduction** | The five-year review must determine whether the remedy at a site is protective of human health and the environment. The EPA guidance describes three questions used to provide a framework for organizing and evaluating data and information and to ensure all relevant issues are considered when determining the protectiveness of a remedy (**EPA, 2001**). These questions are assessed for OU 6 in the following sections. The implementation of ICs is also described. At the end of this table is a summary of the technical assessment. |
| **Question A.** | **Is the remedy functioning as intended by the decision documents?**<br><br>Yes. The documents that detail the remedial decisions for OU 6 are the 1997 *Record of Decision* (**Radian, 1997**) and the 2007 *Explanation of Significant Difference* (**Hill AFB CEVR, 2007a**). The components of the remedy have been implemented and the site is now undergoing O&M.<br><br>An ESD for OU 6 has been signed. The ESD addresses: (1) removal of the requirement to treat the extracted groundwater from the off-Base system in an air stripper prior to discharge; and, (2) provides for discharge of water collected in the Cooley's Spring into the existing surface water collection drains for discharge as part of the off-Base system. Currently, LGAC is used to treat this water. There are plans to bypass the LGAC unit by installation of a drain line from the Cooley's Spring U6-303 to Spring U6-305. Also, the ESD removes the requirement to treat water from Cooley's Spring using an air stripper or carbon adsorption.<br><br>OT026: Based on interviews and data and document review, the on- and off-Base pump and treat systems are thought to be performing as intended by the ROD, though the on-Base pump and treat systems is still in the verification stage since system improvements were implemented in 2006. There is some uncertainty in the efficiency of system capture for both the on- and off-Base systems, though this is being further evaluated. In August 2005, containment of the on-Base system was thought to be lost because TCE concentrations were detected above MCLs at Spring U6-303. Prior to August 2005, TCE concentrations at U6-303 were below MCLs since October 2002. As a result the on-Base system was rehabilitated in 2006. According to an interview with Mark Roginske and Oscar Torres of CEVR, the on-Base system may require the installation of additional extraction wells to contain the OU 6 plume on-Base. In addition, the full extent of the east plume in some areas is undefined, both on- and off-Base. Natural attenuation, the selected remedy for the north arm (which is now understood to be continuous with the main plume), does not appear to be occurring. Investigations to assess these issues are ongoing. These issues, however, are not thought to impact protectiveness in the short term based on the enforcement of ICs.<br><br>ST022: Data from the west plume indicate that natural attenuation is occurring.<br><br><u>Opportunities for Optimization:</u><br><br>Operation and maintenance contractors make recommendations to optimize performance and/or reduce costs. Various improvements to overall system performance, especially the on-Base system, have been made. Changes are also ongoing. The off-Base air stripper was taken offline near the beginning of the five-year review period. Several components that were still operating, including an air compressor, have been removed from operation also. These activities have worked to reduce costs and/or improve overall system performance. Additional opportunities for optimization will be evaluated once current and future investigations are complete. |

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| | Early Indicators of Potential Remedy Problems:<br><br>There are some indications that the East Plume is not completely captured by the on-Base System. The CEVR and the O&M contractor have worked to optimize the system to improve performance. Additional site investigation work is being performed to better understand the conceptual site model at OU 6 as well as plume extent. The north arm of the off-Base plume has been verified to be a part of the plume as a whole. It was anticipated that this arm would attenuate over time, which has not occurred. After investigations are completed, plans will be made to address these issues. The effect of the drain field on aquifer conditions is not well understood but is being investigated. |
| **Question B.** | **Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?**<br><br>Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics:<br><br>No. More stringent toxicity factors for arsenic and newly issued toxicity factors for 2-methylnaphthalene may affect cleanup levels by becoming more stringent. However, toxicity factors for alpha-BHC (Reference Dose), bis(2-ethylhexyl)phthalate (Slope Factor [SF]), chloroform (SF), chloromethane (SF), and 1,1-dichloroethene (SF) have been withdrawn resulting in the cleanup levels listed in the ROD for these compounds to be overprotective.<br><br>Changes in Applicable or Relevant and Appropriate Requirements:<br><br>The ARARs for this OU were identified in the ROD. Chemical-specific, action-specific, and location-specific ARARs were reviewed and were all determined to be either applicable or relevant and appropriate as presented in **Appendix G**. |
| **Question C.** | **Has any other information come to light that could call into question the protectiveness of the remedy?**<br><br>Yes. The extent of the east plume is not completely understood at this point and containment of the plume both on- and off-Base is uncertain. Additionally, a private developer does have plans to develop residences in the area around Cooley's Pond but will grant the Air Force an easement to re-route the Cooley's Spring contaminated water to the off-Base groundwater pump and treat system. The pond will be removed as part of the development. However, this change in land use should not affect protectiveness of the remedy as water use restrictions will continue to be in place. |
| **Institutional Controls** | Institutional controls are generally defined as non-engineered instruments such as administrative and legal tools that do not involve construction or physically changing the site, and that help minimize the potential for human exposure to contamination and/or protect the integrity of a remedy by limiting land and/or resource use (**EPA, 2005**). Institutional controls can be used for many reasons including restriction of site use, modifying behavior, and providing information to people (**EPA, 2000**). Institutional controls may include deed notices, easements, covenants, restrictions, or other conditions on deeds, and/or groundwater and/or land use restriction documents (**EPA, 2001**). The following paragraphs describe ICs implemented at OU 6, the potential affect of future land use plans on ICs, and any plans for changes to site contamination status.<br><br>Types of ICs in Place at the Site:<br><br>Institutional controls currently required by the ROD at OU 6 include LTM of the contaminated subsurface soil, deed restrictions for Hill AFB property, and water rights restrictions, to prevent access to contaminated groundwater and soil.<br><br>Access and institutional controls are currently in place at OU 6. Based on the site inspection, all ICs were implemented as required and fencing at the on-Base P&T System is in good condition, |

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| | with the exception of one fence around a well that has been recently damaged by landfill operations equipment. On-site O&M staff indicated that this happens occasionally, and that the fencing will be repaired. The infiltration gallery fence was also in good condition. Fence around the off-Base air stripper plant was in good condition. The fencing around Cooley's Pond was in poor condition, but it does not appear that this fence is maintained by Hill AFB.<br><br>Hill AFB performs an annual evaluation of the ICs in place for the Base as discussed in **Section 2**. This includes verification of orders, leases, groundwater use restrictions, and inspections of signage, fences, and monitoring wells. An annual land use controls report is prepared documenting the results of this work (**Hill AFB CEVR, 2007b**). Based on this review it was recommended that the contact information in signs be updated. During the site inspection, O&M staff indicated that the signs were recently updated.<br><br>Effects of Future Land Use Plans on ICs:<br><br>A private developer does have plans to develop residences in the area around Cooley's Pond. The pond will be removed as part of this development and the water from Cooley's Spring will be rerouted to the off-Base pump and treat system. Consequently, the proposed development should not impact ICs. However, there are some community concerns related to the planned development. The concern is that if trees are removed, this may result in more seeps and springs flowing and cause migration of the contamination. Hill AFB will be responsible for managing the contaminants, but the developer will be responsible for managing the water. If this occurs, additional ICs may be needed in this area.<br><br>Plans for Changes to Site Contamination Status:<br><br>No changes to site contaminant status are anticipated in the near future. |
| **Summary of the Technical Assessment** | The technical assessment, based on the data review, site inspection, technical evaluation, and interviews indicates that the remedial actions selected for the OU 6 generally appear to have been implemented as intended by the decision documents. However, it is unclear at this time if the on-Base system is achieving containment as the system is still in the verification stages after system enhancements in 2006. Additionally, the full extent of the on- and off-Base portions of the east plume and the containment of these plumes is not entirely understood. Additional investigations are being conducted to investigate these plumes. However, because ICs are in place, the remedy is considered protective in the short-term. Natural attenuation of the west plume appears to be occurring based on a review of groundwater monitoring data, and the remedy for this plume appears to be working. |

Table OU 6-8
# Operable Unit 6
# Technical Assessment Summary for OU 6

Reviewer: Kelly Taylor

| Site ID | Remedy Description | Technical Assessment* | | | Protectiveness | Next Five-Year Review |
|---|---|---|---|---|---|---|
| | | Question A | Question B | Question C | | |
| OT026 | Extraction and air stripping | Yes | No | Yes | Protective in the short-term. | 2013 |
| SD40B | Not required, No Further Response Action Planned (NFRAP) | NA | NA | NA | NA | NA |
| ST022 | Natural attenuation | Yes | No | No | Protective | 2013 |
| OU 6 | Extraction and air stripping and natural attenuation | Yes | No | Yes | Protective in the short-term. | 2013 |

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

NA = Not applicable because the site is designated Applicable or Relevant and Appropriate Requirements
Applicable or Relevant and Appropriate Requirements

Table OU 6-9
## Operable Unit 6
## Five-Year Review Issues, Recommendations and Follow-Up Actions, and Protectiveness Statement

Reviewer: Kelly Taylor

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| **Issues** | Operation and maintenance activities are ongoing at OU 6. Based on the document review, data review, site inspection, interviews, and the technical assessment, the effectiveness of the remedy cannot be determined at this time, though the remedies appear to be functioning as intended by the decision document. However, based on the enforcement of ICs the remedy is protective in the short term. To ensure continued protectiveness, 10 issues are identified in the 2008 five-year review for OU 6, as described below. These issues do not currently affect the protectiveness of the remedy in the short term, although they need to be addressed to ensure continued protectiveness.<br><br>1) As recommended in the 2003 five-year review, additional work was conducted to investigate plume boundaries; however, plume boundaries in some areas of the on- and off-Base plumes remain undefined, and plume containment is uncertain. Recent investigation work has been conducted in an attempt to delineate the plume boundaries and additional work may be required.<br><br>2) The on-Base pump and treat system was rehabilitated in June 2006 after it was determined that fouling was causing serious performance issues and on-Base containment of contaminated groundwater was compromised. System function has improved significantly since the rehabilitation effort, but a routine process for evaluating and insuring that fouling is not impacting system performance has not yet been incorporated into the PSVPlan (scheduled for 2008).<br><br>3) The north arm of the east plume has now been found to be continuous with the east plume and is not a separate plume. The remedy for the north arm in the ROD is natural attenuation. According to the Final Site Recommendations Report, data do not seem to indicate that natural attenuation is occurring at a significant rate (**MWH, 2006**).<br><br>4) As recommended in the 2003 five-year review, human health risks should be re-evaluated at OU 6. A review of toxicity values and remediation goals indicate that more stringent toxicity factors for arsenic and newly issued toxicity factors for 2-methylnaphthalene may affect cleanup levels by becoming more stringent. However, toxicity factors for alpha-BHC (Reference Dose), bis(2-ethylhexyl)phthalate (SF), chloroform (SF), chloromethane (SF), and 1,1-dichloroethene (SF) have been withdrawn resulting in the cleanup levels listed in the ROD for these compounds to be overprotective.<br><br>5) Recent O&M efforts and system modifications have been conducted during this review period, but the current effectiveness of the on-Base and off-Base treatment systems in capturing the plume has not yet been fully documented as recommended during the 2003 five-year review.<br><br>6) The air stripper at the Craigdale pump and treat system is no longer used to treat groundwater, since concentrations in groundwater have consistently been below discharge limits. It is still in place, however, and maintenance of the offline stripper is not included in the O&M plan (**Hill AFB CEVR, 2007c**). If operation of the air stripper were necessary, there is no guarantee that it would operate appropriately because it is not regularly tested. |

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| | 7) Currently, the effect of the on-Base drain field, which is used to discharge effluent from the on-Base pump and treat system after treatment, on aquifer conditions is not well understood. The Final Investigation Work Plan TO 159 Phase III (**MWH, 2007a**) indicates that CPT/direct-push groundwater sampling will be performed at six locations on-Base to evaluate the affect that the on-Base pump and treat system drain field may have on the plume.<br><br>8) Surface water concentrations at Sump U6-610, located at a residence within the off-Base plume boundary, contained an elevated trichloroethene (TCE) concentration (24.9 micrograms per liter [µg/L]) in April of 2006. This is the most recent sample date included in Environmental Restoration Program Information Management System (ERPIMS). It is uncertain if this residence has been addressed under the Indoor Air Program (IAP). Based on a review of the 2005 Final Basewide Indoor Residential Air Mitigation System Summary Report (**MWH, 2005**), a vapor mitigation system was not installed in this residence.<br><br>9) The PSVPlan does not present red-flag values, acceptable values, or response actions for the evaluated performance metrics.<br><br>10) Surface soil sampling was conducted in June 2006 at OU 6 in the on-Base MAMS II area to determine if soils in the area contained SVOCs or metals above screening levels. Leveling and grading operations east of Maple Lane exposed soil that appeared to contain incinerated debris, which prompted the sampling event. Soils contained SVOCs at trace levels and elevated metals, in particular arsenic, lead, barium, chromium, cadmium, and silver. Arsenic was the only analyte to exceed its respective RBC though RBCs were not available for all analytes, specifically lead (**CH2M HILL, 2006**), and MDLs for several other analytes were significantly greater than their corresponding RBC. No recommendations were included in the report. |
| **Recommendations and Follow-Up Actions** | As described in the previous section, ten issues were identified in the 2008 five-year review for OU 6. To address these issues, the following recommendations and follow-up actions have been defined.<br><br>1) The current plume map was updated in 2007. However, additional monitoring locations were recommended as part of that effort. Additional investigations are still being conducted to determine the full extent of the plume and determine if containment is being achieved. An updated plume map based on the most recent and yet-to-be completed efforts should be created as new data are available and additional monitoring locations should be added to the PSVPlan as appropriate.<br><br>2) While some issues related to fouling have been included in the O&M manual, the PSVReport and next update to the PSVPlan should address system fouling.<br><br>3) The ability of the current off-Base pump and treat system to address the north arm of the east plume is currently being assessed (**MWH, 2007c**) as recommended in the 2003 five-year review. This assessment should be completed.<br><br>4) Because toxicity factors are likely to change again, site closure is not anticipated for many years, and the remedy is still considered protective because exposure pathways are incomplete as a result of enforcement of ICs, no action at this time is recommended. While modifications based on toxicity values are not currently recommended because current ICs ensure protectiveness, if circumstances change and exposure pathways become complete, risk and clean up goals will need to be reevaluated at that time.<br><br>5) Complete an evaluation of the effectiveness of the on- and off-Base systems in capturing the plumes and document the results of that evaluation in the PSVPlan (scheduled for 2008). |

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| | 6) The O&M plan needs to be updated to include procedures to operate and inspect the air stripper on a regular schedule to ensure that it functions if, at some future point, operation of the air stripper becomes necessary.<br>7) Based on the results of the sampling efforts defined in the Final Investigation Work Plan TO 159 Phase III (**MWH, 2007a**), it should be determined if discharge to the drainfield is appropriate and does not significantly impact the plume. If it is found that the drainfield is adversely impacting the plume, the discharge should be directed to the POTW as discussed in the ROD or other discharge options should be considered.<br>8) Continued monitoring should be conducted at sump U6-610, as outlined in the PSVPlan, to monitor TCE concentrations and ensure that a complete exposure pathway does not exist. Only one sample was available between 2003 and 2006. Any followup actions deemed necessary to evaluate potential exposure pathways relative to indoor air should be conducted under the IAP if it is determined that this residence has not been previously evaluated or that exposure conditions may have changed (in light of the TCE concentrations detected in the sump) since the last evaluation was conducted.<br>9) The PSVPlan is scheduled to be updated in 2008. As part of this effort, red-flag values, acceptable values, and response actions should be developed to ensure that performance metrics are adequately evaluated.<br>10) Ensure that potential soil contamination in the MAMS II area has been fully evaluated and that potential exposure pathways and risks have been assessed and documented. |
| **Remedial Timeframe** | **Table 3-3** in **Section 3.1.4** presents the remedial timeframe estimates for OU 6. Remediation associated with the on- and off-Base east plumes is estimated to be complete sometime during the 2020's. Remediation associated with the west plume is estimated to be complete sometime during the 2030's. |
| **Protectiveness Statement** | **The protectiveness of the OU 6 remedy cannot be determined until additional information is obtained.** However, enforcement of ICs at OU 6 provide protectiveness in the short-term pending further assessment of the remedy. ICs and land-use controls are assessed annually. The system is still in the verification stage after the O&M improvements that were implemented in 2006, and the effectiveness of the remedy will be evaluated during the PSVPlan update in 2008. |
| **Next Five-Year Review** | Remedial actions at OU 6 will be reviewed in the next five-year review for Hill Air Force Base to be completed during or before September 2013. |

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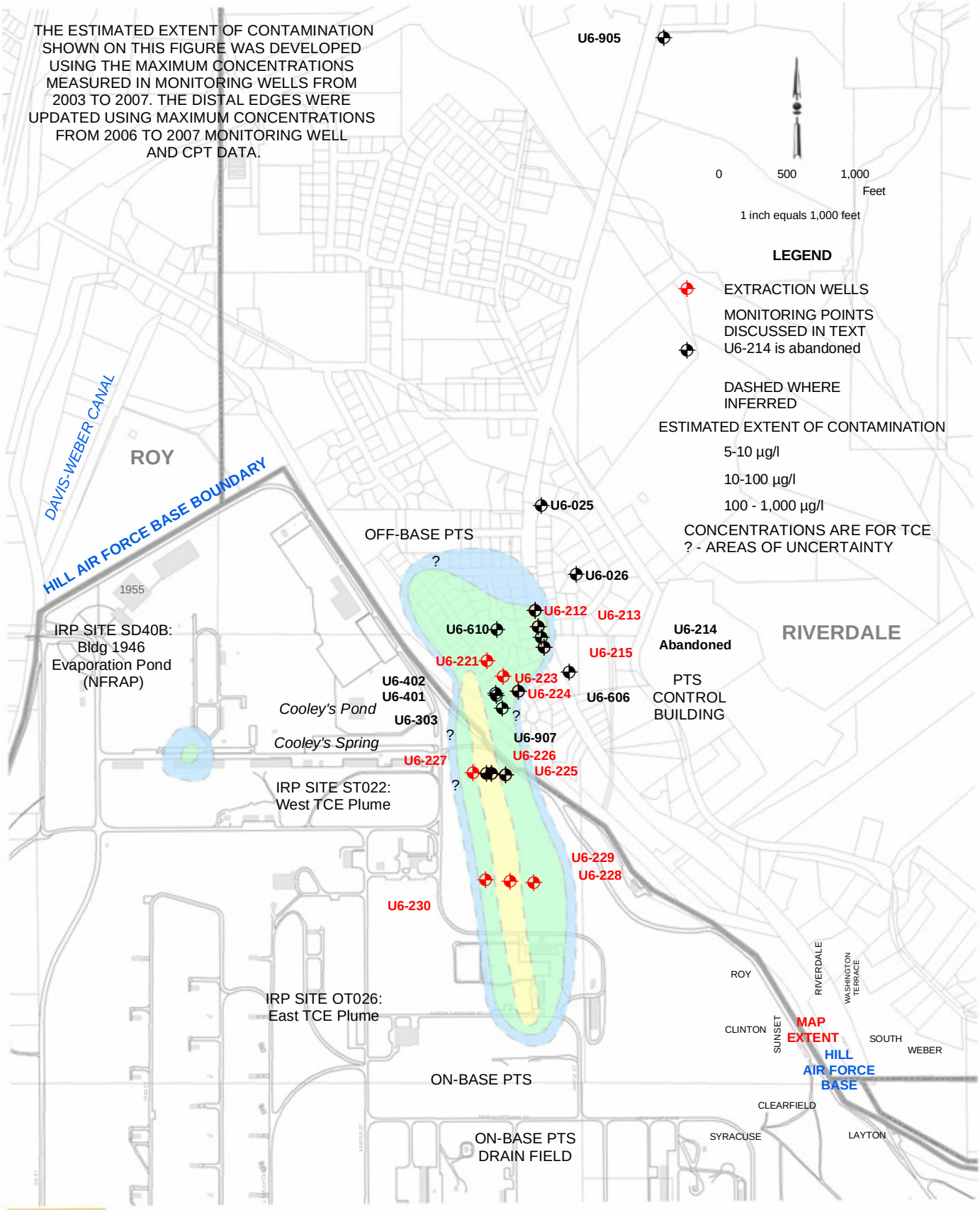


FIGURE OU 6 - 1
**SITE FEATURES OF OPERABLE UNIT 6**
2008 FIVE-YEAR REVIEW
IRP SITES: SD40B, ST022, OT026
HILL AIR FORCE BASE, UTAH

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Table OU 7-1
# Operable Unit 7
# Background Information

Reviewer: Kelly Taylor

<table>
<tr><td>Introduction</td><td>Operable Unit 7 is located in the southern, industrial portion of Hill AFB and is a soils only OU that consists of the following five sites: Building 225 Former Metal Plating Shop; Building 225 PCB Spill Area; Building 204 Beryllium UST; Sill Property Layton (Base Supply Well 6); and Building 220 UST (Figure OU 7-1). The two buildings (225 and 220) lie in the south central portion of the Base, west of the main runway in an industrial area that has been used to service aircraft since the 1940s. Base Supply Well 6 is located northwest of the north end of the main runway. Four of the five sites have been granted NFRAP status and will not be discussed further. Groundwater beneath OU 7 is addressed separately in OU 8 and will be discussed here only in the context of evaluating the protectiveness of the selected soil remedy.<br><br>A list of the documents reviewed for OU 7 as part of the 2008 five-year review is provided in Appendix C.
<table>
<tr><th>IRP Identification</th><th>IRP Site Name</th><th>Status</th></tr>
<tr><td>SS027</td><td>Building 225 Former Metal Plating Shop</td><td>LTO/LTM</td></tr>
<tr><td>SS032</td><td>Building 225 PCB Spill Area</td><td>NFRAP</td></tr>
<tr><td>OT029</td><td>Building 204 Beryllium UST</td><td>NFRAP</td></tr>
<tr><td>SS028</td><td>Sill Property, Layton (Base Supply Well 6)</td><td>NFRAP</td></tr>
<tr><td>ST031</td><td>Building 220 UST</td><td>NFRAP</td></tr>
</table>
</td></tr>
<tr><td>Site Chronology</td><td>Provided separately. See Table OU 7-2.</td></tr>
<tr><td>Background</td><td>Physical Characteristics. Operable Unit 7 consists of soil contamination at several source areas in and around two buildings (Buildings 220 and 225). The two buildings lie in the south central portion of the Base, west of the main runway in an industrial area that has been used to service aircraft since the 1940s. Base Supply Well 6 is located northwest of the north end the main runway. Subsurface conditions in these areas are dominated by interbedded silty sand, sandy silt, and clay.</td></tr>
<tr><td></td><td>Land and Resource Use. Operable Unit 7 is located in the industrial portion of Hill AFB and overlies three aquifers, although these aquifers are not included as part of OU 7. Ground water beneath OU 7 is addressed separately in OU 8. No wetlands are located on-Base in OU 7.</td></tr>
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| | **History of Contamination.** The Former Metals Plating Shop operated from the 1940s until its removal from Building 225 in 1972. It was located along the east side of Building 225. Contents of the plating solution tanks included acids, bases, metal salts, and other chemicals that were frequently discharged into a floor drain system, and over time the plating solutions corroded the drains and piping and they leaked. Soil contamination was first identified beneath the area in 1989, which revealed that soil beneath the area was contaminated with several metals and low concentrations of VOCs. Contaminant concentrations exceeding the EPA risk-based concentrations are confined to an area below the Building 225 Former Metal Plating Shop. Hexavalent chromium and cadmium are the only contaminants found at concentrations that exceed health-based risk criteria (**Hill AFB CEVR, 2007c**). |
| | **Initial Response**. Aside from remedial investigation efforts, no actions were conducted prior to the signing of the ROD. |
| | **Basis for Taking Action.** The human health risk assessment for OU 7 concluded that exposure to chemicals at OU 7 had the potential to arise if the concrete slab is removed from Building 225. No existing risks were identified at OU 7. However, future risks of exposure to hexavalent chromium and cadmium were identified in site soils should the Base be closed and existing facilities removed. An excess cancer risk greater than $1 \times 10^{-4}$ was estimated for future construction workers in the Building 225 South Area based on exposure to hexavalent chromium and cadmium. No ecological exposures or risks were identified (**Hill AFB, 1995**). |
| **Remedial Actions** | **Remedy Selection (i.e. ROD/ESDs).** A final ROD for OU 7 was issued in September 1995 (**Hill AFB, 1995**). The selected remedy for soils at OU 7 is ICs. Components of this remedy include: (1) groundwater quality monitoring upgradient, beneath, and downgradient of the contaminated soils; (2) soil moisture content monitoring around the perimeter of and within the area of contaminated soils; (3) maintenance and preservation of the building and floor slab that overlay the contaminated soils; (4) issuance of a continuing order from the Base commander that will restrict worker access to the contaminated soils as long as Hill AFB owns the property; (5) a notice to the deed will be filed by the Air Force detailing the restrictions of the continuing order; (6) a covenant in the deed that incorporates the restrictions of the continuing order and, upon transfer of the property, establishes the locations and restrictions of use of the contaminated area, and retains rights of access for future response actions, if needed (if land use is changed or Building 225 is removed, the Air Force will reevaluate the protectiveness of the selected remedy and perform any necessary remedial actions); and (7) posting warning signs regarding the presence of contaminated soils that could represent a threat to human health.<br><br>Remedial action objectives for OU 7 as defined in the ROD include: (1) reduce contaminant transport within source areas and reduce chemical transport from soil to groundwater by minimizing surface water infiltration; (2) prevent human exposure to contaminated soil through ingestion, inhalation, and dermal contact, such that the additional risk to an individual for cancer is below $1 \times 10^{-6}$ and the threshold non-cancer hazard index is less than 1.0; and (3) reduce contaminant concentrations to meet risk levels and/or reduce contaminant transport to rates that will not impact ground-water quality above MCLs (**Hill AFB, 1995**). |

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| | **Remedy Implementation.** Because the facility is still actively in use as a primary maintenance aircraft hanger, it was determined that the Building 225's existing floor should be left in place as a cap to mitigate potential infiltration that could mobilize contamination to groundwater. Three monitoring wells and six soil moisture monitoring points (neutron probe, installed in 1996) are used to monitor the effectiveness of the cap at maintaining dry conditions in the subsurface soils and monitor for subsurface utility leaks.<br><br>**Progress Since Implementation.** Groundwater monitoring and soil moisture monitoring have been conducted semi-annually as required by the PSVPlan (**CH2M HILL, 2001**). The results of these monitoring activities since 2001 have been reported in annual Treatment System Operation Report and Inspection, Monitoring, and Maintenance Reports. Groundwater monitoring efforts are conducted as part of the OU 8 program. |
| | **Operations and Maintenance.** The O&M contractors for OU 7 during this review period included URS and CH2M HILL. The current O&M contractor (CH2M HILL) of the OU 7 caps is responsible for: (1) inspection of the caps at a pre-determined interval; (2) performing corrective maintenance of the CERCLA caps; (3) recommending (to Hill AFB) cap repairs and/or modifications to increase system efficiency and economy; (4) conducting discharge water quality and water-level measurements; and (5) submitting monthly, quarterly, and annual reports to Hill AFB. Tasks conducted under this effort include: (1) system performance evaluation and reporting; (2) system operation tasks; (3) inspection, monitoring, and sampling activities; (4) system operational data collection; and (5) system maintenance tasks (**Hill AFB CEVR, 2007b**).<br><br>Operation and maintenance plans are maintained and updated online through the CEVR Dynamic Documents System and O&M procedures follow the most current version of the O&M Plan for CERCLA Caps at OUs 1, 3, 4, and 7 dated July 2007 (**Hill AFB CEVR, 2007b**). |
| **Progress Since Last FYR** | The 2003 five-year review (**URS, 2003**) was completed in 2003. Recommendations presented in the 2003 five-year review are presented in **Table OU 7-3** along with the current status of each recommendation.<br><br>**Current Status**: The floor of Building 225 is functioning as a low-permeability concrete cap that limits water infiltration. The integrity of the floor is maintained through an inspection and maintenance program. Annual Treatment System Operation Reports and IMMRs from inspections conducted in 2005 and 2006 both report that the former Metals Plating Shop in Building 225 concrete cap is in "excellent condition" and that signage at the Building 225 site is in "good condition." Furthermore, they report that a paint sealant had been applied to the floor as part of the remodeling of the facility, and no cracks in the slab or compromised slab joints were observed during the inspection (**CH2M HILL, 2006,** and **CH2M HILL, 2007a**).<br><br>Both the 2003 five-year review and recent annual TSORs and IMMRs conclude that the cap has been maintained in a condition that meets the requirements of the RAOs. Evaluation of the soil moisture data suggests that this RAO is not being met, and therefore response action has been recommended. Because the data analysis method for soil moisture data was questioned during the five-year review (**URS, 2003**), modifications in data analysis were made in the most recent performance standard verification report (PSVReport) (**Hill AFB CEVR, 2007c**) and include: (1) identification of multiple zones for each monitoring location based on depth and soil type and separate analysis of moisture data at each of the depths/soil type zones; (2) analysis of depth-averaged moisture data for each monitoring point (i.e., average of moisture content over the entire depth of the monitoring location); (3) the development of acceptable conditions and red-flag conditions, and the rationale for those chosen conditions based on historical data; and (4) development of response actions.<br><br>While the remedy at OU 7 is protective of human health because there is no pathway for |

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| | exposure, there is adverse impact to the environment based on chromium concentrations that exceed MCLs in the groundwater directly below the Building 225 Chromium Spill site (Site SS027) (**URS, 2003**). Groundwater data indicate that the chromium concentrations downgradient of the source area are consistently higher than concentrations upgradient, suggesting that transport of contaminants from the site may be occurring. Concentrations of hexavalent chromium in groundwater from Monitoring Wells U7-008, U7-009, and U7-012 are now evaluated in the PSVReport even though groundwater for OU 7 is handled under OU 8. Concentrations of total chromium in groundwater do not currently satisfy the requirements of the RAO. Additionally, the discussion of data analysis methodology for hexavalent chromium in groundwater as a means of evaluating the concrete floor of Building 225 as a barrier to water infiltration has been included in this PSVReport (**Hill AFB CEVR, 2007c**).<br><br>The PSVReport (**Hill AFB CEVR, 2007c**) recommendations for future investigation of soil moisture patterns beneath the Building 225 concrete cap through time include: (1) using a second sub-contractor for soil moisture monitoring to verify results; (2) modeling the vadose zone to define the relationship between soil moisture and hydraulic conductivity in the vadose zone beneath the cap; (3) correlating soil moisture data with the precipitation cycle of the past several years; (4) investigating the fate of storm water runoff at Building 225; and (5) possibly increasing soil moisture monitoring outside the cap to provide area soil moisture values for comparison. An additional recommendation included reducing groundwater sampling frequency from semi-annually to annually in 2009 if monitoring data indicate that hexavalent chromium concentrations remain stable or decline. Recommendations and modifications presented in the PSVReport should be included in the next O&M plan update. |

Table OU 7-2

## Chronology of Site Events for Operable Unit 7

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 7 | OU7 | 7 | 1987 | National Priorities List (NPL) | The Base was put on the Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA) NPL list. | ROD for OU 7 |
| 7 | OU7 | 4 | 1991 | FFA | Hill AFB entered into a Federal Facilities Agreement with Utah Department of Environmental Quality (UDEQ) and Environmental Protection Agency. Agreement entered on 4/1/1991. | ROD for OU 7 |
| 7 | OU7 | | 1992 | Remedial Investigation | The RI/FS activities for OU 7 began in the latter part of 1992 and continued until early 1995. | ROD for OU 7 |
| 7 | OU7 | 2 | 1995 | Remedial Investigation | A RI/FS of OU 7 began in the latter part of 1992 and continued to 1995. The Remedial Investigation confirmed the presence of contaminants inside of Building 220, at Base Supply Well 6, in Building 225, at the PCB spill area, and in the former Metal Plating Shop area. In addition, four other possible source areas were investigated inside of Building 225, including the Mop Cleaning Room, a former TCE Degreaser Pit, the former Wash Rack, and the Hydraulic Room. | ROD for OU 7 |
| 7 | OU7 | 9 | 1995 | ROD | The ROD established remedial action objectives (RAOs) and remedial actions for the active OU 7 site (SS027). Two sites (Sites ST031 and SS032) were closed and do not require any remedial actions. | ROD for OU 7 |
| 7 | OU7 | 9 | 1998 | 1998 Five-Year Review | As designed and operated, remedies at OU 7 remain protective of human health and the environment. | Hill AFB Five Year Review. September 1998. |
| 7 | SS027 | | 1940 | Historical Operations | A Metal Plating Shop was formerly located along the east side of Building 225. The plating shop operated from the 1940s until it was removed from Building 225 in 1972. | Record of decision (ROD) for Operable Unit (OU) 7 |
| 7 | OT029 | | 1957 | Historical Operations | A 1,000-gallon hypochlorite above-ground storage tank (AST) and a 5,000-gallon industrial waste underground storage tank (UST) were installed at the site during 1957 or 1958. | Final Decision Document for Installation Restoration Program (IRP) Site OT 029 Category III No Further Remedial Action Planned (NFRAP) Building 204 Beryllium Underground Waste Tank |
| 7 | OT029 | | 1987 | Historical Operations | During 1987, an AST and an UST were removed from the Building 205 area. Both tanks were located in close proximity to the east side of existing Building 205 and the northern side of former Building 204. Reportedly, the AST was used to store hypochlorite. The UST was used to store industrial wastes, including beryllium-related wastes, associated with previous operations conducted at existing Building 205. | Final Decision Document for IRP Site OT 029 Category III NFRAP Building 204 Beryllium Underground Waste Tank |
| 7 | OT029 | 3 | 1998 | NFRAP | No further action was selected as the final remedy for the Building 204 Beryllium Underground Waste Tank. | Final Decision Document for IRP Site OT 029 Category III NFRAP Building 204 Beryllium Underground Waste Tank |

Table OU 7-2
## Chronology of Site Events for Operable Unit 7
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 7 | SS027 | | 1968 | Historical Operations | The plating shop operation expanded and occupied additional space in Building 225. Approximately 150 tanks were used for various plating operations. The expansion included the addition of two new chromium plating areas, for a total of three chromium plating lines. | Site Characterization Report for a Portion of Building 225 and Site Investigation of Fill Soils at Base Supply Well 6 |
| 7 | SS027 | | 1989 | Remedial Investigation | Soil contamination was first identified beneath the former Metal Plating Shop area when a utility trench was installed in 1989. | ROD for Operable Unit 7 |
| 7 | SS027 | | 1990 | Remedial Investigation | During February and March 1990, a site characterization study for the portion of Building 225 that housed the Metal Plating Shop was performed. The objective of this study was to evaluate the nature and extent of metals contamination present beneath the floor in Building 225; assess if the fill placed at Base Supply Well 6 was hazardous; and assess the need for further investigation of the soils beneath Building 225. | Remedial Investigation/ Feasibility Study Report for OU 7 (IRP Sites SS27, ST31, & SS32) Volume II (Appendices A-L) |
| 7 | SS027 | 9 | 2003 | 2003 Five-Year Review | Remedy at SS027 was considered protective of human health and the environment. | Final CERCLA Five-Year Review. September 2003. |
| 7 | SS027 | | 2003 | Operations and Maintenance | It was reported in the Final CERCLA Five-Year Review for Hill Air Force Base, Utah that defects in the floor, recommended for repair in 2001, had not been repaired and that the tape delineating the area of attainment of soil contamination was in disrepair. These repairs were performed in 2003. | 2007 PSVReport |
| 7 | SS028 | 3 | 1989 | Removal Action | The initial removal action for the chromium-contaminated soil at the Sill Property was completed between 18 March 1989 and 25 March 1989. Approximately 327 tons of material were removed from the south site and 163 tons from the north site. | Final Decision Document for Site SS28, Sill Property |
| 7 | SS028 | | 1989 | Historical Operations | In early 1989, chromium-contaminated soil and rubble from Hill AFB (Building 225 excavation) was inadvertently placed as fill at two locations on the Sill Farm in Layton, Utah. | Final Decision Document for Site SS28, Sill Property |
| 7 | SS028 | 9 | 1990 | Removal Action | As requested by the Utah Bureau of Solid and Hazardous Waste, a subsequent sampling and removal operation was conducted at the Sill Property. Two dump truck loads of soil from a localized portion of the north removal site were excavated and trucked offsite on 12 September 1990. | Final Decision Document for Site SS28, Sill Property |
| 7 | SS028 | 2 | 1991 | Removal Action | 'Final Summary Report of Chromium Cleanup at Two Sites in Layton, Utah issued. This document summarized the study methodology and presents findings and conclusions regarding the cleanup of the Sill Farm. | Final Summary Report for Chromium Cleanup at Two Sites in Layton, Utah |
| 7 | SS028 | 6 | 1991 | NFRAP | No further action planned document completed for the Sill Property. | Final Decision Document for Site SS28, Sill Property |
| 7 | SS032 | | 1960 | Historical Operations | This area of Bldg 225 was the site of a former transformer storage area that was removed in the 1960s. | ROD for OU 7 |

Table OU 7-2
## Chronology of Site Events for Operable Unit 7
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 7 | SS032 | | 1989 | Remedial Investigation | Polychlorinated biphenyls were found in soil beneath Building 225 approximately 100 feet west of the former Metal Plating Shop. During excavation of a utility trench in 1989, unusual odors and discolored soil were reported. A subsequent investigation revealed that the soil contained PCBs. | ROD for Operable Unit 7 |
| 7 | SS032 | | 1989 | Removal Action | Circa 1989, 95 tons of contaminated soil were removed and disposed of at a facility permitted by the Toxic Substances Control Act. Following the soil removal, confirmation soil samples taken from the walls of the excavation revealed that only insignificant concentrations (less than 0.23 mg/kg) of residual PCBs remained in localized areas. | ROD for Operable Unit 7 |
| 7 | SS032 | | 1989 | Removal Action | During the summer of 1989, a utility trench excavation in Building 225 revealed the presence of PCB-contaminated soils. Personnel from Hill AFB conducted a preliminary soil sampling program, prepared a brief cleanup and closure plan, removed PCB-contaminated soil, and conducted a post-removal sampling program to allow the utility trench construction project to be completed. | Remedial Investigation/ Feasibility Study Report for OU 7 (IRP Sites SS27, ST31, & SS32) Volume II (Appendices A-L) |
| 7 | SS032 | 9 | 1995 | NFRAP | Based on the findings of the OU 7 RI and Risk Assessment, SS032 does not require remedial actions because either the risks posed by the contaminants at this site were not significant or the concentrations for the contaminants were within background levels. | ROD for OU 7 |
| 7 | ST031 | | 1957 | Historical Operations | Bldg 220 was constructed in 1957 and was used as aircraft painting and paint stripping facility. Painting and paint stripping activities have used many types of paints, paint strippers, solvents, acids, and other chemicals. Three underground concrete separator tanks were located on the northwest side of the building. These tanks were used to separate paint chips and sludge from the wastewater solutions generated during paint stripping operations. Wastewater from the tanks was discharged to the industrial wastewater pipeline and the industrial wastewater treatment plant (IWTP). | ROD for Operable Unit 7 |
| 7 | ST031 | | 1984 | Remedial Investigation | An initial environmental investigation at Building 220 characterized the industrial wastewater generated by the paint stripping and painting activities. Wastewater was generally characterized by elevated levels of oil and grease, total suspended solids, chemical oxygen demand, and acidity. The majority of the organics in the wastewater are VOCs. Paint and degreasing solvents, along with BNAEs including phthalates and polynuclear aromatic hydrocarbons were also present in the wastewater. | ROD for OU 7 |

Table OU 7-2
## Chronology of Site Events for Operable Unit 7
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 7 | ST031 | | 1984 | Remedial Investigation | Radian Corporation collected samples of wastewater generated from Building 220, conducted treatability studies, and prepared a report recommending a wastewater treatment system design. | Remedial Investigation/ Feasibility Study (RI/FS) Report for OU 7 (IRP Sites SS27, ST31, & SS32) Volume II (Appendices A-L) |
| 7 | ST031 | | 1985 | Remedial Investigation | Radian investigated three underground storage tanks at Building 220 suspected of releasing contaminants to the underlying soils and groundwater. Field work was conducted during October and November 1985. | RI/FS Report for OU 7 (IRP Sites SS27, ST31, & SS32) Volume II (Appendices A-L) |
| 7 | ST031 | | 1985 | Removal Action | Before the Bldg 220 addition was constructed, some of the contaminated soils was removed and taken to an off-Base hazardous waste disposal facility (no date given in literature, therefore date is approximate). | ROD for OU 7 |
| 7 | ST031 | | 1986 | Removal Action | Building 220 was renovated in 1986 and expanded over an area that contained the three underground separator tanks. As part of this renovation, the three underground separator tanks and a 20,000-gallon fuel storage tank located in the vicinity were excavated and removed. Because previous investigations indicated that environmental contamination was present in the soils beneath the USTs, Hill AFB personnel collected several soil samples in May 1987 following tank removal. | RI/FS Report for OU 7 (IRP Sites SS27, ST31, & SS32) Volume II (Appendices A-L) |
| 7 | ST031 | 6 | 1987 | Remedial Investigation | Additional groundwater samples were collected during June 1987. 51 soil samples and 13 groundwater and potable water samples were collected. Various inorganic and organic contaminants were detected in both the soil and groundwater in the vicinity of Building 220. However, due to problems with quality control samples some of the data were suspect. | RI/FS Report for OU 7 (IRP Sites SS27, ST31, & SS32) Volume II (Appendices A-L) |
| 7 | ST031 | | 1992 | Remedial Investigation | The RI/FS activities for OU 7 began in the latter part of 1992 and continued until early 1995. To identify potential contamination sources, both sampling around and inside of Building 220 was completed during the RI. Organic compounds detected included several BNAEs, VOCs, furans, and PCBs. In addition, numerous metals were detected above background although, with the exception of arsenic and beryllium, none of these organic compounds or the metals above background were present in concentrations that exceeded those listed in the RBC table. | Remedial Investigation/Feasibility Study Report for OU 7 (IRP Sites SS27, ST31, & SS32) Volume I (Text) |
| 7 | ST031 | 9 | 1995 | NFRAP | Based on the findings of the OU 7 RI and Risk Assessment, Building 220 does not require remedial actions because either the risks posed by the contaminants at this site were not significant or the concentrations for the contaminants were within background levels. | ROD for OU 7 |

Table OU 7-2

## Chronology of Site Events for Operable Unit 7

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|

**Notes**

| | |
|---|---|
| AFB | Air Force Base |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| EE/CA | Engineering Evaluation/Cost Analysis |
| EPA | United States Environmental Protection Agency |
| FYR | Five-Year Review |
| IRP | installation restoration program |
| NFRAP | no further response action planned |
| NPL | National Priorities List |
| O&M | Operations and Maintenance |
| OU | Operable Unit |
| PSVPlan | Performance Standard Verification Plan |
| RI | Remedial Investigation |
| ROD | Record of Decision |
| SVE | soil vapor extraction |
| TCE | trichloroethene |
| TPH | total petroleum hydrocarbons |
| UDEQ | Utah Department of Environmental Quality |
| µg/L | microgram per liter |
| VOC | volatile organic compound |

Table OU 7-3

## Progress Since Last Five Year Review - Status of Recommendations and Follow-Up Actions at OU 7

*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Site | 2003 Five-Year Review Recommendations | Current Status | Carry Over to Next FYR? |
|---|---|---|---|
| Building 225 Former Metal Plating Shop (SS027) | Update warning signs within Building 225 so verbiage is in compliance with the intent of the Record of Decision (ROD) | **Rejected.** As indicated in an interview with Barbara Hall/CEVR (**CH2M HILL, 2007c**), this recommendation was rejected upon further review. Excavation under the building slab/cap is controlled through Base permitting process. | No |
| | Repair defects in the floor slab of Building 225 and replace the tape that delineates the area of attainment, using another method to outline this area | **Complete.** Repairs were made to the slab floor in 2003 as recommended in the second five-year review. In general, defects in the subfloor are repaired as required by the Operable Units (OUs) 1,3,4,7 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Caps Inspection, Operation, and Maintenance Work Plan (**Hill AFB CEVR, 2007b**). Results of 2007 cap inspection indicates that the cap is free of defects (**CH2M HILL, 2007a**). Replacement of the tape was scheduled for 2003 as stated in Appendix A of the Performance Standard Verification Report (PSVReport) (**Hill AFB CEVR, 2007c**). Rather than using tape, the outline of the cap area has been painted along non-traffic areas within Building 225. | No |
| | Investigate the source of elevated hexavalent chromium in groundwater beneath Building 225 and potential remedies if necessary | **Ongoing.** Concentrations of hexavalent chromium in groundwater from monitoring wells U7-008, U7-009, and U7-012 are now evaluated in the PSVReport even though groundwater for OU 7 is handled under OU 8 (**Hill AFB CEVR, 2007a**). Because groundwater data indicate that the chromium concentrations downgradient of the source area are consistently higher than concentrations upgradient, transport of contaminants from the site may be occurring. Additional monitoring may be conducted as indicated by Barbara Hall/CEVR in the five-year review interview record (**CH2M HILL, 2007c**). According to the PSVReport, annual Treatment System Operation Report and Inspection, Monitoring, and Maintenance Reports have not reported on hexavalent chromium concentrations in groundwater. Concentrations of hexavalent chromium in groundwater should be used to evaluate the ability of the cap to reduce contaminant mobilization from the source area. The method of data analysis is to review data from select monitoring wells for hexavalent chromium and compare the recent values to the baseline and acceptable values derived from historical data. | Yes |
| | Establish an appropriate action level for an increase in soil moisture content based on soil moisture results. | **Complete.** The PSVReport has established two times the standard deviation of baseline as a red-flag value which warrants additional evaluation (**Hill AFB CEVR, 2007c**). | No |
| | Determine what actions should be taken if an increase in soil moisture content occurs at a particular depth | **Complete.** Response actions have been developed based on elevated soil moisture as outlined in Section 4 of the PSVReport (**Hill AFB CEVR, 2007c**). | No |
| | Modify annual reporting to capture current, historical, and baseline soil moisture data for all intervals to ensure proper evaluation of these data | **Complete.** Baseline soil moisture data is presented in the PSVReport (**Hill AFB CEVR, 2007c**). Graphs presenting historical and current soil moisture concentrations are presented in the most recent annual Treatment System Operation Report (**CH2M HILL, 2007a**). | No |
| | Schedule soil moisture data collection in the same months of each year to ensure comparable results | **Ongoing.** As discussed in the PSVReport, soil moisture data is recommended for collection semi-annually (**Hill AFB CEVR, 2007c**). The data collection procedures and measurement frequency for soil moisture content beneath the Building 225 floor slab are to be in accordance with those presented in the Final Operable Units 1, 3, 4, and 7 CERCLA Caps Inspection, Operation, and Maintenance Work Plan (**Hill AFB CEVR, 2007b**). According to the 2006 Treatment System Operation Report (**CH2M HILL, 2007a**) soil moisture measurements have not been collected in the same months during each semi-annual collection effort. The first collection generally is collected within a four month spread (April through June). The second sampling effort is conducted 6 months later (October through January). However, soil moisture data scheduling has been addressed in both the PSVReport and the O&M plan. | No |
| | Incorporate historical data from annual reports and current neutron logging data at all intervals into the Environmental Restoration Program Information Management System (ERPIMS) to ensure data availability for future comparisons | **Ongoing.** Based on a review of ERPIMS data from 2003 to 2007, soil moisture data from U7-201 through U7-206, formerly identified as U7-013 through U7-018, have been included in the database. | No |
| | Review the PSVPlan and ensure either the long term monitoring (LTM) or Operation and Maintenance (O&M) contractor is addressing all aspects of monitoring and reporting | **Ongoing.** The PSVPlan was completed in 2001; the PSVReport was most recently updated in June 2007; the O&M plan was most recently updated in July 2007. All recommendations from the PSVReport are included in either the O&M plan or the Sampling and Analysis Plan (**Hill AFB CEVR, 2007c**). | No |
| | Re-evaluate risk analysis due to change in hexavalent chromium reference dose levels (URS, 2003). | **Ongoing.** Because the calculated non-carcinogenic risk changed significantly for several sites within OU 7, a revised risk assessment should be conducted prior to allowing construction work involving subsurface soils in OU 7 (**Hill AFB CEVR and SES, 2007**). If construction activities are proposed, contaminant concentrations in the soil will be compared to the then current risk screening concentrations to determine what, if any, action is required. | Yes |

**Notes**
ERPIMS = environmental restoration program information management system
LTM = long term monitoring
O&M = operations and maintenance
OU = operable unit
PSVPlan = Performance Standard Verification Plan
PSVReport = Performance Standard Verification Report
ROD = record of decision
TSOR = Treatment System Operation Report

Table OU 7-4
# Operable Unit 7
# Five-Year Review Process

Reviewer: Kelly Taylor

| | |
|---|---|
| **Introduction** | This 2008 five-year review for Hill AFB has been conducted in accordance with the EPA's Comprehensive Five-Year Review Guidance dated June 2001 (**EPA, 2001**). Administrative and community involvement components of the five-year review are described in **Section 2.0** of this report for the overall five-year review. In addition, interviews were conducted with relevant parties. A site inspection of OU 7 was performed. Relevant site documents and applicable data covering the period of the five-year review were evaluated. The site interviews, site inspection, and data review are further discussed in the following sections. |
| **Interviews** | Interviews for OU 7 were conducted with Barbara Hall/75 CEG/CEVR, Ray Spencer/75 CEG/CEVR, and Mike Cox/CH2M HILL O&M contractor. Copies of the Interview Record Forms are provided in **Appendix D**.<br><br>Barbara Hall was interviewed on September 28, 2007. She indicated that the cap is well maintained and the work force in Bldg 225 is aware of the location of the cap. The frequency of the cap inspections has been revised from quarterly to annually in an effort to reduce costs. There has been a change in the hexavalent chromium concentration in one groundwater monitoring well and more monitoring is being considered at other well locations. However, this is not considered to be an indication of a problem with the cap. She also noted that the objectives for soil moisture monitoring have been clarified and updated in the latest PSVReport.<br><br>Ray Spencer, interviewed on December 13, 2007, indicated that there has been very little activity at OU 7 other than normal O&M and the delineation of the cap area with paint. He also noted that the data do not indicate that there is any infiltration below the slab or through the soil and there are no signs of leaking utilities.<br><br>Mike Cox was interviewed on September 28, 2007 and indicated that the remedial action is functioning as designed, there is minimal infiltration, and the cap has not been penetrated by any construction in the area. Additionally, the slab has been enhanced by the installation of an epoxy coated floor. Hill AFB needs to look at the current soil moisture monitoring method (down-hole neutron method) and determine if a better method exists to monitor the soil moisture under the cap. It is unknown if a better method exists, but due the range a variability in the current method an alternate method may be appropriate. |
| **Site Inspection** | The site inspection for OU 7 was conducted on September 28, 2007. The completed site inspection checklist is provided in **Appendix E**.<br><br>During the site visit, the floor was found to be in good condition with the exception of minor cracking in the epoxy seal on the floor.<br><br>The site inspection checklist addressed four discussion topics. These discussion topics are presented below, followed by responses and general observations based on the site inspection.<br><br>(1) Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).<br><br>The OU 7 remedy was to achieve three RAOs: (1) Reduce contaminant transport within source areas and reduce chemical transport from soil to groundwater by minimizing surface water infiltration; (2) prevent human exposure to contaminated soil through ingestion, inhalation, and dermal contact, such that the additional risk to an individual for cancer is |

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|---|---|
| | below $1x10^{-6}$ and the non-cancer threshold is less than 1.0; and (3) reduce contaminant concentrations to meet risk levels and/or reduce contaminant transport rates that will not impact groundwater quality above MCLs. Groundwater underneath OU 7 is being addressed as part of OU 8. The ROD states that the remedy will not meet the chemical-specific goals, but that implementation of ICs would address the RAOs for OU 7.<br><br>The Building 225 floor slab is in place to prevent direct contact with contaminated soils at OU 7. Soil moisture monitoring is performed to monitor for surface water infiltration underneath the slab and determine if there is potential for contamination to be migrating to groundwater.<br><br>A continuing order is in place that restricts digging underneath or disturbing the floor slab of Building 225 and requiring that the integrity of the floor slab be maintained. Also, a restriction has been placed on the property deed in the event that Hill AFB is closed and the property transferred. Groundwater use restrictions are also in place.<br><br>Based on the site inspection, all components of the remedy appear to be functioning as designed.<br><br>(2) Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.<br><br>Operation and maintenance at the site includes maintenance and inspection of the floor slab and soil moisture monitoring. Groundwater under OU 7 is part of OU 8, and is monitored as part of the Basewide program. Proper inspection and maintenance procedures are in place and implemented to ensure the integrity of the remedy and to ensure the enforcement of ICs (groundwater use restrictions, land use restrictions on-site, integrity of the floor slab).<br><br>(3) Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.<br><br>There are no indications of potential remedy failure based on the site inspection. Some minor cracking in the epoxy seal on the floor slab was observed, but this cracking does not currently affect the integrity of the slab.<br><br>(4) Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.<br><br>No opportunities to optimize the remedy for OU 7 were identified as part of the site inspection. The O&M contractor and CEVR staff are working to make changes to improve the procedures and methods used to monitor soil moisture under the floor slab. Additionally, the frequency of cap inspections was reduced from quarterly to annually. |
| **Data Review** | The data reviewed as part of the 2008 five-year review included groundwater data and soil moisture measurements. Groundwater data were collected on a semiannual basis at three monitoring wells during the review period. Soil moisture monitoring was performed semi-annually at six locations during the review period.<br><br>The ROD did not establish remediation goals for soil at OU 7 because the selected remedy does not include soil excavation or treatment. Instead the cap will serve to prevent transport of the chromium concentrations into groundwater. Remedial action objectives include reducing concentrations of contaminants to meet risk levels and/or reduce contaminant transport to rates that will not impact groundwater quality above MCLs. The individual MCLs in place at the time of the ROD are not specified by the ROD. |

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| | Based on a review of data during the review period, soil moisture values at OU 7 have been observed to be generally increasing since 2003 and volumetric moisture content values measured in 2004 and 2005 exceed the defined red-flag values at all six monitoring locations in each of the three layers and each location as a whole. All soil moisture values directly beneath the cap (0 to 7 feet bgs), however, are generally low (less than 25 percent). It is suspected that the elevated soil moisture readings are the result of possible neutron probe calibration problems. This has been identified as an issue in the PSVReport and recommendations have been made to evaluate the accuracy of these results.<br><br>Groundwater data are collected under OU 8 sampling efforts. Three locations are sampled and analyzed for hexavalent chromium. Samples were only collected from U7-009 during the review period because the other two monitoring locations were dry at the time of sampling. The results from this well indicate that hexavalent chromium is present at concentrations above those detected upgradient of OU 7. Concentrations in this well ranged from less than 7 µg/L to 300 µg/L. Hexavalent chromium concentrations in U8-008 (located 1800 feet north of U7-009) appear to be decreasing over time with a current concentration of 113 µg/L (January 2007). Hexavalent chromium was just recently sampled at U8-133 in January 2007; the detected concentration was 5.2 µg/L. The concentrations at U7-009 did not exceed the action level during the review period and suggests that the remedy is functioning as intended. However, additional evaluation may be necessary considering that upgradient concentrations (U8-008) are lower than downgradient concentrations (U7-009). |

Table OU 7-5

## Chemicals of Concern and Remediation Goals at OU 7

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Media | Chemical of Concern | Risk-Based Remediation Goal | Computer Modeling Based Remediation Goals | 95% Upper Confidence Limit | Units |
|---|---|---|---|---|---|
| Soil | Cadmium | 7.57 | NM | 53.9 | mg/kg |
| | Hexavalent Chromium | 1.16 | 13 to 1017 | 348 | mg/kg |

Notes:

Remediation goals listed are from the OU 7 ROD (**Hill AFB, 1995**)

mg/kg = milligrams per kilogram

NM - cadmium was not expected to be mobile in soil under normal pH conditions

Table OU 7-6
# Operable Unit 7
# Five-Year Review Technical Assessment

Reviewer: Kelly Taylor

| | |
|---|---|
| **Introduction** | The five-year review must determine whether the remedy at a site is protective of human health and the environment. The EPA guidance describes three questions used to provide a framework for organizing and evaluating data and information and to ensure all relevant issues are considered when determining the protectiveness of a remedy (**EPA, 2001**). These questions are assessed for OU 7 in the following sections. The implementation of ICs is also described. At the end of this table is a summary of the technical assessment. |
| **Question A.** | **Is the remedy functioning as intended by the decision documents?**<br><br>Yes. The document that details the remedial decisions for OU 7 is the 1995 *Record of Decision*. Because the facility is still actively in use as a primary maintenance aircraft hanger, it was determined that the building's existing floor should be left in place as a cap to mitigate potential infiltration that could mobilize contamination to groundwater.<br><br>A review of groundwater data collected during the review period indicates that action levels were not exceeded in any sample and suggests that the cap is functioning as intended. Hexavalent chromium concentrations upgradient of the site are lower than hexavalent concentrations downgradient; however, this is not thought to indicate that the cap is not functioning as intended. According to the Site Manager, additional evaluation may be necessary to assess the hexavalent chromium concentrations in groundwater (Hall, 2007). Additionally, soil moisture monitoring data appear to have some irregularities that will be addressed as recommended in the PSVReport. However, these issues are not believed to impact the protectiveness of the cap in the short term because no exposure pathways are complete and annual inspection reports conclude that the cap is in excellent condition with no cracks in the slab (**CH2M HILL, 2006** and **CH2M HILL, 2007a**)<br><br><u>Opportunities for Optimization:</u><br><br>No opportunities to optimize the remedy for OU 7 were identified as part of the site inspection. The O&M contractor and CEVR staff are working to make changes to improve the procedures and methods used to monitor soil moisture under the floor slab. Additionally, the frequency of cap inspections was reduced from quarterly to annually.<br><br><u>Early Indicators of Potential Remedy Problems:</u><br><br>There are no indications of potential remedy failure based on the site inspection. Some minor cracking in the epoxy seal on the floor slab was observed, but this cracking does not currently affect the integrity of the slab. Additional evaluation of hexavalent chromium in groundwater may be assessed but this is not believed to be an indicator of remedy problems. |
| **Question B.** | **Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?**<br><br><u>Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics:</u><br><br>No. As noted in the *2003 CERCLA Five-Year Review*, the reference dose for hexavalent chromium has become more stringent than when the ROD was issued. However, since the soil RAO, is based on the cancer slope factor, the RAO for hexavalent chromium does not need to be modified in light of this change. |

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|---|---|
| | Changes in Applicable or Relevant and Appropriate Requirements:<br><br>The ARARs for this OU were identified in the ROD. Chemical-specific, action-specific, and location-specific ARARs were reviewed and were all determined to be either applicable or relevant and appropriate as presented in **Appendix G**. |
| **Question C.** | **Has any other information come to light that could call into question the protectiveness of the remedy?**<br><br>No. As discussed above, hexavalent chromium concentrations upgradient of the site are lower than those downgradient and additional evaluation will be conducted to assess this; however, this is not thought to affect the protectiveness of the remedy in the short term. |
| **Institutional Controls** | Institutional controls are generally defined as non-engineered instruments such as administrative and legal tools that do not involve construction or physically changing the site, and that help minimize the potential for human exposure to contamination and/or protect the integrity of a remedy by limiting land and/or resource use (**EPA, 2005**). Institutional controls can be used for many reasons including restriction of site use, modifying behavior, and providing information to people (**EPA, 2000**). Institutional controls may include deed notices, easements, covenants, restrictions, or other conditions on deeds, and/or groundwater and/or land use restriction documents (**EPA, 2001**). The following paragraphs describe ICs implemented at OU 7, the potential affect of future land use plans on ICs, and any plans for changes to site contamination status.<br><br>Types of ICs in Place at the Site:<br><br>Institutional controls required by the ROD at OU 7 include: (1) issuing a continuing order, (2) posting warning signs, and (3) providing for restrictions on future land use in the deed for Hill Air Force Base.<br><br>Access and institutional controls are currently in place at OU 7. Based on the site inspection, ICs were implemented as required. Hill AFB performs an annual evaluation of the ICs in place for the Base. This includes verification of orders, leases, groundwater use restrictions, and inspections of signage, fences, and monitoring wells. An annual land use controls report is prepared documenting the results of this work (EMR, 2007).<br><br>The following LUCs were assessed for OU 7 during the last Annual LUC Assessment (**Hill AFB CEVR, 2007a**): Utah Division of Water Right restrictions; the restricted use access map for Hill AFB; continuing order (AFI 32-7020 HAFBSU P 1); leases/easements/permits; and warning signs. Each of these LUCs is described below:<br><br>• Utah Division of Water Right Restrictions: This LUC is based on water rights and well drilling restrictions for on-Base and off-Base areas with shallow groundwater contamination. These restrictions are administered by the UDWR. There were no changes to the Hill AFB Water Rights Restrictions and Areas of Groundwater Contamination map. However, the map was submitted to the UDWR through a memorandum to ensure well drilling and water rights restrictions continue to be enforced in these areas of groundwater contamination in the vicinity of Hill AFB. The groundwater contamination depicted on the Hill Air Force Base Water Rights Restrictions and Areas of Groundwater Contamination map is limited to what Hill AFB calls the shallow aquifer. Beneath this aquifer are several thick sequences of silty clay that separate the Sunset and Delta aquifers.<br><br>• Hill AFB Restricted Use Access Map: The Restricted Use Access Map identifies areas on-Base with land-use and development restrictions due to known and potentially contaminated soil and groundwater. Individual maps for contaminated and potentially contaminated areas at Hill AFB are updated and distributed annually. The Restricted Use Access Maps for Hill AFB were updated during 2006. The updated maps were |

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| | distributed to appropriate personnel at Hill AFB and posted on the Hill AFB Restoration Intranet website to provide Basewide access.<br><br>• Continuing Order (AFI 32-7020 HAFBSUP 1): This LUC is established by AFI 32-7020 HAFBSUP 1, and restricts unauthorized development or construction in Operable Units at Hill AFB. There were no changes to the Continuing Order, and there was no new supplement to AFI 32-7020 released during Calendar Year 2006.<br><br>• Warning Signs: Sign can be used to restrict unauthorized access, prevent unauthorized excavation and/or construction, and prevent potential exposure to contaminated areas. The warning signs also provide contact information if access to these areas is necessary. Signs were evaluated at OU 7 and no recommendations were made.<br><br><u>Effects of Future Land Use Plans on ICs:</u><br><br>No changes to future land use are expected in the near future.<br><br><u>Plans for Changes to Site Contamination Status:</u><br><br>No plans are in place to change the site contamination status. |
| **Summary of the Technical Assessment** | The technical assessment, based on the data review, site inspection, technical evaluation, and interviews indicates that the remedial actions selected for the OU 7 appear to have been implemented as intended by the decision documents. While additional investigation may be conducted to assess hexavalent chromium in groundwater and methods for assessing soil moisture are going to be reviewed and modified, if appropriate, these issues are not expected to impact the protectiveness of the remedy because there is no pathway for exposure and based on annual inspections, the cap is in excellent condition. |

Table OU 7-7
# Operable Unit 7
# Technical Assessment Summary for OU 7

Reviewer: Kelly Taylor

| Site ID | Remedy Description | Technical Assessment | | | Protectiveness | Next Five-Year Review |
|---|---|---|---|---|---|---|
| | | Question A* | Question B* | Question C* | | |
| SS027 | Floor slab (cap) | Yes | No | No | Protective | 2013 |
| ST031 | NFRAP | NA | NA | NA | NA | NA |
| SS032 | NFRAP | NA | NA | NA | NA | NA |
| SS028 | NFRAP | NA | NA | NA | NA | NA |
| OT029 | NFRAP | NA | NA | NA | NA | NA |
| OU 7 | Floor slab (cap) | Yes | No | No | Protective | 2013 |

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

NA = Not applicable because the site is designated NFRAP

Table OU 7-8

# Operable Unit 7
# Five-Year Review Issues, Recommendations and Follow-Up Actions, and Protectiveness Statement

Reviewer: Kelly Taylor

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| **Issues** | Operation and maintenance activities are ongoing at OU 7. Based on the document review, data review, site inspection, interviews, and the technical assessment, it appears the remedy has been implemented as planned and is functioning as intended by the decision document in the short-term. To ensure continued protectiveness, three issues are identified in the 2008 five-year review for OU 7, as described below. These issues do not currently affect the protectiveness of the remedy, although they need to be addressed to ensure continued protectiveness.<br>1) Soil moisture data seem to indicate that a potential exists for calibration problems with the equipment used to measure soil moisture.<br>2) The 2003 five-year review recommended reevaluating risk at OU 7. Based on a reevaluation of risk it was determined that the calculated non-carcinogenic risk changed significantly for several sites within OU 7.<br>3) As indicated in the PSVReport, the hexavalent chromium concentrations downgradient of the source area consistently demonstrate hexavalent chromium concentrations higher than concentrations upgradient of the source, suggesting that transport of contaminants from the site is occurring (**Hill AFB CEVR, 2007c**). |
| **Recommendations and Follow-Up Actions** | As described in the previous section, three issues were identified in the 2008 five-year review for OU 7. To address these issues, the following recommendations and follow-up actions have been defined.<br>1) As recommended in the PSVReport, additional evaluation is needed to determine the adequacy of the soil moisture measurements. If it is determined that the soil moisture data are inadequate, an alternate method for assessing soil moisture should be developed (**Hill AFB CEVR, 2007c**).<br>2) While non-carcinogenic risk changed for several sites in OU 7, exposure pathways are not currently considered complete, and additional action is not currently recommended. However, if the situation changes and exposure pathways become complete, and before site closure, risk should be re-evaluated to ensure protectiveness.<br>3) Hexavalent chromium concentrations should continue to be evaluated as recommended in the PSVReport. As indicated in the 2008 five-year review interview with Barbara Hall/ Environmental Management, Restoration Division (CEVR), additional monitoring of hexavalent chromium may be conducted though hexavalent chromium concentrations in groundwater are not currently considered to be an indication of problems with the cap. If appropriate, additional monitoring points should be added to further evaluate the groundwater in this area. |
| **Remedial Timeframe** | **Table 3-3** in **Section 3.1.4** presents the remedial timeframe estimates for OU 7. The remedial timeframe for the O&M and LTM efforts is indefinite. |
| **Protectiveness Statement** | **The remedy in place at OU 7 is considered protective of human health and the environment.** The cap in place at this site prevents surface water infiltration, thus inhibiting the migration of soil contaminants beneath the cap. Continued O&M as part of the remedial action, including annual cap inspections, will ensure that the selected remedy continues to be protective. |
| **Next Five-Year Review** | Remedial actions at OU 7 will be reviewed in the next five-year review for Hill AFB to be completed during or before September 2013. |

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FIGURE OU 7 - 1
**SITE FEATURES OF OPERABLE UNIT 7**
2008 FIVE-YEAR REVIEW
IRP SITES: OT029, ST031, SS027, SS032, SS028
HILL AIR FORCE BASE, UTAH

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Table OU 8-1
# Operable Unit 8
# Background Information

Reviewer: Kelly Taylor

<table>
<tr><td>Introduction</td><td>Operable Unit 8 was created in 1993 as a groundwater-only OU, and comprises the shallow groundwater aquifer beneath OU 3 and OU 7, the Industrial Complex Area of the Base, and off-Base areas beneath the cities of Layton and Clearfield (Figure OU 8-1). Potential sources include Buildings 220 and 225 (OU 7); the former Berman Pond (OU 3), the Hill AFB IWTP Sludge Drying Beds, the Sodium Hydroxide Tank Site, the RVMF (OU 3); Ponds 1 and 3 (OU 3/OU 9); and the UST sites 260 (ST74) and 280 (ST35). Each of these potential source areas has been addressed under separate investigations and decision documents. Remedial actions for OUs 3 and 7 are in place or being implemented. While OU 9 sites (Ponds 1 and 3) were closed out under OU 3, they were reopened under OU 9. Soil at each of the OU 9 areas was determined to not pose a threat to the underlying groundwater; therefore, the only media/source managed under OU 8 is groundwater. Known UST sites overlying the OU 8 plume are either under LTO and management or have been remediated and are closed. Contaminants, principally TCE and 1,2- DCA, have migrated to the south and southwest from suspected on-Base source areas to off-Base areas under the City of Layton. Chlorinated compounds, primarily TCE, comprise the on-Base plume.<br><br>A list of the documents reviewed for OU 8 as part of the 2008 five-year review is provided in Appendix C.
<table>
<tr><th>IRP Identification</th><th>IRP Site Name</th><th>Status</th></tr>
<tr><td>OT033</td><td>TCE Plume</td><td>LTO/ LTM</td></tr>
</table>
</td></tr>
<tr><td>Site Chronology</td><td>Provided separately. See Table OU8-2.</td></tr>
<tr><td>Background</td><td>Physical Characteristics. The groundwater plume associated with the suspected on-Base source areas has migrated approximately 11,000 feet beyond the south Base boundary. The total acreage of the plume is currently estimated at 600 acres, with 300 acres in on-Base areas and 300 acres in off-Base areas. Depth to groundwater varies significantly across the area overlying the contaminant plume. On-Base, depth to groundwater varies from 70 feet bgs at the southern Base boundary to 180 feet bgs at the northern extent of the on-Base plume. Depth to groundwater in the off-Base areas varies from 1 to 3 feet bgs in the plume area immediately east of Interstate-15, to 75 feet bgs in the area west of Main Street in Layton. Groundwater on-Base generally flows to the north/northwest, and to the southwest off-Base.</td></tr>
<tr><td></td><td>Land and Resource Use. The off-Base portion of the plume underlies residential, commercial, and agricultural use properties. Three schools are located in the area: Lincoln Elementary, North Layton Junior High School, and Northridge High School. Weber State University has a satellite campus in the area. A hospital (Davis Medical Center) is located near the southwest extent of the off-Base plume, west of Interstate-15. Shallow groundwater is not currently used as a source of drinking water in the area. At the time the ROD was written, five residents had or did use the shallow groundwater for irrigation or stockwatering purposes only. However, according to the Annual LUC Assessment Report (Hill AFB CEVR, 2007b), current groundwater restrictions are in place. The Weber Basin Water Conservancy District supplies municipal water to the City of Layton. The district provides water from wells that tap deep aquifers that are unaffected by contaminants associated with OU 8. There are no jurisdictional wetlands, as designated by the United States Army Corps of Engineers, within the OU 8 area. In addition, the OU 8 area is highly developed and does not provide critical or important habitats for any wildlife species, and no threatened or endangered species are known</td></tr>
</table>

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| | to inhabit the area. There are no uses or known occurrences of commercially valuable natural resources within the OU 8 area, with the exception of deeper drinking water aquifers (**Hill AFB, 2005a**). |
| | **History of Contamination.** Contaminants, principally TCE and 1,2-dichloroethane, have migrated from suspected on-Base source areas to off-Base areas within the City of Layton. Potential sources include Buildings 220 and 225 (OU 7); the former Berman Pond, the Hill AFB IWTP Sludge Drying Beds, the Sodium Hydroxide Tank Site, the RVMF, Ponds 1 and 3 (OU 3); and the UST sites 260 (ST74) and 280 (ST35). Historically, shallow field drains used for agricultural purposes have transported shallow contaminated groundwater to previously uncontaminated areas. At present, the groundwater plume associated with the suspected on-Base source areas has migrated approximately 11,000 feet beyond the south Base boundary. The total acreage of the plume is currently estimated at 600 acres, with 300 acres in on-Base areas and 300 acres in off-Base areas. |
| | **Initial Response**. OU 8 has an IRA in place for the containment and extraction of contaminated groundwater at the southern Base boundary. The objective of the IRA HCS system is to induce a hydraulic gradient that will contain contaminated groundwater migrating off-Base at the southern boundary of Hill AFB. The OU 8 HCS has been operational since 18 May 1998. Eight extraction wells pump groundwater on a semi-continuous basis discharging to the sanitary sewer for treatment at NDSD. Because the system transects Hillfield Drive adjacent to the south gate of Hill AFB, the conveyance and instrumentation are operated independently as separate East and West systems. Because the objective of the IRA HCS is containment, cleanup levels were not established (**Hill AFB, 2005a**).While the HCS was installed as an IRA originally, it was also included as part of the Final ROD as discussed below in the Remedial Actions section. |
| | **Basis for Taking Action.** Based on the human health risk assessment, current cancer risks were within the potentially acceptable risk range for all receptors and non-cancer HIs were less than 1. Based on potential future conditions, cancer risk exceeded $1x10^{-4}$ and the non-cancer HI exceeded 1 in multiple exposure scenarios including both on-base and off-base receptors. These risk estimates were primarily driven by the potential use of the shallow ground water as a source of drinking water (**Hill AFB, 2005a).** The Base Boundary HCS was implemented in an effort to reduce potential future risks to off-Base receptors and minimize the potential migration of contaminants from on-Base source areas to off-Base areas (**Hill AFB, 2005a**). |
| **Remedial Actions** | **Remedy Selection (ie. ROD/ESDs).** A final ROD for OU 8 was issued in 2005 (**Hill AFB, 2005a**). The selected remedy for the OU 8 is groundwater extraction and discharge to the sanitary sewer. If contaminant concentrations increase, discharge of extracted groundwater to the on-Base IWTP may be considered as a modification to the OU 8 HCS (**Hill AFB CEVR, 2008**). The selected remedy for OU 8 includes the following components (**Hill AFB, 2005a**):<br>**On-Base Areas**<br>• Implementation of MNA to remediate on-Base groundwater.<br>• Continuous operation of the OU 8 IRA HCS at the southern Base boundary to prevent further migration of contaminated groundwater to off-Base areas and, as a secondary objective, contaminant mass removal.<br>**Off-Base Areas**<br>• Installation of groundwater extraction systems to extract contaminated groundwater. This component also assumes the continued operation of the OU 8 IRA HCS to prevent further migration of on-Base contamination to off-Base areas.<br>**Both On-Base and Off-Base Areas**<br>• Groundwater monitoring to monitor projected declines in contaminant concentrations. |

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| | • Institutional controls.<br><br>The selected remedy for OU 8 addresses the principal threats posed by the site by minimizing or preventing direct contact with contaminated groundwater, and by active contaminant mass removal through groundwater extraction. Further, the selected remedy prevents further off-Base transport of contaminants through continuous operation of the IRA HCS. Additional investigation and data evaluation have been conducted to address the monitored natural attenuation portion of the remedy as presented in the Evaluation of Natural Attenuation of Groundwater Contamination at OU 8 (**MWH, 2007f**).<br><br>Remedial action objectives for OU 8 as defined in the ROD (**Hill AFB, 2005a**) include: (1) revent human exposure to contaminated groundwater above concentrations corresponding to an excess cancer risk between $1 \times 10^{-4}$ and $1 \times 10^{-6}$ and a chronic health risk defined by a hazard quotient of 1; (2) protect uncontaminated groundwater for future use; and (3) reduce the mass of contaminants in shallow groundwater to PRGs within a reasonable timeframe.<br><br>It should be noted that the CEVR site manager indicates that an ESD is planned for 2010. Modeling and additional evaluation performed after the ROD was signed indicate that the reduction in cleanup timeframe associated with the AES is insignificant (approximately 5 years) relative to the overall cleanup time. Consequently, only one set of extraction wells has been installed off-Base at the toe of the 1,2-DCA plume to prevent further migration of the 1,2-DCA plume (**Hill AFB CEVR, 2007a**). A 25-year site access agreement was granted in 2005 between Landstar Development, LLC and the Air Force in case it is determined the AES system needs to be installed (**Hill AFB, 2005b**). |
| | **Remedy Implementation.** Construction of an HCS for OU 8 at Hill AFB was completed in the Spring of 1998 and the system started operating on May 15, 1998 (**Hill AFB CEVR, 2008**). The East System was shut down on May 21, 1998, after only 4 days of operation due to flooding of the electrical pullbox that resulted in electrical component damage. After several design changes and site re-grading, the East System was restarted in April 1999, and has been in nearly continuous operation since that time. In an effort to minimize the potential further migration of contaminants, Hill AFB designed and installed a groundwater extraction system during the summer of 2005, called the 1,2- DCA Groundwater Extraction System, located at the leading edge of the OU 8 plume. The 1,2-DCA Groundwater Extraction System at OU 8 consists of three extraction wells (U8-216, U8-217, and U8-218), conveyance lines, manholes/vaults, and electronic control systems necessary to extract groundwater at a cumulative rate of approximately 120 gallons per minute (**Hill AFB CEVR, 2007c**). Extracted groundwater from the wells is combined in a manifold vault and is discharged untreated to the Hill AFB storm sewer beneath Main Street in the City of Layton (**MWH, 2007c**). In May 2006, Monitoring Wells U8-148 and U8-149 were installed each to a depth of approximately 140 feet and screened from approximately 120 to 140 feet bgs in an effort to better understand the performance of the system. In addition to those wells previously used to evaluate system performance, as presented in the OU 8 PSVPlan (www.hafbdyndocs.com), results of samples collected from these wells and water level measurement information are used to monitor performance of the 1, 2-DCA Groundwater Extraction System and its effect on the groundwater level in the area.<br><br>**Progress Since Implementation.** According to the 1,2-DCA Annual Cost and Performance Report, 86,509,336 gallons of water have been extracted to-date from the 1,2-DCA system and 2.09 pounds of 1,2-DCA were removed from April 2006 to March 2007 (**MWH, 2007i**). The combined cumulative number of gallons extracted from both the east and west extraction systems associated with the HCS to-date is 69,410,036 and from April 2006 to March 2007, 2.82 pounds of TCE were extracted (**MWH, 2007h**). |
| | **Operations and Maintenance**. Hill AFB is responsible for the O&M of the OU 8 HCS, assessment of collected data, and determination of whether operational changes or modifications to the system are warranted to increase the efficiency of the HCS. Previous |

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| | O&M contractors during this review period included Montgomery Watson and CH2M HILL. Currently, O&M tasks have been delegated to MWH, the O&M contractor. The O&M contractor is responsible for the following: (1) operating the system with intent to optimize hydraulic containment and minimize system downtime; (2) performing routine maintenance of the system; (3) providing recommendation to Hill AFB for system repairs and/or modifications to increase system efficiency and economy; (4) conducting groundwater quality and water level measurements; (5) conducting performance monitoring and discharge water quality sampling; (6) submitting monthly, quarterly, and annual reports to Hill AFB; and (7) reporting any spills or discharge permit violations immediately to Hill AFB. General O&M tasks include: (1) system performance evaluation and reporting; (2) system operation task; (3) system inspection monitoring; (4) system operational data collection; (5) system discharge water sampling; (6) collect and analyze groundwater and discharge water samples; and conduct water level monitoring; (7) system maintenance tasks; and (8) system troubleshooting (**Hill AFB CEVR, 2008**).<br><br>Operation and maintenance of the 1,2-DCA Groundwater Extraction System is discussed in a separate O&M plan (**Hill AFB CEVR, 2007c**). Kleinfelder was the construction contractor for this system in 2005. MWH is the current O&M contractor. The objective of system maintenance is to ensure smooth operation with minimum system downtime. System maintenance activities associated with normal system operation include both preventative and corrective maintenance. Maintenance is generally performed according to the manufacturer's instructions to prevent potential problems as a result of normal operations. Maintenance may include cleaning and inspection of equipment parts and adjustment of water levels and/or the variable frequency drives. Recommendations for optimizing system performance and streamlining future O&M activities include: (1) replacing the existing drop pipe in the extraction wells with Wellmaster Tubing; (2) investigating alternate sump-pump options for the 1,2-DCA ES leak detection manhole (LDMH) and manifold vault; (3) evaluating the feasibility of adding desiccant to the transducers in the extraction wells; (4) sealing the link seals in the pressure clean out manholes (PCOMHs); and (5) implementing data collection and tracking of maintenance monitoring parameters to provide early detection of well deterioration (**MWH, 2007c**).<br><br>Operation and maintenance plans are maintained and updated online through the CEVR Dynamic Documents System and O&M procedures follow the most current version of the O&M plans (**Hill AFB CEVR, 2008** and **MWH, 2007c**). |
| **Progress Since Last FYR** | The most recent five-year review was conducted in 2003 (**URS, 2003**). Recommendations based on this review are presented in **Table OU8-3** along with current status of each recommendation.<br><br>Current Status. Since the last five-year review, the 1,2-DCA Groundwater Extraction System has been installed to prevent potential contaminant migration at the leading edge of the plume, as discussed above. As of 2007, review of the piezometeric surface map generated using water-level data collected on 4 June 2007 indicates that the OU 8 HCS is hydraulically containing contaminated groundwater and preventing further migration of contaminated groundwater at the Base boundary **(MWH, 2007a**).<br><br>In May 2006, two additional monitoring wells, U8-148 and U8-149, were installed (each to a depth of approximately 140 feet bgs and screened from approximately 120 to 140 feet bgs) to help monitor performance of the 1,2-DCA Groundwater Extraction System and delineate the lateral extent of 1,2-DCA contamination in groundwater (**Hill AFB CEVR, 2007a**). MWH will continue to monitor the pumping rate in Extraction Well U8-218 and will schedule pump maintenance and well redevelopment in the near future (**MWH, 2007b**). The 1,2-DCA Groundwater Extraction System operated sufficiently during the April 2006 through March 2007 period to meet the objective of removing and preventing further migration of 1,2-DCA contaminated groundwater. |

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| | According to the most recent version of the PVSPlan, weekly water level measurements collected at Base Boundary HCS Extraction Wells U8-202 and U8-210 indicate these wells are experiencing large fluctuations in drawdown and therefore large fluctuations in specific capacity (**Hill AFB CEVR, 2007a**). The PSVPlan concludes that the performance metric regarding specific capacity should not be regarded as a strong indicator of plume containment. Based on this condition, it is recommended that: (1) further investigation into these fluctuations is undertaken, possibly involving automatic data logging of water levels for a period of time to observe water level behavior more closely; (2) because the monitoring network in the stagnation zone is very limited, additional piezometers could be added to improve delineation of the capture zones and stagnation point; and (3) monitoring wells for groundwater sampling should be added south of State Route 193 in the Sun Valley apartment complex directly downgradient (south) of the Base Boundary HCS to aid in evaluation of plume migration/containment.<br><br>Recommendations for VOCs within the on-Base source areas were not presented in the latest PSVPlan; however, wells with historical hexavalent chromium concentrations above the chromium MCL were recommended for continued sampling (**Hill AFB CEVR, 2007a**). Additionally, monitoring wells downgradient of current hexavalent chromium detections (e.g., U8-133, and possibly U8-132 or U8-092) were also recommended for sampling to further address the stated hypothesis that the area of hexavalent chromium contamination is stable or shrinking through time. The recommended additions to the groundwater monitoring efforts have been accounted for in the latest sampling and analysis plan (**MWH, 2007j**). Because the western boundary of the on-Base groundwater plume has expanded beyond the Area of Attainment defined in the OU 8 ROD, in the vicinity of monitoring wells U8-133 and possibly near U8-108, further investigation is needed in that area. The existing monitoring network to the west of U8-108 is also insufficient, as monitoring wells U8-010 and U8-009 are not believed to be screened at proper depths for monitoring of contamination in that area (**Hill AFB CEVR, 2007a**).<br><br>In regard to the off-Base plume, further investigation was recommended in the PVSPlan (MWH, 2007h) to: (1) identify the source or sources of 1,2-DCA that contribute to the off-Base plume; (2) to further define the extent of 1,2-DCA in the groundwater near the isolated lobe; and (3) to better understand the extent of groundwater contamination in the areas south and west of the TCE isolated lobe and to identify potential locations for new sentry wells. The most up-to-date groundwater monitoring efforts were developed considering the recommendations in the OU 8 PSVReport and are presented in the sampling and analysis plan (**MWH, 2007j**).<br><br>In late 2006, CPT and direct-push groundwater sampling was conducted at off-Base locations by MWH under two task orders (TO 139 and TO 167) as recommended in the PSVPlan update (previously discussed). The primary objective of the investigation was to determine if groundwater was contributing to VOC concentrations detected in indoor air. Based on groundwater sample results from both investigations, contamination is believed to be traveling in a southwestern direction within the shallow perched zone and decreasing in concentration to below MCLs towards the southwest in the same area in which the water table becomes deeper (**MWH, 2007d** and **MWH, 2007e**). Due to the detections of TCE in the shallow groundwater in the northwest corner of Robins Park, some homes in this neighborhood may have detectable concentrations of TCE in indoor air. The 2006 to 2007 Basewide Residential Indoor Air Sampling round, which began in November 2006, was expanded to include a larger portion of Robins Park due to the results of the TO 139 investigation and pending the results of the follow-up TO 167 groundwater investigation. MWH recommended air sampling in this neighborhood for at least one round, after which the results should be evaluated to determine if homes are impacted by the low concentrations of TCE in the underlying shallow groundwater. If indoor air sampling should continue after the initial round of sampling, MWH recommended that the sampling be confined to the northwest portion of the neighborhood because TCE has been consistently absent in groundwater samples collected during both investigations from |

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| | locations in other parts of the neighborhood. Installation of seven shallow monitoring wells in the areas near Antelope Drive was planned for April 2007 (**MWH, 2007g**). Analytical results from samples collected from these wells were used to confirm the results of the groundwater investigations and to evaluate contaminant distribution and determine the need for further investigation in areas west and southwest near Target.<br><br>In early 2007, additional CPT efforts were conducted to evaluate the isolated lobes of the off-Base plume. The primary objectives of the investigation was to determine the extent of 1,2-DCA and TCE contamination in groundwater in the isolated lobes of the TCE and 1,2-DCA plumes in Layton, Utah. TCE concentration in monitoring well U8-074 (located north of Tinseltown Movie Theater) increased from approximately 3 to 49 µg/L. This monitoring well was previously considered a sentry well because it was located south of the isolated lobe of the TCE plume as it was historically depicted based on data available through 2003. Further investigation was required to better understand the extent of groundwater contamination and to identify potential locations for new sentry wells. Monitoring locations intended to evaluate the 1,2-DCA plume are not believed to be screened at the appropriate depth, therefore, additional evaluation was needed to determine the current extent of 1,2-DCA contamination and identify appropriate locations for new sentry wells. As a result of this investigation, further investigation southwest of Interstate-15 to determine the southwestern extent of contamination is recommended as well as investigation upgradient of monitoring well U8-074 to further understand the increase in TCE concentrations in this well. Subsequent investigations should focus on depths near 55 feet bgs because site contaminants were consistently detected near this depth during this investigation.<br><br>Because natural attenuation is a part of the selected remedy for the on-Base portion of the plume and because natural attenuation is thought to be the primary means of plume mass decline off-Base, additional investigation was conducted in late 2007 to assess the rate at which natural attenuation is occurring and to assess the cleanup time frame (**MWH, 2007f**). Conclusions for the on-Base plume indicate that: (1) the TCE plume mass is declining through time and the plume mass is not migrating; (2) reductive dehalogenation is not a major cause of observed TCE loss on-Base; and (3) hexavalent chromium concentrations are decreasing primarily as a result of dilution and natural attenuation. Conclusions related to the off-Base plume indicate that: (1) the TCE plume mass is declining through time and the plume mass may be migrating to the west; (2) reductive dehalogenation of TCE contributes more to the observed decline in plume mass off-Base than on-Base; and (3) natural attenuation of 1,2-DCA is occurring; however, reductive dechlorination is not a major factor in the observed reduction. In addition, some modifications to the PSVPlan were recommended including: (1) modifying the use of the method which uses the calculated rates of decline to derive the expected values for plume mass; (2) conducting additional hexavalent chromium investigation near U8-133; (3) continuing sampling for TCE breakdown products and MNA indicator compounds off-Base to support the evaluation of natural attenuation; (4) consider eliminating TCE breakdown products and MNA indicator compounds from the on-Base monitoring programs; and (5) updating PSVPlan objectives. |

Table OU 8-2

## Chronology of Site Events for Operable Unit 8

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 8 | OU 8 | 7 | 1987 | National Priorities List (NPL) | The Base was put on the Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA) NPL list. | Hill Air Force Base (AFB). 2005. Record of Decision (ROD) for Operable Unit (OU) 8, Hill AFB, Utah. March. |
| 8 | OU 8 | 4 | 1991 | FFA | Hill AFB entered into a Federal Facilities Agreement with Utah Department of Environmental Quality (UDEQ) and Environmental Protection Agency (EPA). Agreement entered on 4/1/1991. | ROD for OU 8 |
| 8 | OT033 | | 1993 | Transfer to Another OU | OU 8 was created in 1993, and consisted of contaminated groundwater previously considered part of OU 3 and OU 7. | Remedial Investigation (RI) Report for OU 8 |
| 8 | OT033 | 5 | 1997 | Interim Action | An interim ROD for an Interim Remedial Action at OU 8 was finalized in May 1997. | RI Report for OU 8. |
| 8 | OT033 | 10 | 1997 | Interim Action | The Base Boundary Hydraulic Containment System (BBHCS) was constructed beginning 20 October 1997 and completed 1 May 1998. | Construction Completion Report (CRC) for OU 8 Interim Remedial Action (IRA) Hydraulic Containment System (HCS) |
| 8 | OT033 | 5 | 1998 | Interim Action | The west system of the BBHCS was operational. | RI Report for OU 8. |
| 8 | OT033 | 9 | 1998 | 1998 Five-Year Review | As designed and operated, remedies at OU 8 remain protective of human health and the environment. | Hill AFB Five Year Review. September 1998. |
| 8 | OT033 | | 1998 | Interim Action | Final inspection of the OU 8 IRA HCS was conducted on 4 May 1998. A final facility inspection by the EPA and UDEQ was conducted on 20 July 1998. O&M system startup was on 18 May 1998. | Final IRA Report for OU 8 |
| 8 | OT033 | 4 | 1999 | Interim Action | The East System was shut down on May 21, 1998 after only four days of operation due to flooding of the electrical pullbox that resulted in electrical component damage. After several design changes were implemented, the East System was restarted in April 1999. | RI Report for OU 8. |
| 8 | OT033 | 12 | 2001 | Remedial Investigation | Remedial Investigation Report for OU 8 was finalized. | RI Report for OU 8. |
| 8 | OT033 | 3 | 2003 | Feasibility Study | Feasibility Study Report for OU 8 was finalized. | Feasibility Study (FS) Report for OU 8 |

Table OU 8-2

## Chronology of Site Events for Operable Unit 8

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 8 | OT033 | 9 | 2003 | 2003 Five-Year Review | Protectiveness at OT033 could not be determined until additional information obtained. | Final CERCLA Five-Year Review. September 2003. |
| 8 | OT033 | 3 | 2005 | Record of Decision | ROD for OU 8 was signed. | ROD for OU 8. |
| 8 | OT033 | 5 | 2005 | Remedial Action | The 1,2-DCA Extraction System installation was completed in July 2005. | OU 8 1,2-DCA Extraction System CRC, Hill AFB, Utah. |
| 8 | OT033 | 5 | 2006 | Post-ROD Study | Previous performance monitoring of the 1, 2-DCA Extraction System showed insufficient water level data west of the system to adequately delineate the capture zone. Consequently, monitoring wells U8-148 and U8-149 were installed in May 2006. | OU 8 PVSPlan. |
| 8 | OT033 | 2 | 2007 | Post-ROD Study | Cone penetration testing (CPT) and direct-push groundwater sampling performed at OU 8 in support of the Indoor Air Program. | Final OU 8 CPT and Groundwater Investigation in Support of the Indoor Air Program, Hill AFB, Utah. |
| 8 | OT033 | 5 | 2007 | PSVPlan | PSVPlan published. | OU 8 PVSPlan. |
| 8 | OT033 | 11 | 2007 | Post-ROD Study | Data evaluation conducted in late 2007 to assess the rate at which natural attenuation is occurring and to assess the clean-up time frame. | MWH. 2007. Evaluation of Natural Attenuation of Groundwater Contamination at OU 8. |

**Notes**

| | |
|---|---|
| AFB | Air Force Base |
| BBHCS | base boundary hydraulic containment system |
| CCR | Construction Completion Report |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CPT | Cone penetration test |
| EPA | United States Environmental Protection Agency |
| FS | Feasibility Study |
| NPL | National Priorities List |
| O&M | Operations and Maintenance |
| OU | Operable Unit |
| PSVPlan | Performance Standard Verification Plan |
| RI | Remedial Investigation |
| ROD | Record of Decision |
| UDEQ | Utah Department of Environmental Quality |

Table OU 8-3

## Progress Since Last Five Year Review - Status of Recommendations and Follow-Up Actions at OU 8

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Site | 2003 Five-Year Review Recommendations | Current Status | Carry Over to Next FYR? |
|---|---|---|---|
| OT33 | Clarify appropriate chemicals of concern (COCs) in the final ROD | **Complete.** The Record of Decision (ROD) for Operable Unit (OU) 8 was signed in 2005 (**Hill AFB, 2005a**) and COCs were clarified under the effort; the primary COCs are trichloroethene (TCE) and 1,2-dichloroethane (1,2-DCA) though metals including hexavalent chromium were also included (see Tables 3-1 and 3-2 of the ROD). | No |
| | Investigate the following options: (a) reducing the cost of the sampling program by reducing the frequency of sampling for the East system wells if the change does not significantly impact the accuracy of the mass removal calculation, (b) reducing the method detection limit (MDL) with the laboratory to a reporting limit less than 5 µg/L for better quantification of contaminant concentration to support taking wells off-line, (c) in an effort to reduce system operating costs, taking some or all of the East System wells off-line (U8-201, U8-207, U8-208) based on statistically-proven concentrations below MCLs and modeling to ensure that capture of the 5 µg/L contour is not compromised, and (d) changing the discharge point of the East System from the sanitary sewer to the storm drain due to the low concentrations being captured by this section of the system | **Complete.** The PSVPlan was completed in 2007. In regard to item A, sampling frequency was evaluated and a sampling program was developed as presented in the PSVPlan. As noted in item B, the Basewide Quality Assurance Project Plan (QAPP) was updated in December 2003 (**MWH, 2003**) and presents a reporting limit for TCE of 5 ug/L. Because the MDLs are laboratory specific, the QAPP did not present them; however, based on a review of ERPIMS data, it appears the MDL is much lower than 5 ug/L based on low level detected concentrations (i.e. 0.4 ug/L); therefore, the MDL issue has been resolved. In regard to item C, based on the latest PSVPlan, no extraction wells have been taken offline. Because well U8-208 continues to exceed MCLs for TCE it would not be appropriate to take this well offline. In regard to item D, no change has been made in regard to the discharge point for the East system. Because TCE concentrations in U8-208 still exceed MCLs, it may not currently be feasible to discharge to the storm drain at this time. This should continue to be evaluated when optimizing the system. | No |
| | Calculating maximum shutdown durations for each well within the IRA system to ensure future capture of the entire plume transect and comparing the maximum well shutdown durations for each well to determine the maximum system shutdown duration | **Complete.** The maximum system downtime of the Base Boundary Hydraulic Containment System (HCS) is 38 to 50 days as specified in Appendix K of the Hydraulic Containment System Operation and Maintenance Manual for OU 8 (**Hill AFB CEVR, 2008**). The maximum system downtime for the 1,2-DCA ES, as provided in Appendix D of PVSPlan, is one month. While individual well shutdown durations have not been determined for either system in the PSVPlan or O&M plans, the PSVPlan has identified red-flag values for water levels which will ensure that the wells are operating at the necessary rates to ensure capture. | No |
| | Address operational issues including (a) during the next revision of the O&M Plan, the pump specifications based on predicted flows should be replaced by pump specifications based on actual flows, (b) cleaning and maintaining spare pumps, (c) completing a cost-benefit analysis for replacement or re-engineering of the current pressure transmitter enclosures | **Ongoing.** Operational issues have been addressed in the latest versions of the O&M Plans (**Hill AFB CEVR, 2008** and **Hill AFB CEVR, 2007c**), meeting minutes, and/or monthly reports. Such issues are evaluated continually as part of routine O&M. When/if equipment or SOPs change as a result of these evaluations (for any reason) the O&M Manuals are updated accordingly. Across the board, the O&M contracts require the O&M contractors to point out viable cost saving and efficiency improvements and these recommendations are evaluated individually and funded as appropriate. In the case for the BBHCS, these particular issues were included on a lengthy list of potential system “improvements” that have or will be evaluated by the O&M contractor. | No |

Table OU 8-3

## Progress Since Last Five Year Review - Status of Recommendations and Follow-Up Actions at OU 8

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Site | 2003 Five-Year Review Recommendations | Current Status | Carry Over to Next FYR? |
|---|---|---|---|
| | Re-evaluating previous indoor air data, and if necessary obtain additional air samples to determine if the new action level for TCE (0.43 parts per billion by volume [ppbv]) in indoor air would warrant additional mitigation measures in off-Base residential areas (if additional indoor air samples are needed, they should be collected during winter months when vapor intrusion will reach its maximum) | **Ongoing.** The Basewide Indoor Air Program currently uses this updated action level to assess risk based on exposure to TCE in indoor air. The 2006-2007 Basewide Residential Indoor Air Sampling round, which began in November 2006, was expanded to include a larger portion of Robins Park due to the results of the TO 139 investigation and pending the results of the follow-up TO 167 groundwater investigation (**MWH, 2007d** and **MWH, 2007e**). MWH recommended air sampling in this neighborhood for at least one round, after which the results should be evaluated to determine if homes are impacted by the low concentrations of TCE in the underlying shallow groundwater. | No |
| | Reviewing analytical sampling results for U3-633 to quantify exposure risks at this location and continuing sampling at this location to develop a statistically relevant representation of the exposure risks. | **Ongoing.** U3-633 was sampled on April 2003 and TCE was detected at a concentration of 14 ug/L. U3-633 was located within the western arm of the off-base plume. According to the RI report (**MWH, 2001**), investigations at OU 8 indicated that contaminated groundwater collected by field drains discharges to the stormwater drain system which eventually drains into Kay's Creek. During development efforts in the area, U3-633 was piped by the developer directly to a storm drain and is no longer evident (**Hicken, 2007**). According to the PSVPlan, surface water samples are collected from the Kay's Creek outfall (U8-9003) and analyzed for VOCs. This sampling was initiated in 2005 and only trace levels of 1,2-DCA have been detected. Annual sampling of this outfall has been recommended in the PSVPlan (Section 4.1.3) with increased frequency if concentrations in the 1,2-DCA extraction system effluent increase significantly. This discharge is regulated by permit and the discharge limit for 1,2-DCA is 37 ug/L (well above the trace levels detected). | No |
| | Human health risks should be re-evaluated at Operable Units (OUs) 1 through 8. | **Ongoing.** Human health risks were re-evaluated in a recent technical memorandum (**CEVR and SES, 2007**). Based on this evaluation, no actions were recommended at OU 8. However, a review of toxicity factors and remediation goals indicates that a new standard for arsenic in drinking water was adopted by the EPA and UDEQ which became effective as of 1/23/2006. On this date the standard was lowered from 50 parts per billion (ppb) to 10 ppb. | Yes |

**Notes**

1,2-DCA = 1,2-dichloroethane
EPA = U.S. Environmental Protection Agency
HCS = hydraulic containment system
MDL = method detection limit
O&M = operations and maintenance
OU = operable unit
ppb = parts per billion
PSVReport = Performance Standard Verification Report
QAPP = quality assurance project plan
ROD = record of decision
TCE = trichloroethylene
UDEQ = Utah Department of Environmental Quality
VOC = volatile organic compound

Table OU 8-4
# Operable Unit 8
# Five-Year Review Process

Reviewer: Kelly Taylor

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| **Introduction** | This 2008 five-year review for Hill AFB has been conducted in accordance with the EPA's Comprehensive Five-Year Review Guidance dated June 2001 (**EPA, 2001**). Administrative and community involvement components of the five-year review are described in **Section 2.0** of this report for the overall five-year review. In addition, interviews were conducted with relevant parties. A site inspection of OU 8 was performed. Relevant site documents and applicable data covering the period of the five-year review were evaluated. The site interviews, site inspection, and data review are further discussed in the following sections. |
| **Interviews** | Interviews for OU 8 were conducted with Barbara Hall/75 CEG CEVR, Aaron Pettley/ O&M contractor with MWH, and Jason Dalpias/75 CEG CEVR. Copies of the Interview Record Forms are provided in **Appendix D**.<br><br>Barbara Hall was interviewed on September 27, 2007 and indicated that remedial efforts at OU 8 have had a positive effect and that the total plume mass is decreasing over time. Additional monitoring will be performed to assess whether or not the HCS is completely containing the plume. However, the plume mass is dropping both on- and off-Base, and the center of mass is not moving. The 1,2-DCA system is effectively containing the toe of the plume. Improved metrics, introduced in the last couple of years, are working well for evaluating the mass of the plume. She also indicated that well fouling had been an issue but that a better approach for proactively planning well rehabilitation has been developed.<br><br>Aaron Pettley, interviewed on September 27, 2007, indicated that the systems are functioning as intended and that both systems are easy to operate and maintain. Operation and maintenance is focused on maintaining operating (pumping) time and minimizing down time of the systems. He also indicated that options currently being evaluated for optimization include: (1) the ability to view some operational data online and have the ability to control some systems remotely; (2) assessing shutdown of some wells; (3) replacing the transducers in the 1,2-DCA system wells; and (3) installing dessicant packaging to remove moisture and prevent premature failure. Operation and maintenance difficulties included water infiltration into the leak detection system at the 1,2-DCA system as a result of heavy rainfall and failure of a central processing unit (CPU) processor card at the HCS which was replaced.<br><br>Jason Dalpias was interviewed on December 14, 2007. He indicated that, based of the capture zones that are developed from piezometric surface contouring, both the HCS and the 1,2-DCA Groundwater Extraction System appear to capture their respective plumes. He also indicated that fouling had been an issue at both systems but that CEVR has developed better pump and well rehabilitation methods and invested resources in better monitoring, which has allowed for timely rehabilitation of pumps and wells. Despite the fouling challenges at the two systems, containment of the plumes has still been achieved.<br><br>Community interviews were also conducted as part of this five-year review. An interview was conducted with Mr. David Krieger/Layton resident. A copy of the Interview Record Form is provided in **Appendix B.**<br><br>Mr. David Krieger indicated that Hill AFB was doing what they could to address cleanup issues but that things were rather inconvenient when they had to clean up a sewer line break they caused in his basement. He indicated that neither he nor his neighbors seemed overly worried about things and they are satisfied with the remedies that have been completed on their properties. He feels that Hill AFB adequately informs residents and that he receives newsletters all the time. He is also involved in the quarterly sampling regiment. He has a vapor mitigation system that is inspected annually. Contractors also frequently sample the piezometers on his property. Overall, he thinks Hill AFB has done an admirable job. |

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| **Site Inspection** | The site inspection for OU 8 was conducted on September 27, 2007. The completed site inspection checklist is provided in **Appendix E**.<br><br>During the site inspection, all wells that were inspected appeared to be in good condition. There was some trenching for installation of a utility along the west system of the HCS. The CEVR staff did not recall receiving a notice regarding the digging in this area, and were not sure if the proper process for excavation/trenching had been followed for this work. The CEVR staff were looking into this issue at the time of the site inspection. It was also noted that three wells (U8-218, U8-17, and U8-216) associated with the 1,2-DCA system have problems with transducer failure.<br><br>The site inspection checklist addressed four discussion topics. These discussion topics are presented below, followed by responses and general observations based on the site inspection.<br><br>(1) Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).<br><br>Based on the site inspection, all components of the remedy appear to be functioning as designed. However, trenching had occurred at OU 8 to install a utility. The CEVR staff were not aware or had not been provided proper notice that the excavation activities were to occur. The trenching crossed electric lines for the west system of the HCS, but did not damage it. This was being investigated at the time of the site inspection.<br><br>(2) Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.<br><br>Operation and maintenance at OU8 includes O&M of the HCS and 1,2-DCA systems, groundwater monitoring, implementation and enforcement of ICs, and compliance monitoring. Documentation of the groundwater monitoring activities is provided in the Final Sampling and Analysis Plan for Operable Units 3, 7, and 8 and CMP for Operable Units 1, 2, 4, 5, and 12 (**MWH, 2007m**). Institutional controls compliance was not followed in the case of the trenching activity previously noted.<br><br>(3) Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.<br><br>There are no indications of potential remedy failure based on the site inspection.<br><br>(4) Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.<br><br>No opportunities to optimize the remedy for OU8 were identified as part of the site inspection. Operation and maintenance contractors regularly make recommendations to optimize performance and/or reduce costs. The O&M contractor has recommended installation of a callout system to provide notice when the pump and treat system shuts down. Currently, if the system shuts down, it remains down until an operator/technician arrives at the site for O&M. Modeling indicates that the HCS can be down for a period of one month (OU 8 PSVPlan) before contamination migrates beyond the Base boundary. O&M staff are onsite a minimum of once per week. The lack of a callout system does not affect the protectiveness of the remedy as long as the modeling is correct and the current O&M schedule is maintained. |
| **Data Review** | The data reviewed as part of the 2008 five-year review included groundwater sampling and elevation measurements, contaminant mass removal data, discharge effluent, and extraction well pumping rates. Groundwater data were collected on a semiannual basis at 27 monitoring wells for the HCS and at 18 monitoring wells for the 1,2-DCA system during the review period. Water levels were collected monthly at monitoring wells and weekly at extraction wells and used to create piezometric surface contour maps to delineate capture zones as presented in |

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| | quarterly reports. Effluent was sampled quarterly during the review period. Well pumping rates were recorded weekly during the review period.<br><br>The ROD established remediation goals for groundwater at OU 8. For groundwater, the remediation goals were set at the MCLs established under the SDWA and the UDEQ as presented in **Table OU 8-5**. The HCS discharges to the NDSD sanitary sewer, and the 1,2-DCA system discharges to the Hill AFB storm sewer. Discharge limits are set by permit and are presented in **Table OU 8-6**.<br><br>1,2-DCA Extraction System<br><br>Based on a data review, the 1,2-DCA extraction system seems to be functioning as intended. Effluent from the 1,2-DCA system did not exceed the permit limits (**Table OU 8-6**) during the review period. Extraction well pumping rates for individual wells were outside of the acceptable range on a few occasions during the review period. All three wells appear to have been turned off in May/June 2006 for periods of 2 to 4 weeks each. U8-218 was routinely below the lower limit of the acceptable range for approximately 4 months in 2006. U8-217 was also frequently pumping at a rate below the acceptable lower limit in 2005. However, pumping rates for the system as a whole have routinely been within the total system acceptable range (with the exception of two weeks in May/June 2006) indicating that capture was likely being attained. Based on a review of capture zones presented in quarterly reports, the 1,2-DCA system appears to be containing the toe of the plume. From April 2006 through June 2007, 1.84 pounds of 1,2-DCA were removed. 1,2-DCA concentrations in downgradient wells (U8-134, U8-137, U8-138, U8-139, U8-140, U8-144, U8-145, U8-148, and U8-149) were all non-detect during the review period suggesting that plume contaminants have not migrated to these wells. Concentrations of 1,2-DCA in wells outside of the attainment area (U8-126, U8-130, U8-131, U8-132, U8-133, U8-137, U8-138, and U8-144) were generally non-detect or less than 1 microgram per liter (µg/L) and indicate that concentrations of 1,2-DCA are not above maximum contaminant levels (MCLs) in those wells outside the attainment area. Additionally, 1,2-DCA concentrations in U8-124 (just north of extraction well U8-217) appear to be decreasing.<br><br>Base Boundary HCS<br><br>Based on a data review, the base boundary HCS seems to be functioning as intended. Effluent from the HCS did not exceed the permit limits (**Table OU 8-6**) during the review period. Pumping rates for the extraction wells associated with the HCS were generally within the acceptable range and suggest that plume containment is being achieved. Capture zones based on piezometric surface contours, as presented in quarterly reports, also indicate that the system is achieving containment and groundwater flow direction has not changed significantly. From April 2005 through June 2007, 6.27 pounds of TCE was removed. Groundwater data from downgradient wells (U8-058, U8-065, U8-070, U8-080, U8-085, and U8-087) generally show stable or decreasing TCE concentrations, suggesting that the plume mass is stable or decreasing. 1,2-DCA concentrations in downgradient wells (U8-134, U8-137, U8-138, U8-139, U8-140, U8-144, U8-145, U8-148, and U8-149) were all non-detect during the review period suggesting that plume contaminants have not migrated to these wells. Concentrations of TCE in well U8-016, located outside of the attainment area, were less than 1 µg/L. Trichloroethene concentrations in wells U8-016, U8-023, U8-024, U8-047, U8-051, U8-058, U8-070, U8-080, U8-85, U8-087, U8-102, U8-104, and U8-147 (used to update plume maps) appear to be stable or decreasing. However, TCE concentrations in U8-105 appear to be increasing slightly, though concentrations are still less than the MCL.<br><br>On-Base Plume<br><br>Monitored natural attenuation is part of the remedy for the on-Base plume. Based on a recent evaluation of MNA at OU 8 (**MWH, 2007f**), data for the on-Base plume indicate that: (1) the TCE plume mass is declining through time and the plume mass is not migrating; (2) reductive dehalogenation is not a major cause of observed TCE loss on-Base; and (3) hexavalent |

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|---|---|
| | chromium concentrations are decreasing, mostly as a result of natural attenuation, primarily from dilution. However, groundwater TCE concentrations in U8-133, used to assess attainment of the on-Base plume, have increased during the review period suggesting that the plume extends beyond the attainment area. Groundwater flow direction has not changed significantly as compared to historical flow direction.<br><br>Data collected during the review period were reviewed from wells located outside of the attainment area (U3-056, U8-015, and U8-132) and indicate that TCE concentrations are stable or decreasing. Wells (U3-019R, U3-054, U8-055, U3-056, U7-011, U8-007, U8-008, U8-009, U8-010, U8-013, U8-015, U8-017, U8-128, U8-129, U8-132, and U8-133) used to update the plume map were also reviewed to assess trends in contaminant concentrations. In general concentrations remained stable; however, TCE concentrations in U8-055 (located along the east boundary), U8-017 (located in the area of highest TCE concentrations), and U8-108 (located in the area of highest TCE concentrations) appear to be decreasing. Trichloroethene concentrations in U8-133 have increased and indicate that the western boundary of the on-Base groundwater plume has expanded beyond the Area of Attainment defined in the OU 8 ROD. Since 2003, TCE concentrations have increased from less than 1 µg/L to a maximum of 21 µg/L. The most recent sample collected on January 11, 2007 had a TCE concentration of 14 µg/L. Trichloroethene concentrations in U8-008 may also be increasing, though the increasing concentrations may also be the result of anticipated fluctuations over time.<br><br>Wells with historical hexavalent chromium concentrations above the chromium MCL (U7-008, U7-009, U7-012, and U8-008) appear to have stable or decreasing concentrations of hexavalent chromium. Monitoring Well U8-133, downgradient of current hexavalent chromium detections, was sampled to further address the stated hypothesis that the area of hexavalent chromium contamination is stable or shrinking through time. The chromium concentration in this well was 0.0052 mg/L and is outside of the acceptable value as defined in the PSVPlan. Consequently, additional evaluation is required as outlined in the PSVPlan.<br><br><u>Off-Base Plume</u><br><br>Data collected during the review period were reviewed from wells located outside of the attainment area as presented in the PSVPlan and indicate that TCE and 1,2-DCA concentrations are stable or decreasing. Data from wells used to update the plume map (as presented in Table 5-1 of the PSVPlan) were also reviewed to assess trends in contaminant concentrations. In general, concentrations remained stable; however, 1,2-DCA concentrations in U8-033 (located along the east boundary of the TCE plume) and TCE concentrations in U8-084 (located along the east edge of Weber State University boundary), U8-093 (along the east boundary of the TCE plume), U8-116 (located along the southwest edge of Weber State University boundary), and U8-127 (located just east of the 1,2-DCA boundary but within the TCE boundary) appear to be decreasing.<br><br>Monitored natural attenuation is not part of the remedy for the off-Base plume, but the rate of attenuation was recently estimated off-Base (**MWH, 2007f**). Based on this recent evaluation, the TCE plume mass is declining through time and the plume mass may be migrating to the west. Reductive dehalogenation of TCE contributes more to the observed decline in plume mass off-Base than on-Base, and natural attenuation of 1,2-DCA is occurring; however, reductive dechlorination is not a major factor in the observed reduction. A review of data collected during the 2006 and 2007 cone penetrometer testing efforts suggests that the plume boundaries for the eastern arm of the off-base plume and the isolated off-base plume are not fully understood. Volatile organic compound concentrations in shallow groundwater in areas that were not previously evaluated were detected in shallow groundwater north of Antelope Drive. The groundwater flow direction has not changed significantly as compared to historical flow direction. |

Table OU 8-5

# Chemicals of Concern and Remediation Goals at OU 8

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Media | Chemical of Concern | Remediation Goal | Units |
|---|---|---|---|
| Groundwater | Arsenic | 10* | μg/L |
| | Chromium (total) | 100 | μg/L |
| | Chromium (hexavalent) | 100 | μg/L |
| | Benzene | 5 | μg/L |
| | Chlorobenzene | 100 | μg/L |
| | Carbon Tetrachloride | 5 | μg/L |
| | Cis-1,2-dichlorethene | 70 | μg/L |
| | 1,1-Dichloroethene | 7 | μg/L |
| | 1,2-Dichlorobenzene | 600 | μg/L |
| | 1,2-Dichloroethane | 5 | μg/L |
| | 1,2-Dichloropropane | 5 | μg/L |
| | Ethylbenzene | 700 | μg/L |
| | Tetrachlorethene | 5 | μg/L |
| | 1,1,1-Trichloroethane | 200 | μg/L |
| | Trichlorethene | 5 | μg/L |
| | Toluene | 1000 | μg/L |
| | Vinyl Chloride | 2 | μg/L |

**Notes:**

* - Remediation goal revised to reflect change to the MCL (see Appendix F)

Unless otherwise specified, the concentrations for ground and surface water are maximum contaminated levels (MCLs) established under the Safe Drinking Water Act and/or Utah Primary Drinking Water Standards

μg/L = micrograms per liter

Table OU 8-6

# OU 8 System Effluent Discharge Limits

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Analyte | Discharge Limit | Units |
|---|---|---|
| *1,2-DCA System** | | |
| 1,2-DCA | 37 | µg/L |
| *HCS*** | | |
| Total VOCs | 2130 | µg/L |

**Notes:**

* 1,2-DCA discharges to Hill AFB storm sewer

** HCS discharges to the North Davis Sewer District

µg/L micrograms per liter

VOCs = volatile organic compounds

Table OU 8-7
# Operable Unit 8
# Five-Year Review Technical Assessment

Reviewer: Kelly Taylor

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| **Introduction** | The five-year review must determine whether the remedy at a site is protective of human health and the environment. The EPA guidance describes three questions used to provide a framework for organizing and evaluating data and information and to ensure all relevant issues are considered when determining the protectiveness of a remedy (**EPA, 2001**). These questions are assessed for OU 8 in the following sections. The implementation of ICs is also described. At the end of this table is a summary of the technical assessment. |
| **Question A.** | **Is the remedy functioning as intended by the decision documents?**<br><br>Yes. The document that details the remedial decisions for OU 8 is the 2005 *Record of Decision* (**Hill AFB, 2005a**). Construction of a Hydraulic Containment System (HCS) for OU 8 at Hill AFB was completed in the spring of 1998. In an effort to minimize the potential further migration of contaminants, Hill AFB designed and installed a groundwater extraction system during the summer of 2005, called the 1,2- DCA Groundwater Extraction System, located at the leading edge of the OU 8 1,2-DCA plume. It should be noted that an ESD or ROD Amendment is anticipated because the AES, as presented in the ROD, was not installed. Modeling and additional evaluation performed since the Feasibility Study (**MWH, 2003**) was prepared indicate that the reduction in cleanup timeframe associated with the AES is insignificant (approximately 5 years) relative to the overall cleanup time. Consequently, only one set of extraction wells has been installed off-Base at the toe of the 1,2-DCA plume to prevent further migration of the 1,2-DCA plume (**Hill AFB CEVR, 2007a**).<br><br>Based on a review of data, the 1,2-DCA Groundwater Extraction System and the HCS appear to be functioning as intended. Extraction well pumping rates are within acceptable limits and concentrations of contaminants in downgradient wells are below detection limits, remain stable, or are decreasing. Additionally, all effluent is below discharge limits and capture zones indicate the systems are achieving containment.<br><br>However, a portion of the on-Base plume has expanded beyond the Area of Attainment defined in the OU 8 ROD, in the vicinity of Monitoring Well U8-133, suggesting that plume migration may be occurring. Additionally, the isolated TCE plume in the off-Base area has been found to extend beyond the area of attainment (**MWH, 2007d** and **MWH 2007e**). Results of the CPT efforts in 2006 to assess VOC concentrations in the off-Base plume indicated that concentrations of TCE and 1,2-DCA were detected in shallow groundwater beyond the area of attainment as defined in the ROD. This is likely the result of compounds being present in shallow groundwater which was not previously evaluated. Concentrations of VOCs in shallow groundwater require further investigation.<br><br><u>Opportunities for Optimization:</u><br><br>Operation and maintenance contractors regularly make recommendations to optimize performance and/or reduce costs. Optimization recommendations currently being evaluated for the BBHCS include: (1) the ability to view some operational data online and have the ability to control some systems remotely; (2) assessing shutdown of some wells; (3) replacing the transducers in the 1,2-DCA system wells; and (3) installing dessicant packaging to remove moisture and prevent premature failure. Recommendations for optimizing the 1,2-DCA Groundwater Extraction System performance and streamlining future O&M activities include: (1) replacing the existing drop pipe in the extraction wells with Wellmaster Tubing; (2) investigating alternate sump-pump options for the 1,2-DCA Groundwater Extraction System leak detection manhole (LDMH) and manifold vault; (3) evaluating the feasibility of adding |

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| | desiccant to the transducers in the extraction wells; (4) sealing the link seals in the PCOMHs; and (5) implementing data collection and tracking of maintenance monitoring parameters to provide early detection of well deterioration (**MWH, 2007c**). Additionally, O&M contractors should continue evaluating the concentrations at the current discharge point of the East System to determine if the effluent from this system could be discharged to the storm drain as opposed to the sanitary sewer due to the low concentrations being captured by this section of the system. Though MNA is not part of the remedy for the off-Base plume, evaluations indicate that attenuation is occurring and is a significant contributor to plume reduction based on the results of the MNA evaluation.<br><br>Early Indicators of Potential Remedy Problems:<br><br>There are no indications of potential remedy failure based on the site inspection or document and data review. |
| **Question B.** | **Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?**<br><br>Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics:<br><br>No, a new standard for arsenic in drinking water was adopted by the EPA and the UDEQ which became effective as of January 23, 2006. On this date the standard was lowered from 50 ppb to 10 ppb.<br><br>Changes in Applicable or Relevant and Appropriate Requirements:<br><br>The ARARs for this OU were identified in the ROD. Chemical-specific, action-specific, and location-specific ARARs were reviewed and were all determined to be either applicable or relevant and appropriate as presented in **Appendix G**. |
| **Question C.** | **Has any other information come to light that could call into question the protectiveness of the remedy?**<br><br>Yes, some portions of the off-Base and on-Base plume extend beyond the Area of Attainment as presented in the ROD. Further investigation is being conducted to assess these areas, and because no known complete exposure pathways exist, this does not currently affect the protectiveness of the remedy. |
| **Institutional Controls** | Institutional controls are generally defined as non-engineered instruments such as administrative and legal tools that do not involve construction or physically changing the site, and that help minimize the potential for human exposure to contamination and/or protect the integrity of a remedy by limiting land and/or resource use (**EPA, 2005**). Institutional controls can be used for many reasons including restriction of site use, modifying behavior, and providing information to people (**EPA, 2000**). Institutional controls may include deed notices, easements, covenants, restrictions, or other conditions on deeds, and/or groundwater and/or land use restriction documents (**EPA, 2001**). The following paragraphs describe ICs implemented at OU 8, the potential affect of future land use plans on ICs, and any plans for changes to site contamination status.<br><br>Types of ICs in Place at the Site:<br><br>Institutional controls required by the ROD at OU 8 include groundwater use restrictions and drilling and digging restrictions. A Base order is in place to prevent disturbance of the components of the remedy, and to provide notice to CEVR of digging activities on-Base. Hill AFB has acquired and maintained property leases and easements for remediation systems and monitoring locations. The leases will be renewed as needed and will remain in effect throughout the life of the remedy. State restrictions are in place to inhibit the installation of new wells in the shallow aquifer. Hill AFB requests annual verification from the State Engineer that the restrictions are still in place and being enforced. |

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| | Based on the site inspection, all ICs were implemented as required and buildings associated with remedy were locked and secured including the control panel at 1,2-DCA Groundwater Extraction System.<br><br>Hill AFB performs an annual evaluation of the ICs in place for the Base as discussed in **Section 2**. This includes verification of orders, leases, groundwater use restrictions, and inspections of signage, fences, and monitoring wells. An annual land use controls report is prepared documenting the results of this work (**Hill AFB CEVR, 2007b**). The LUCs were found to be adequate and no recommendations were made for OU 8.<br><br>It should also be noted that trenching activities occurred at OU 8 to install a utility. However, CEVR staff were not aware or had not been provided proper notice that the excavation activities were to occur. The trenching crossed electric lines for the west system of the HCS, but did not damage it. This was being investigated at the time of the site inspection. The systems in place to ensure ICs needs to be reevaluated to ensure that the correct processes are followed.<br><br>Effects of Future Land Use Plans on ICs:<br><br>No land use changes were identified during the site inspection and no known future plans exist.<br><br>Plans for Changes to Site Contamination Status:<br><br>No changes to site contamination status are anticipated in the near future. |
| **Summary of the Technical Assessment** | The technical assessment, based on the data review, site inspection, technical evaluation, and interviews indicates that the remedial actions selected for OU 8 generally appear to have been implemented as intended by the decision documents. While some plume definition efforts are still being conducted, the enforcement of ICs and the operation of the current remedial systems ensure protectiveness in the short-term.<br><br>Water levels and capture zones for each system indicate that containment is being achieved. Groundwater concentrations for the 1,2-DCA system support the conclusion that concentrations are stable or decreasing and that concentrations have not expanded beyond the attainment area. The HCS system maintains capture. Concentrations are stable or decreasing though they appear to be increasing slightly in U8-105 (they are still below the MCL).<br><br>Groundwater concentrations used to assess the on- and off-Base plumes also support the conclusion that concentrations are stable or decreasing. However, TCE concentrations in both plumes appear to extend beyond the area of attainment defined in the OU 8 ROD. Additional investigation is recommended or currently being conducted to assess these areas. |

Table OU 8-8
## Operable Unit 8
## Technical Assessment Summary for OU 8

Reviewer: Kelly Taylor

| Site ID | Remedy Description | Technical Assessment | | | Protectiveness | Next Five-Year Review |
|---|---|---|---|---|---|---|
| | | Question A* | Question B* | Question C* | | |
| OT033 | Groundwater extraction and containment, institutional controls | Yes | No | Yes | Protective in the short-term. | 2013 |
| OU 8 | Groundwater extraction and containment, institutional controls | Yes | No | Yes | Protective in the short-term. | 2013 |

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

Table OU 8-9
## Operable Unit 8
## Five-Year Review Issues, Recommendations and Follow-Up Actions, and Protectiveness Statement

Reviewer: Kelly Taylor

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| **Issues** | Operation and maintenance activities are ongoing at OU 8. Based on the document review, data review, site inspection, interviews, and the technical assessment, the effectiveness of the remedy cannot be determined at this time, though the remedies appear to be functioning as intended by the decision document. However, the enforcement of ICs provides protectiveness in the short-term. To ensure continued protectiveness, six issues are identified in the 2008 five-year review for OU 8, as described below. These issues do not currently affect the protectiveness of the remedy, although they need to be addressed to ensure continued protectiveness.<br><br>1) A new standard for arsenic in drinking water was adopted by the EPA and UDEQ effective as of January 23, 2006. On this date the standard was lowered from 50 ppb to 10 ppb. The remedial goal for arsenic in the OU 8 ROD is 50 ppb. During the review period, arsenic was detected in groundwater at concentrations ranging from nondetect to 237 µg/L.<br><br>2) As discussed in the PSVPlan, the western boundary of the on-Base groundwater plume has expanded beyond the Area of Attainment defined in the OU 8 ROD, in the vicinity of monitoring well U8-133 and possibly near U8-108. In addition, the existing monitoring network to the west of U8-108 is thought to be insufficient, as monitoring wells U8-010 and U8-009 are not believed to be screened at proper depths for monitoring of contamination in that area.<br><br>3) Based on detections of VOCs in indoor air and additional CPT evaluations, it was determined that the TCE plume in the off-base area extends beyond the area of attainment into shallow groundwater (**MWH, 2007e**). Additional investigations are in progress to delineate the plume in this area.<br><br>4) Though MNA is not part of the remedy for the off-Base plume, evaluations indicate that attenuation is occurring. Currently, the PSVPlan does not include all the performance metrics necessary to assess attenuation in the off-base plume even though it is possibly a significant contributor to plume reduction based on the results of the MNA evaluation (**MWH. 2007f**).<br><br>5) As discussed in the PSVPlan, sampling was recommended at wells located downgradient of wells with historical hexavalent chromium exceedances. According to the PSVPlan, the acceptable condition for hexavalent chromium concentrations in U8-133 includes no detections. In January of 2007, U8-133, located downgradient, was sampled and found to contain a low concentration of hexavalent chromium.<br><br>6) As required by the ROD, an extraction system was to be installed at the toe of the off-Base TCE plume. Modeling and additional evaluation performed after the ROD was signed (**MWH, 2003**) indicate that the reduction in cleanup timeframe associated with the Artesian Extraction System (AES) is insignificant (approximately 5 years) relative to the overall cleanup time. Consequently, only one set of extraction wells has been installed off Base at the toe of the 1,2-Dichloroethane (DCA) plume to prevent further migration of the 1,2-DCA plume (**Hill AFB CEVR, 2007a**). |

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| **Recommendations and Follow-Up Actions** | As described in the previous section, six issues were identified in the 2008 five-year review for OU 8. To address these issues, the following recommendations and follow-up actions have been defined.<br>1) In consideration of the revised drinking water standard from 50 ppb to 10 ppb, arsenic concentrations should be tracked and compared to this revised standard. Despite this revised standard, the remedy is still considered protective because groundwater exposure pathways are not complete. However, if it is determined that exposure pathways become complete or prior to site closure, risk from such exposures should be evaluated in light of the new standard.<br>2) As noted in the PSVPlan, additional investigation should be conducted to adequately define the western plume boundary in the on-base area. Additional monitoring locations should be installed to adequately assess contaminant concentrations in groundwater at appropriate depths if it is determined that the current monitoring network is inadequate. If it is determined that the plume extends beyond the area of attainment, it may be necessary to consider amending the ROD.<br>3) Seven additional monitoring wells were proposed for installation to delineate and monitor the plume in the off-base area in early 2007 (**MWH, 2007g**). Once these investigations have been completed, newly installed monitoring locations should be included in the PSVPlan as part of the groundwater monitoring program and plume maps should be updated in annual reports using this new data.<br>4) As recommended in the MNA report (**MWH. 2007f**), Hill AFB should consider including evaluation of natural attenuation off-base in the monitoring program and the PSVPlan. The evaluation should assess the effects of natural attenuation on plume mass reduction and remedy performance.<br>5) Chromium should be monitored in U8-133 for two more consecutive sampling events as required by the PSVPlan. If chromium concentrations continue to be detected in U8-133, additional assessment will be necessary.<br>6) An ESD needs to be scheduled and completed to indicate that the AES as presented in the ROD will be not installed as required. |
| **Remedial Timeframe** | **Table 3-3** in **Section 3.1.4** presents the remedial timeframe estimates for OU 8. Remediation associated with the on-base plume is estimated to be completed sometime during the 2080's. Remediation associated with the off-base TCE plume is estimated to be complete sometime during the 2070's and the off-base 1,2-DCA plume sometime during the 2130's. |
| **Protectiveness Statement** | **The protectiveness of the OU 8 remedy cannot be determined until additional information is obtained.** However, enforcement of ICs at OU 8 provide protectiveness in the short-term pending further assessment of the remedy. ICs and land-use controls are assessed annually. Because portions of both the on- and off-base plumes are still not completely defined, capture of these areas cannot be determined with any certainty. |
| **Next Five-Year Review** | Remedial actions at OU 8 will be reviewed in the next five-year review for Hill AFB to be completed during or before September 2013. |

DFW\\CHUCKWAGON\GIS\NWOFILES\HILLAFB\MXD\OU8_SITE_FEATURES.MXD NBHATTAC 04/11/08

THE ESTIMATED EXTENT OF CONTAMINATION SHOWN ON THIS FIGURE WAS DEVELOPED USING THE MAXIMUM CONCENTRATIONS MEASURED IN MONITORING WELLS AND CPT LOCATIONS FROM 2005 TO 2006. THE EASTERN AND ISOLATED LOBES WERE UPDATED USING RESULTS FROM 2006 TO 2007.

0 1,000 2,000 Feet

1 inch equals 1,449.326531 feet

**LEGEND**

- EXTRACTION WELLS
- MONITORING POINTS DISCUSSED IN TEXT
- DASHED WHERE INFERRED

1,2-DCA ISOCONCENTRATION

- > 5 µg/l
- ESTIMATED EXTENT OF CONTAMINATION
- 5-10 µg/l
- 10-100 µg/l
- 100 - 1,000 µg/l

? - AREAS OF UNCERTAINTY CONCENTRATIONS ARE FOR TCE

U8-023 U8-207 U8-210 U8-024 U8-203 U8-209 U8-208 U8-201 U8-104 U8-147 U8-102 U8-051 U8-211 U8-202 U8-065 U8-058 U8-105 U8-070 U8-047

HYDRAULIC CONTAINMENT SYSTEM

U8-085

Detail Map A

U8-132 U8-008 U7-011 U8-133 U8-129 U8-009 U7-012 U7-008 U7-009 U8-055 U8-010 U8-017 U3-054 U3-056 U8-013 U8-128 U8-015 U3-019R U8-016 See Detail Map A U8-023

HILL AIR FORCE BASE BOUNDARY

U8-131 U8-148 U8-124 U8-149 U8-217 U8-216 U8-218 U8-130

1,2-DCA EXTRACTION SYSTEM

Detail Map B

Hill Field Road

DAVIS-WEBER CANAL

IRP SITE OT033: TCE PLUME

U8-087 U8-080 U8-084 U8-093 U8-116 U8-127

HYDRAULIC CONTAINMENT SYSTEM

CLEARFIELD

LAYTON

U8-033

DAVIS-WEBER CANAL

Antelope Drive

See Detail Map B

U8-126

1,2 - DCA EXTRACTION SYSTEM

U8-145 U8-144 U8-140 U8-138 U8-139 U8-134 U8-137

AREA UNDER INVESTIGATION

?

ROY RIVERDALE WASHINGTON TERRACE CLINTON SUNSET HILL AIR FORCE BASE SOUTH WEBER CLEARFIELD SYRACUSE LAYTON MAP EXTENT

75th AIR BASE WING

FIGURE OU 8 - 1

**SITE FEATURES OF OPERABLE UNIT 8**

2008 FIVE-YEAR REVIEW

IRP SITE: OT033

HILL AIR FORCE BASE, UTAH

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Table OU 9-1
# Operable Unit 9
# Background Information

Reviewer: Victor Martinez

**Introduction**

Operable Unit 9 encompasses several independent sites spread throughout Hill AFB. Currently, OU 9 consists of three areas located in different parts of the Base: the 800/900, 1100, and Golf Course Area. Other sites that were investigated as part of OU 9 include: Pond 1, Pond 3, Pond 7, the Industrial Waste Collection System lines to the IWTP, PCB sites, Building 786 pesticide storage, and deferred sites (**CH2M HILL, 2005a**) (see **Figure OU 9-1**). The EPA requested that the OU 9 ROD address only those sites for which an action has been defined, and as a result, the deferred sites were removed from OU 9 in August 2007 and returned to Site Inspection status. These sites remain under the FFA and will be addressed under CERCLA, but they are not currently assigned to an OU.

An RI/FS have been completed for OU 9. The FS specified that the soil at each of the OU 9 areas was determined to not pose a threat to the underlying groundwater; therefore, the only media/source of concern at OU 9 is groundwater. The FS describes RAOs developed to prevent future risks. These RAOs include: (1) prevent human exposure to contaminated groundwater above PRGs and (2) remediate contamination in groundwater to concentrations below MCLs within a reasonable timeframe (**CH2M HILL, 2005b**). A ROD is not yet in place for OU9. Hill AFB and the EPA are currently discussing issues regarding the selection of MNA as a component of the remedy. The ROD has been postponed until 2010 to collect more data and conduct an assessment of the natural attenuation of contaminants. Groundwater monitoring is ongoing at OU 9 to monitor groundwater contamination levels and to develop a database to evaluate the natural attenuation of contaminants in groundwater (**CH2M HILL, 2007b**).

A list of the documents reviewed for OU 9 as part of the 2008 five-year review is provided in **Appendix C**.

| IRP Identification | IRP Site Name | Status |
|---|---|---|
| SD023 | Pond 3 | NFRAP |
| SD034 | Pond 1 | Ongoing |
| SS092 | Building 786 | NFRAP |
| OT106 | Deferred Sites | Removed from OU 9 |
| SD040 | Pond 7 Area | NFRAP |
| SS089 | 1100 Area | Ongoing |
| SS090 | Golf Course Area | Ongoing |
| SS108 | 800/900 Warehouse Area | Ongoing |
| PT093 | Transformer Storage Yard | NFRAP |
| SS094 | Building 2402 | NFRAP |
| SS095 | Building 2403 | NFRAP |

**Site Chronology**

Provided separately. See **Table OU 9-2**.

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| **Background** | **Physical Characteristics.** The geology for the 1100, Pond 7, and Golf Course Areas generally consists of interbedded zones of sand, silt, and clay. The geology of the 800/900 Area is similar to the other sites but has considerably more coarse-grained materials (gravels up to cobble size) in portions of the subsurface of the site. Contaminants migrate vertically through the higher permeability gravel, sand, and silt zones that constitute the shallow aquifer stratigraphy. These zones also likely act as preferential flow paths for the horizontal movement of contaminated groundwater. Vertical migration of contaminated groundwater is limited at each of the OU 9 Areas by the low permeability Alpine clay that underlies the higher permeability zones. The aquifers underlying Hill AFB consist of a shallow water-bearing zone located near the interface of the Provo and Alpine Formations and within the Alpine Formation, and two drinking water aquifers, the Sunset and the Delta Aquifers. The Sunset and the Delta aquifers are the most widely used drinking water aquifers in the area. They are located in the western portions of Hill AFB at depths of about 250 to 400 feet and 450 to 750 feet bgs, respectively (**CH2M HILL, 2005a**). |
| | **Land and Resource Use.** The 800/900, 1100, and Pond 7 Areas of OU 9 are located within industrial areas of the Base that perform various military support operations. Land use in the off-Base portions of the Pond 7 and 1100 Areas consist of residential and commercial properties. Off-Base land use near the Hill AFB Golf Course consists of agricultural 'unique' farmland. Unique farmlands are lands used for the production of specific high-value food/fiber crops (**CH2M HILL, 2005a**). No land use changes were observed on-Base or off-Base during the 2008 Five-Year Review Site Inspection (**CH2M HILL 2007c**). |
| | **History of Contamination.** Sites included in OU 9 have various and unrelated histories. The following paragraphs provide a brief description of the history of contamination at the eight IRP sites at OU 9.<br><br>Pond 1: Pond 1 is located along the southern boundary of Hill AFB, east of the South Gate and southeast of Berman Pond. From 1940 to 1956, Pond 1 received overflow from Berman Pond, which operated as an evaporation pond and received storm water runoff and industrial wastewater containing spent solvents, metals, and hydrocarbons from shop operations and spills in the industrial area. The storm drain system operated as the industrial sewer until the construction of the IWTP in 1956. The storm drain system was disconnected from Berman Pond and rerouted to Pond 1, and Pond 1 became the primary stormwater retention basin for the southern portion of Hill AFB.(**CH2M HILL, 2005a**).<br><br>Pond 3: Pond 3 is located in the southern portion of the Base, and has been used as a stormwater retention pond since 1957 and was also designed as a wildlife habitat area. Surface water runoff contained in the pond emanated from existing and former industrial areas that have used hazardous materials and generated hazardous wastes. Surface water runoff collected in Pond 1 drains into Pond 3. Water in Pond 3 drains to the south and eventually discharges to Kay's Creek located southeast of the Base. The arsenic contamination released to Pond 3 resided in the pond sediments at various depths and at levels exceeding RBSLs (**URS, 2003**).<br><br>Building 786: Hill AFB began using Building 786 as a pesticide/herbicide storage building in 1984. Miscellaneous pesticides and herbicides were stored in the facility until it was demolished in 1997. The building was identified during the North Area Site Investigation as having a potential for a past release of pesticides and or herbicides into the environment. Further investigation conducted at Building 786 concluded that trace levels of pesticides and herbicides were detected but none were detected above residential RBSLs (**URS, 2003**). Results of the investigation revealed that the site posed no risk to human health or the environment and in 2002, a NFRAP designation was granted to Building 786. The results of the investigation were documented in the *Building 768 No Further Response Action Planning Decision Document* (**CH2M HILL, 2005a**).<br><br>Pond 7: Constructed in 1976, Pond 7 receives surface runoff from the DRMO area and other on-Base areas surrounding the pond. Subsurface soil, sediment, surface water, and groundwater near Pond 7 were investigated as part of the Pond 7 Preliminary Assessment/Site Investigation. Risk analysis indicated that Pond 7 did not pose significant risks to human health or the |

environment (**URS, 2003**). During the Basewide CPT Investigation in 1999, TCE was detected at a concentration of 150 µg/L at the Pond 7 Area. However, these TCE concentrations could not be confirmed by either subsequent CPT groundwater samples or monitoring well data. Data from existing monitoring wells at the Pond 7 Area contain a maximum TCE concentration of 14.2 µg/L. The results of soil and groundwater investigations suggested that Pond 7 posed no risk to human health or the environment. In February 2005 a NFRP status was assigned to Pond 7. This is documented in the *Pond 7 Area No Further Response Action Planned Decision Document.*

Zone 9 Transformer Yard, Building 2402, and Building 2403: During the North Area Site Investigation, transformer storage areas were investigated to assess the presence of PCBs and other contamination. Polychlorinated biphenyls were identified in the soil above RBSLs in the Zone 9 Transformer Yard (IRP Site 0T093), Building 2402 area (IRP Site SS094), and Building 2403 area (IRP Site SS095). These sites are located at the north end of the Missile and Munitions Storage area in the 2400 Zone. These areas were further investigated to evaluate the nature and extent of the soil contamination as specified in the PCB Removal Work Plans for Buildings 2402 and 2403 and the Used Transformer Storage Yard (**CH2M HILL, 2005a**). After delineation of the areas, an interim remedial action was implemented to remove the contaminated soil. The interim action consisted of the removal and off-site disposal of the contaminated soils as specified in the *PCB Removal Report for Buildings 2402 & 2403 and the Used Transformer Storage Yard*. The interim action was completed in 1999 and documented in the *PCB Removal Report for Buildings 2402 & 2403 and the Used Transformer Storage Yard* (**CH2M HILL, 2005a**). The interim action regulated under the Toxic Substances Control Act (TSCA), resulted in closure of the sites.

Deferred Sites: The deferred areas were sites that could not be fully investigated because field sampling could not be done without disturbing facility operations and were considered to pose little risk to human health based on existing land use and lack of an exposure route. These sites were deferred from further investigation until such time as the facility could be completely investigated. The draft ROD for OU 9 proposed to continue to defer action on these sites; however, EPA requested that the OU 9 ROD address only those sites for which an action has been defined. As a result, the deferred sites were removed from OU 9 in August 2007 and returned to Site Inspection status. These sites remain under the FFA and will be addressed under CERCLA, but they are not currently assigned to an OU (**Smith, 2008**). The deferred sites are located throughout the Base and are inventoried annually until they can be further characterized (**URS, 2003**).

1100 Area: The 1100 Area is approximately 128 acres located in the western portion of the Base. Zone 1100 includes the Base administration area, fire station (Building 1151), and several vehicle maintenance shops. Improper handling of solvents and possibly of other petroleum products in this area resulted in the contamination of the shallow groundwater (**URS, 2003**). The 1100 Area groundwater plume extends approximately 1,300 feet off-Base into Sunset City as depicted in **Figure OU 9-1**. The 1100 Area consists of TCE groundwater contamination beneath and north of Building 1141. The plume extends east of Building 1141 approximately 300 feet and off-Base approximately 1,000 feet into Sunset City (see **Figure OU 9-1**). The plume is at a depth of approximately 10 to 60 feet bgs. No soil contamination has been identified in this area (**Hill AFB, 2006**).

Golf Course Area: The Golf Course Area is located on the southeastern edge of the Base. Contamination at the Golf Course Area is believed to be the result of improper handling of solvents and other products used in the Golf Course maintenance shop, Building 710. During wash down of the maintenance-building floor, overflow water from a former catch basin located south of the maintenance shop flowed across the land surface and collected in a drainage ditch along the Base boundary fence line (**URS, 2003**). The Golf Course Area consists of PCE and TCE groundwater contamination along the eastern Base boundary. The plume extends from the north to the south, with a majority of the plume under Base property approximately 25 to 50 feet bgs (see **Figure OU 9-1**). No soil contamination above Risk Based Screening levels has been

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| | identified in this area (**Hill AFB, 2006**).<br><br>800/900 Warehouse Area: Previous investigations at the 800/900 Warehouse Area indicate that the groundwater is contaminated mainly with chlorinated solvent and fuel-type compounds. Known sources of contamination include Site 914 UST and the industrial buildings located east and southeast of this site, and no other sources have been conclusively identified (**URS, 2003**). Currently, the 800/900 Area consists of carbon tetrachloride groundwater contamination north of Building 845, TCE groundwater contamination beneath Building 48, and associated soils above each of the respective plumes. The 800/900 plume does not extend off-Base (**Figure OU 9-1**) (**CH2M HILL, 2005a**). |
| | **Initial Response.** Operable Unit 9 was originally designated to investigate all areas of Hill AFB that were not included in the other operable units or investigation/remediation programs. Operable Unit 9 was divided into South and North Areas due to the size of the operational unit. Investigation of the South Area began in 1993 with the initiation of the South Area Preliminary Assessment (SAPA). In 1995, the South Area Site Investigation was initiated to investigate facilities of concern (FOC) and determine if contamination was present. The North Area investigation began in 1995 with the North Area Preliminary Assessment (NAPA). In 1995, the North Area Site Investigation was initiated to investigate facilities and determine if contamination was present. Facilities of concern identified in both the North and South Areas Site Investigation were categorized according to the potential threat to human health and the environment. The results of the OU 9 North and South Areas Site Investigation identified areas of groundwater and soil contamination that were not being addressed as part of other Hill AFB OUs or other programs such as the UST program.. The following areas were identified for further investigation: South Area Site 43; South Area Site 454; North Area Zone 12 Groundwater Plume; North Area Zone 16 Munitions Storage; North Area Zone 9 Transformer Yard, Building 2402 and Building 2403; North Area Golf Course Maintenance Building; and North Area Zone 11 Groundwater Plume. Further investigation of these areas, under OU 9 and other programs, led to the discovery of additional areas of concern. These areas include: (1) Pond 1 Sediment Contamination; (2) Pond 3 Sediment Contamination; (3) Former Building 786 Pesticide Storage Area; (4) 800/900 Area; and (5) Pond 7 Area. The 1100, Pond 7, and Golf Course Areas were reorganized under OU 9 in the fall of 2001 because of similar groundwater contaminants and similar anticipated remedial objectives. The 800/900, 1100, Pond 7, and Golf Course Areas were the focus of the RI. Remediation at the remaining sites has been implemented as an interim remedial action under OU 9. Sites investigated in the North and South Area Site Investigation that are not included as part of the RI were closed based on the lack of contamination observed during the investigation or were classified as a Deferred Site (**CH2M HILL, 2005a**). The status of these sites is presented in the Progress Since Last Five-Year Review section. |
| | **Basis for Taking Action.** The purpose of the response actions conducted at the OU 9 site was to protect public health and welfare and the environment from potential exposure for each medium that might pose unacceptable risks, including soil contents, air, groundwater, and surface water. The major threats posed by the site, which includes: groundwater beneath the 800/900, 1100, and Golf Course Areas and groundwater in the off-Base 1100 Area were evaluated for current and future risk. (**CH2M HILL, 2005a**). |
| **Remedial Actions** | **Remedy Selection (i.e. ROD/ESDs)**. The ROD for OU 9 is currently in preparation. In September 2006, Hill AFB requested public comment on the Proposed Plan for cleanup of groundwater at OU 9. The proposed plan was based on findings from the OU 9 RI Report, OU 9 Feasibility Study Report, and Baseline Risk Assessment included in the OU 9 RI Report. The 800/900, 1100, and Golf Course Area were the only sites included in the plan. The proposed plan states that MNA is the preferred remedy for each of the OU 9 sites because it is protective and represented the most cost-effective alternative. Record of Decision, dated May 2007. However, the EPA and Hill AFB are currently discussing issues regarding the selection of MNA as the preferred remedy. The ROD has been postponed until 2010 to collect more data and conduct an assessment of the natural attenuation of contaminants. |

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| | **Remediation Goals.** Based on the Remedial Investigation and risk assessment results, RAOs were developed for the media/sources of concern at the OU 9 areas. The RAOs were also established to meet ARARs. The soil at each of the OU 9 areas was determined to not pose a threat to the underlying groundwater; therefore, the only media/source of concern at OU 9 is groundwater. Remedial action objectives developed to prevent future risks include (**Hill AFB, 2006**):<br><br>**Groundwater RAOs**. The RAOs for groundwater for each of the OU 9 sites are: to prevent unacceptable human exposure to contaminated groundwater: to restore groundwater to contaminant concentrations below Utah State Groundwater Quality Standards and federal MCLs for drinking water within approximately 50 to 70 years. |
| | **Remedy Implementation.** Although the ROD has not yet been finalized for OU 9, two interim remedial actions have been performed at this OU. At Pond 1, a soil cover with pond expansion was constructed. The remediation included excavation of the contaminated sediments, expansion of the south bank of the pond, consolidation of the contaminated sediments, placement of a soil cover over the contaminated sediments, installation of drainage improvement piping and structures, and grading and revegetation. The expansion of the pond was required to maintain the retention capacity lost due to the soil cover. To maintain the retention capacity of Pond 1, the eastern and southern boundaries were expanded to increase the surface area of the pond. Construction was completed on October 10, 2003 (**CH2M HILL, 2004a**). At Pond 3, approximately 260 cubic yards of arsenic-contaminated sediments were removed and disposed offsite at an approved disposal facility. The remedial actions resulted in closure and restoration of the site with no long-term monitoring or institutional controls. Construction was completed on December 16, 2003 (**CH2M HILL, 2004c**). |
| | **Operations and Maintenance.** No O&M activities are required at OU 9 at this time. |
| | **Progress Since Initiation of Remedial Action.** Approximately 260 cubic yards of arsenic-contaminated sediments were removed from Pond 3 and disposed offsite at an approved disposal facility. At Pond 1, approximately 2,269 cubic yards of contaminated sediments were excavated at defined depths of 2 to 5 feet bgs in Areas 1 through 4 and stockpiled on liners within the pond. |
| **Progress Since Last FYR** | Four recommendations were included in the 2003 five-year review for OU 9. Recommendations and follow up actions for OU 9 are presented in **Table OU 9-3** along with the current status of each recommendation.<br><br>Current Status: Operable Unit 9 is currently in the RI/FS phase of the CERCLA process. The RI/FS Reports for OU 9 were finalized and presented to the public in April and August 2005 respectively. The Proposed Plan for remedial actions at OU 9 was issued in 2006. Groundwater monitoring and evaluation of natural attenuation to support MNA as a possible remedy is ongoing. A ROD is currently scheduled for 2010. In August 2007, EPA requested that the OU 9 ROD, in preparation, address only those sites for which an action has been defined. The deferred sites, therefore, are addressed separately (**Smith, 2008**).<br><br>A NFRAP was selected as the final remedial alternative for all media associated with the Pond 7 Area. The NFRAP determination was based on the results of recent groundwater samples as part of the OU 9 RI and on the fact that concentrations of TCE detected during investigations in the late 1990s could not be confirmed. Historical trends also indicate that the isolated groundwater contaminant concentrations are declining, suggesting that contamination is naturally attenuating in this area (**CH2M HILL, 2005c**).<br><br>A remedial action was conducted at Pond 1 to address soil contamination. Contaminated soil was consolidated and covered with a soil cover. The selected remedy for Pond 1 includes institutional controls in the form of land use restrictions during which time the soil cover is monitored on an annual basis to ensure the cover's integrity. |

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| | At Pond 3, approximately 260 cubic yards of arsenic-contaminated sediments were removed and disposed in a solid waste landfill due to low arsenic concentrations The selected remedy resulted in closure and restoration of the site with no long-term monitoring or institutional controls.<br><br>In September 2006, Hill AFB presented to the public the Proposed Plan for OU 9. Monitored natural attenuation was the selected remedy for each of the OU 9 sites because it was protective and represented the most cost-effective alternative. After the preferred remedy is approved through public and regulatory input, a ROD will be prepared and signed for OU 9. Hill AFB and the EPA are currently discussing issues regarding the selection of MNA as a component of the remedy (**Hill AFB, 2007**). The ROD has been postponed until 2010 to collect more data and conduct an assessment of the natural attenuation of contaminants. This decision document will present the remedy selected to be implemented for OU 9, as well as the criteria that the remedy needs to meet to achieve the remedial goals.<br><br>Currently, groundwater monitoring and data collection is underway and additional wells are being installed to fill data gaps at OU 9. Data collected during the sampling events will be used to develop a database to reevaluate natural attenuation of contaminants at OU 9. On-Base groundwater use restrictions are the only ICs for OU 9 (**CH2M HILL, 2007b**).<br><br>The State of Utah enforces groundwater land use controls off-Base. For areas in OU 9 where shallow groundwater contains contaminants above MCLs, use of groundwater is restricted following the Ground Water Management Plan for the Weber Delta Sub-Area of the East Shore Area. These include groundwater drilling permit restrictions that restrict installation of new wells in areas covered by the land use controls. The land use controls are registered through the State Engineer's Office and the UDWR. As a part of this agreement, Hill AFB sends the UDWR a memorandum and map with updated groundwater contamination information on an annual basis to verify that the land use controls are maintained (**Hill AFB, 2006**). |

Table OU 9-2

# Chronology of Site Events OU 9

*2008 Five -Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| | | 7 | 1987 | Hill AFB placed on the National Priorities List (NPL) | The U.S. EPA placed HAFB on the NPL under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). | Remedial Investigation Report Operable Unit 5 Sites SS17, SD16 Volume 1 - Text |
| | | 2 | 2004 | Land Use Control (Continuing Order AFI 32-7020) | Land use controls are implemented On-Base through Continuing Order AFI 32-7020 (Hill AFB Supplement 1, 18 February 2004) | |
| 9 | OT106 | 7 | 2000 | Deferred Sites | Site inspection for the North Area. Facilities were categorized based on level of contamination found, threat to human health, accessibility for sampling (deferred action), environmental management programs. | Operable Unit 9 Calendar Year 2001 Deferred Sites Inventory Report, Hill Air Force Base, Utah. Draft |
| 9 | OT106 | 2 | 2001 | Deferred Sites | Site inspection for the South Area. Facilities were categorized based on level of contamination found, threat to human health, accessibility for sampling (deferred action), environmental management programs. | Operable Unit 9 Calendar Year 2001 Deferred Sites Inventory Report, Hill Air Force Base, Utah. Draft |
| 9 | OT106 | | 2001 | Deferred Sites | 2001 OU 9 Deferred Sites Inventory Report | Operable Unit 9 Calendar Year 2001 Deferred Sites Inventory Report. Hill Air Force Base, Utah. |
| 9 | OT106 | 3 | 2002 | Deferred Sites | Site Management Plan for OU 9 Deferred Sites issued. The document provides a mechanism to track and inventory deferred sites. | Operable Unit 9 Calendar Year 2001 Deferred Sites Inventory Report, Hill Air Force Base, Utah. Draft |
| 9 | OT106 | | 2002 | Deferred Sites | Phase I Site Investigation conducted in summer 2002 at 50 facilities. Results pending. Once results are published for a site, the site will be removed from OT106 | Operable Unit 9 Calendar Year 2001 Deferred Sites Inventory Report, Hill Air Force Base, Utah. Draft |
| 9 | OT106 | | 2002 | Deferred Sites | 2002 OU 9 Deferred Sites Inventory Report | Operable Unit 9 Calendar Year 2002 Deferred Sites Inventory Report. Hill Air Force Base, Utah. |
| 9 | OT106 | | 2003 | Deferred Sites | 2003 OU 9 Deferred Sites Inventory Report | Final Operable Unit 9, Calendar Year 2003 and 2004 Inventory Report for Deferred Sites, Hill Air Force Base, Utah. |
| 9 | OT106 | | 2004 | Deferred Sites | 2004 OU 9 Deferred Sites Inventory Report | Final Operable Unit 9, Calendar Year 2003 and 2004 Inventory Report for Deferred Sites, Hill Air Force Base, Utah. |
| 9 | OT106 | | 2005 | Deferred Sites | 2005 OU 9 Deferred Sites Inventory Report | Operable Unit 9 Calendar Year 2005 Deferred Sites Inventory Report. Hill Air Force Base, Utah. |
| 9 | OT106 | 11 | 2006 | Deferred Sites | 2006 OU 9 Deferred Sites Inventory Report | Letter Report for the Operable Unit 9 Calendar Year 2006 Inventory of Deferred Sites |
| 9 | OU9 | 9 | 1998 | First Five Year Review | The first Five-Year Review for OU 9 stated that the remedies selected for the site remain protective of human health and the environment. | Five-Year Review Report, First Five-Year Review Report for Hill Air Force Base, Utah. |
| 9 | OU 9 | 9 | 2003 | Five Year Review | The second Five-Year Review stated that the remedy for site SD034 at OU 9 will be protective of human health and the environment once it is completed. Institutional controls have been implemented at all deferred sites under remedial investigation to limit human exposure to potential contamination until the need for remedial action can be determined. | Final CERCLA Five-Year Review Report, Second Five-Year Review Report for Hill Air Force Base, Utah. |
| 9 | OU 9 | 4 | 2005 | Remedial Investigation | Remedial Investigation Report for OU 9 was published. The 800/900, 1100, Pond 7, and Golf Course Areas, were investigated as part of OU 9 and were the focus of the RI. The remaining sites were investigated under other Hill AFB programs. | Final Remedial Investigation Report for Operable Unit 9 Vol 1, Hill Air Force Base, Utah. |
| 9 | OU 9 | 8 | 2005 | Feasibility Study | Feasibility Study Report for OU 9 was published. The FS presented the RAOs for soil and groundwater at OU9. The RAOs for groundwater are: (1) Prevent human exposure to contaminated groundwater above preliminary remediation goals (PRGs); and (2) Achieve PRGs in a reasonable time frame. The RAO for soil is: (1) Prevent human exposure to contaminated soil above PRGs. | Final Feasibility Study Report for Operable Unit 9, Hill Air Force Base, Utah. |

Table OU 9-2
Chronology of Site Events OU 9
*2008 Five -Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 9 | OU 9 | 9 | 2006 | Proposed Plan | The FS presented the RAOs for soil and groundwater at OU5. The RAOs for groundwater are: (1) Prevent human exposure to contaminated groundwater above preliminary remediation goals (PRGs); and (2) Achieve PRGs in a reasonable time frame. The RAO for soil is: (1) Prevent human exposure to contaminated soil above PRGs. MNA was the proposed selected remedy at each of the OU 9 sites because it was protective and represented the most cost-effective alternative. After the preferred remedy is approved through public and regulatory input, a ROD will be prepared and signed for OU 9. | Operational Unit 9 Proposed Plan, Hill Air Force Base, Utah. |
| 9 | SD023 | | 1989 | Remedial Investigation | RI/FS process for Pond 3 was initiated to evaluate the presence/absence of contaminants in pond surface water and sediment. | Record of Decision for Operable Unit 3 |
| 9 | SD023 | 4 | 1992 | Remedial Investigation | Investigation to evaluate the nature and extent of surface water and sediment contamination at Pond 3. Surface water and pond sediments sampled. | Record of Decision for Operable Unit 3 |
| 9 | SD023 | 3 | 1995 | Remedial Investigation | Investigation to evaluate the nature and extent of surface water and sediment contamination at Pond 3. Surface water and pond sediments sampled. | Record of Decision for Operable Unit 3 |
| 9 | SD023 | 9 | 1995 | Record of Decision | Based on OU 3 RI/FS and Risk assessments, contaminants in Pond 3 surface water and sediment do not pose current or future health risk or present a threat to groundwater. Therefore, cleanup actions area not necessary at Pond 3. | Record of Decision for Operable Unit 3 |
| 9 | SD023 | 9 | 1999 | Transfer to Another Operable Unit | EMR voluntarily initiated additional investigation at Pond 3 when contamination was detected on Pond 1 inlet. The survey included depth measurement of Pond 3. Investigation reopened under OU 9. | Final Data Summary Report and Preliminary Conceptual Model for Operable Unit 9 Investigation Areas |
| 9 | SD023 | 10 | 2000 | Remedial Investigation | Remedial Investigation reopened at Pond 3. Investigation included hand augured soil borings at 10 locations. Each were driven to a depth ranging from 3 to 4 ft. Soil samples were collected beneath the surface of the water and were sampled for VOCs, SVOCs and trace metals. Investigation was to provide information on the horizontal and vertical extent of potentially contaminated sediment. Findings will be summarized in a future conceptual site model report. (Completion of the RI is planned for 2004.) | Final Analytical Data Report (ADR) For Operable Unit 9 Investigation Areas 1 May Through 10 October 2000 |
| | SD023 | 6 | 2003 | Interim Action | Remedial Action Construction at Pond 3 started. Soil Removal Action Activities at Pond 3 began on June 17, 2003 | Operable Unit 9 Pond 3 Remedial Action Construction Report, Hill Air Force Base |
| | SD023 | 12 | 2003 | Interim Action | Remedial Action Construction at Pond 3 finished. Construction activities at Pond 3 completed on December 16, 2003 | Operable Unit 9 Pond 3 Remedial Action Construction Report, Hill Air Force Base |
| 9 | SD023 | 1 | 2004 | Action Memorandum | Operable Unit 9 Pond 3 Action Memorandum issued. The purpose of this Action Memorandum was to request and document approval of the proposed removal action for Pond 3 at OU 9.<br>• Proposed actions included: Excavation of approximately 260 cy of arsenic-contaminated sediments within Pond 3 in four areas adjacent to the south bank in the western portion of the pond<br>• Placement of sediments in roll-off containers in the staging area for composite sampling<br>• Performance of confirmation sampling to evaluate adequate arsenic-contaminated sediment removal<br>• Transportation and disposal of contaminated soil at an offsite facility and<br>• Site restoration | Operable Unit 9 Pond 3 Action Memorandum, Hill Air Force Base |
| 9 | SD023 | 1 | 2004 | Interim Action | Pond 1 Remedial Action Construction Report issued. Components of the remedial Action at Pond 1 included: institutional controls in the form of land use restrictions during which time the soil cover is monitored on an annual basis to ensure the cover's integrity. | Operable Unit 9 Pond 1 Remedial Action Construction Report, Hill Air Force Base |
| 9 | SD023 | 5 | 2004 | Interim Action | Pond 3 Remedial Action Construction Report issued. The primary components of the Pond 3 remedial action were dewatering activities, contaminated sediment removal, confirmation and characterization sampling, site restoration, and excavated soil disposal. | Operable Unit 9 Pond 3 Remedial Action Construction Report, Hill Air Force Base |
| 9 | SD023 | 9 | 2004 | Interim Action | Operable Unit 9 Pond 3 Remedial Action Report issued. The Remedial Action Report certifies that the construction has been completed for Operable Unit9, Pond 3 at Hill Air Force Base | |

Table OU 9-2
Chronology of Site Events OU 9
*2008 Five -Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 9 | SD023 | 9 | 2004 | Interim Action | Pond 1 Remedial Action Report issued. The Remedial Action Report certifies that the construction has been completed for Operable Unit9, Pond 1 at Hill Air Force Base | Operable Unit 9 Pond 1 Remedial Action Report, Hill Air Force Base |
| 9 | SD034 | | 1940 | Historical Operations | Between 1940 -1944, Pond 1 received discharge from Berman Pond during times of overflow from high intensity storms. Berman Pond operated as an unlined evaporation pond from 1940 to 1956 and received storm-water runoff and industrial wastewater, which includes spent solvents, metals, and hydrocarbons. | Final Data Summary Report and Preliminary Conceptual Model for Operable Unit 9 Investigation Areas |
| 9 | SD034 | | 1956 | Historical Operations | Pond 1 was disconnected from Berman Pond. Berman Pond was connected to a sewer line leading to the IWTP in 1956. | Final Data Summary Report and Preliminary Conceptual Model for Operable Unit 9 Investigation Areas |
| 9 | SD034 | 9 | 1988 | Remedial Investigation | RI/FS process for Pond 1 was initiated. Investigation to evaluate the presence/absence of contaminants in pond surface water and sediment. | Record of Decision for Operable Unit 3 |
| 9 | SD034 | 4 | 1992 | Remedial Investigation | Phase I Investigation performed at Pond 1 to evaluate the nature and extent of surface water and sediment contamination. Surface water and pond sediments sampled. | Record of Decision for Operable Unit 3 |
| 9 | SD034 | 3 | 1995 | Remedial Investigation | Phase II Investigation performed at Pond 1 to evaluate the nature and extent of surface water and sediment contamination. Surface water and pond sediments sampled. | Record of Decision for Operable Unit 3 |
| 9 | SD034 | 9 | 1995 | Record of Decision | Based on OU 3 RI/FS and Risk assessments, contaminants in Pond 1 surface water and sediment do not pose current or future health risk or present a threat to groundwater. Therefore, cleanup actions are not necessary at Pond 1. | Record of Decision for Operable Unit 3 |
| 9 | SD034 | 1 | 1997 | Transfer to Another Operable Unit | Samples collected near Pond 1 inlet to investigate potential contamination of pond sediments as a result of contamination detected in the storm water system at Berman Pond. RBSLs were exceeded for arsenic, beryllium, PCBs, chlorobenzene, and dichlorobenzene. Investigation performed under OU 9. | Engineering Evaluation/Cost Analysis for the OU9 Pond 1 Removal Action, Final Report |
| 9 | SD034 | 8 | 1999 | Remedial Investigation | Detailed topographic survey performed at Pond 1. Crew measured approx. 925 locations for vertical and horizontal control. Objective of the survey was to provide enough data to create an accurate contour map of the pond area. | Final Data Summary Report and Preliminary Conceptual Model for Operable Unit 9 Investigation Areas |
| 9 | SD034 | 9 | 1999 | Remedial Investigation | Phase I Pond 1 investigation performed. Investigation included direct-push borings and hand auger borings . 50 soil samples were collected and analyzed for VOCs, SVOCs, PCBs, pesticides, and TVPH, TEPH, hexavalent chromium, and trace metals. Industrial RBSLs were not exceeded. Residential RBSLs were exceeded for trace metals, PCB, and SVOCs. | Final Data Summary Report and Preliminary Conceptual Model for Operable Unit 9 Investigation Areas |
| 9 | SD034 | 8 | 2000 | Remedial Investigation | Sediment samples collected at Pond 1. Investigation included direct-push soil borings at 29 locations. Each were driven to a depth ranging from 4 to 12 ft. 40 soil samples were collected from various depths throughout the pond footprint and analyzed for VOCs, SVOCs, PCBs, petroleum hydrocarbons (PHC), and trace metals. Sediment samples were found to exceed both residential and industrial RBSLs for PHC, cadmium, and mercury | Engineering Evaluation/Cost Analysis for the OU9 Pond 1 Removal Action, Final Report |
| 9 | SD034 | | 2001 | Remedial Investigation | Soil samples collected in the drainage channel and in the Pond 1. 7 hand auger borings were excavated to a depth of 6 to 10 ft bgs. The borings were located in the drainage channel between the flight line storm drain outlet east of Pond 1 and the pond basin. The samples were analyzed for VOCs, SVOCs, metals, and TPH. Residential RBSLs were not exceeded. | Engineering Evaluation/Cost Analysis for the OU9 Pond 1 Removal Action, Final Report |

Table OU 9-2
Chronology of Site Events OU 9
*2008 Five -Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 9 | SD034 | 4 | 2002 | Engineering Evaluation / Cost Analysis | 4 areas of contaminated pond sediments found. EE/CA recommends excavation of pond sediments that exceed residential RBSLs in two areas, combine these sediments with the other two areas, and place an 8-ft soil cover on top. Also included pond expansion. After construction and implementation of the recommended institutional controls, the soil cover is expected to be protective of human health and the environment. The 8 ft soil cover will limit the exposure pathway for any future residential and industrial tenant on the facility. The soil cover also reduces the potential mobility of the contaminants. However, the toxicity and volume of the contaminants remain unchanged. (Construction is scheduled for May 2003) | Engineering Evaluation/Cost Analysis for the OU9 Pond 1 Removal Action, Final Report |
| 9 | SD034 | 9 | 2002 | Action Memorandum | Operable Unit 9 Pond 1 Final Action Memorandum signed. The requirements and objectives of the selected remedy are described in the Final Action Memorandum for Pond 1 at OU 9. The components of the selected remedy include:<br>• Excavation of contaminated sediments [approximately 2,269 cubic yards (CY)] to defined depths of 2 to 5 feet bgs in Areas 1 through 4 and stockpiled within the pond.<br>• Collection of composite samples for laboratory analysis from the excavated areas to confirm adequate contaminated sediment removal.<br>• Transportation of stockpiled sediments to the contaminated cell location and placement of 8 feet of clean soil over compacted contaminated sediments.<br>• Excavation of the area to the south of the pond in order to expand the pond size and provide fill material for the soil cover. | Operable Unit 9 Pond 1 Action Memorandum, Hill Air Force Base |
| 9 | SD034 | 1 | 2003 | Interim Action | The Remedial Action Construction began at Pond 1 with issuance of the Notice to Proceed on January 16, 2003. | Operable Unit 9 Pond 1 Remedial Action Construction Report, Hill Air Force Base |
| 9 | SD034 | 6 | 2003 | Engineering Evaluation / Cost Analysis | Three alternatives are presented in this EECA to address the contaminated sediments in Pond 3: no action, contaminated sediment removal with off-site disposal, and implementation of phytoremediation for arsenic removal. The EECA conducted recommended that the contaminated sediments be excavated and transported off-site to an approved disposal facility. The recommended alternative includes confirmation sampling to assure adequate contaminant removal. No long-term maintenance or monitoring will be required for this alternative. | Engineering Evaluation/Cost Analysis for the OU9 Pond 3 Removal Action, Final Report |
| 9 | SD034 | 10 | 2003 | Interim Action | Remedial Action Construction at Pond 1 finished. Construction was completed on October 10, 2003. | Operable Unit 9 Pond 1 Remedial Action Construction Report, Hill Air Force Base |
| 9 | SD040 | | 1976 | Historical Operations | Pond 7 constructed. Designed to store runoff from the southwest side of Hill AFB. | Decision Document for IRP Site SD40A Category III NFRAP Pond 6 |
| 9 | SD040 | 9 | 1993 | Remedial Investigation | Preliminary Assessment / Site Inspection at Pond 7 performed. Surface soil, pond sediments, groundwater, and surface water were investigated. Detected organics levels were below the residential RBSLs. Metals were observed at only slightly higher concentrations than established background concentrations. | Final South Area Of Operable Unit 9 Site Inspection, Final Comprehensive Data Evaluation, Volume 1 |
| 9 | SD040 | 3 | 1998 | No Further Response Action Planned (NFRAP) | NFRAP developed for Pond 7 (aka Pond 6). Pond 7 was incorrectly identified as Pond 6 in the Decision Document. | Decision Document for IRP Site SD40A Category III NFRAP Pond 6 |

Table OU 9-2
Chronology of Site Events OU 9
*2008 Five -Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 9 | SD040 | | 1999 | Remedial Investigation | Groundwater contamination was detected downgradient of Pond 7 Area during the basewide CPT investigation. Part of basewide CPT investigation. TCE detected from 22 - 55 ft bgs and maximum TCE conc. detected was 150 ug/L. Other VOCs detected were all below their respective MCLs. | Final Data Summary Report and Preliminary Conceptual Model for Operable Unit 9 Investigation Areas |
| 9 | SD040 | 7 | 2000 | Remedial Investigation | Site Inspection - North Area. Potential groundwater contamination originated from Pond 7 area. Additional investigation was recommended. | Final South Area Of Operable Unit 9 Site Inspection, Final Comprehensive Data Evaluation, Volume 1 |
| 9 | SD040 | 10 | 2000 | Remedial Investigation | Remedial Investigation - physical and analytical data collection at the Pond 7 Area. Investigation includes CPT investigation, groundwater sampling, installation of 5 CPT piezometers and 4 monitoring wells, and groundwater elevation measurements. Findings will be summarized in a future Conceptual Site Model (CSM) report. | Final Analytical Data Report (ADR) For Operable Unit 9 Investigation Areas 1 May Through 10 October 2000 |
| 9 | SD040 | 1 | 2002 | Remedial Investigation | Remedial Investigation - physical and analytical data collection at the Pond 7 Area. Groundwater mapping, CPT investigation, groundwater sampling, and groundwater elevation measurements. Data will be evaluated in the RI report (planned for 2004). | OU10 Remedial Investigation/Feasibility Study Operable Unit 10 Analytical Data Report, May 1 2001 - January 31 2002 |
| 9 | SD040 | 2 | 2005 | NFRAP | No further action was selected as the final remedial alternative for all media associated with Installation Restoration Program (IRP) Site SD40A (Pond 7). | Operable Unit 9 Final Pond 7 Area No Further Response Action Planned Decision Document |
| 9 | SS089 | 3 | 1998 | Remedial Investigation | Site Inspection - OU 9 North Area - includes the West Gate area. Field data was collected between Dec 1995 and Mar 1998 for various OU 9 investigation sites. | Final Data Summary Report and Preliminary Conceptual Model for Operable Unit 9 Investigation Areas |
| 9 | SS089 | 4 | 2000 | Remedial Investigation | Remedial Investigation - included the West Gate area. Field data was collected between April 1998 and April 2000 for various OU 9 investigation sites. | Final Data Summary Report and Preliminary Conceptual Model for Operable Unit 9 Investigation Areas |
| 9 | SS089 | 10 | 2000 | Remedial Investigation | Remedial Investigation -physical and analytical data collection at the 1100 Area. Investigation included CPT and direct-push groundwater sampling, installation of 11 new monitoring wells (U9-11-008 through U9-11-018) ranging from 32-42 ft bgs, and in-situ permeability tests (slug tests) at the new wells. Findings will be summarized in a future Conceptual Site Model (CSM) report. | Final Analytical Data Report (ADR) For Operable Unit 9 Investigation Areas 1 May Through 10 October 2000 |
| 9 | SS089 | 10 | 2000 | Remedial Investigation | 'Preliminary conceptual site models were developed for the West Gate area. Based on data collected during the North Area Site Inspection (1995 to 1998) and between 1998 and 2000, during the ongoing RI/FS investigation of OU 9. Sources of the groundwater contamination plume are unknown since the soil investigations have not been conclusive. | Final Data Summary Report and Preliminary Conceptual Model for Operable Unit 9 Investigation Areas |
| 9 | SS089 | 1 | 2002 | Remedial Investigation | Remedial Investigation - physical and analytical data collection at the 1100 Area. Investigation performed at on and off-Base locations and included groundwater mapping, CPT investigation, groundwater sampling, and groundwater elevation measurements. Data will be evaluated in the RI report (planned for 2004). | OU10 Remedial Investigation/Feasibility Study Operable Unit 10 Analytical Data Report, May 1 2001 - January 31 2002 |
| 9 | SS090 | 3 | 1998 | Remedial Investigation | Field data was collected between Dec 1995 and Mar 1998 for various OU 9 investigation sites in the North Area. | Final Data Summary Report and Preliminary Conceptual Model for Operable Unit 9 Investigation Areas |

Table OU 9-2
Chronology of Site Events OU 9
*2008 Five -Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 9 | SS090 | 10 | 2000 | Remedial Investigation | Remedial Investigation -physical and analytical data collection at the Golf Course. Investigation was performed as part of the ongoing RI/FS investigation at OU 9. Investigation included CPT and direct-push groundwater sampling to define the nature and extent of groundwater contamination. Groundwater samples were analyzed for VOCs. Five new monitoring wells (U9-07-007 through U9-011) were installed in the Golf Course area with depths ranging from 40 to 51.5 ft. Groundwater was sampled at one of the new wells and 6 previously established wells. Groundwater sampled from the monitoring wells was analyzed for VOCs, cations, sulfide, anions, alkalinity, total dissolved solids (TDS), total organic carbon (TOC), and field parameters. Soil from the screened intervals was also sampled. Groundwater elevation measurements were taken in 11 monitoring wells and 12 piezometer locations throughout the study area. Findings will be summarized in a future Conceptual Site Model (CSM) report. | Final Analytical Data Report (ADR) For Operable Unit 9 Investigation Areas 1 May Through 10 October 2000 |
| 9 | SS090 | 10 | 2000 | Remedial Investigation | Preliminary conceptual site models were developed for the Golf Course. Based on data collected during the North Area Site Inspection (1995 to 1998) and between 1998 and 2000, during the ongoing RI/FS investigation of OU 9. Building 710, the maintenance shop, is the likely source of the groundwater contamination. | Final Data Summary Report and Preliminary Conceptual Model for Operable Unit 9 Investigation Areas |
| 9 | SS090 | | 2001 | Remedial Investigation | Remedial Investigation - source of contamination identified. Building 710 (golf course maintenance shop) was identified as the primary source of contamination in the area. TCE and PCE were detected above their respective MCLs in groundwater with CPT and monitoring well samples. | OU11 Remedial Investigation/Feasibility Study, Operable Unit 11 Analytical Data Report, May 1 2001 - January 31 2002 |
| 9 | SS090 | 1 | 2002 | Remedial Investigation | Remedial Investigation - physical and analytical data collection at the Golf Course Area to further delineate the plume boundaries. Phase I investigation to further delineate the extent of the horizontal and vertical plume boundaries. Investigation included groundwater mapping, CPT investigation, groundwater sampling, and groundwater elevation measurements. Data will be evaluated in the RI report. | OU11 Remedial Investigation/Feasibility Study, Operable Unit 11 Analytical Data Report, May 1 2001 - January 31 2002 |
| 9 | SS090 | 10 | 2002 | Transfer to Another Operable Unit | Management of the Zone 7 Golf Course was transferred from OU 11 to OU 9. | FYR Site List |
| 9 | SS092 | | 1984 | Historical Operations | Between 1984 - 1997, Building 786 was used as a pesticide/herbicide storage building. | Building 786 No Further Response Action Planned Decision Document, IRP Site SS092, Final Report |
| 9 | SS092 | 6 | 1996 | Remedial Investigation | Samples were collected during the OU 9 North Area Site Inspection at Building 786. Pesticides were detected above residential RBSLs in one soil sample. | Building 786 No Further Response Action Planned Decision Document, IRP Site SS092, Final Report |
| 9 | SS092 | | 1997 | Historical Operations | Building 786 was demolished. | Building 786 No Further Response Action Planned Decision Document, IRP Site SS092, Final Report |
| 9 | SS092 | 4 | 2000 | Remedial Investigation | Building 786 investigated. Two soil borings were drilled to 16 ft bgs. Groundwater was not encountered. Pesticides and herbicides were not detected at or above residential RBSLs. Surface soil samples were collected at 8 locations from 0-6 inches. Pesticides were not detected at or above residential RBSLs. | Building 786 No Further Response Action Planned Decision Document, IRP Site SS092, Final Report |
| 9 | SS092 | 9 | 2002 | NFRAP | NFRAP status obtained for Building 786. EPA concurred with NFRAP on September 4, 2002. | Building 786 No Further Response Action Planned Decision Document, IRP Site SS092, Final Report |
| 9 | SS108 | 12 | 1993 | Remedial Investigation | Free product detected at 30 ft bgs near Building 914 and is being investigated as part of the basewide UST Program. Draft Final Subsurface Investigation Report for UST Sites 780 (ST77), 859 (ST84; EGTD), 914 (ST71; EHVC), and 1243 (ST57), December 1993. | Proposed 1st Round Cone Penetration Testing Locations for the 800 / 900 Area, Operable Unit 11 |
| 9 | SS108 | 2 | 2001 | Remedial Investigation | SI performed near the 800/900 Warehouse Area | Proposed 1st Round Cone Penetration Testing Locations for the 800 / 900 Area, Operable Unit 11 |
| 9 | SS108 | 12 | 2001 | Remedial Investigation | During the RI four OU 8, chlorinated solvents were detected above their respective MCLs in the groundwater at 150-165 ft bgs at monitoring well U8-091. RI concluded that the contamination at U8-091 was not hydraulically connected with the OU8 plume. | Proposed 1st Round Cone Penetration Testing Locations for the 800 / 900 Area, Operable Unit 11 |

Table OU 9-2
## Chronology of Site Events OU 9
*2008 Five -Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 9 | SS108 | | 2001 | Transfer to Another Operable Unit | Management of the 800/900 Warehouse Area was transferred from OU 8 to OU 11 in the fall of 2001. | OU11 Remedial Investigation/Feasibility Study, Operable Unit 11 Analytical Data Report, May 1 2001 - January 31 2002 |
| 9 | SS108 | 1 | 2002 | Remedial Investigation | Basewide CPT Investigation performed. TCE detected above its MCL at 74 ft bgs (U9-BW-639) and at 91 ft bgs (U9-BW-644). Free product detected near Building 914 is being investigated as part of the basewide UST Program. | Proposed 1st Round Cone Penetration Testing Locations for the 800 / 900 Area, Operable Unit 11 |
| 9 | SS108 | 10 | 2002 | Transfer to Another Operable Unit | Management of the 800/900 Warehouse Area was transferred from OU 11 to OU 9. Additional investigation planned under OU 9. | FYR Site List |

**Notes**

| | |
|---|---|
| AFB | Air Force Base |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| EPA | United States Environmental Protection Agency |
| EECA | Engineering Evaluation/Cost Analysis |
| FS | Feasibility Study |
| IRP | Installation Restoration Program |
| NFRAP | No Further Response Action Planned |
| NPL | National Priority List |
| O&M | Operations and Maintenance |
| OU 9 | Operable Unit 9 |
| PRGs | Preliminary Remediation Goals |
| RAOs | Remedial Action Objectives |
| RBSLs | Risk Based Screening Levels |
| RI | Remedial Investigation |
| ROD | Record of Decision |
| TCE | Trichloroethylene |
| UDEQ | Utah Department of Environmental Quality |
| IWTP | Industrial Wastewater Treatment Plant |
| µg/l | microgram per liter |

Table OU 9-3

## Progress Since Last Five Year Review - Status of Recommendations and Follow-Up Actions at OU 9

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Site | 2003 Five-Year Review Recommendations | Current Status | Carry over to next FYR |
|---|---|---|---|
| Pond 1 | Construct soil cover at Pond 1 as scheduled in May 2003. | **Complete.** A remedial action was conducted at Pond 1 to address soil contamination. Contaminated soil was consolidated and covered with a soil cover. The remedial action for Pond 1 includes institutional controls in the form of land use restrictions during which time the soil cover is monitored on an annual basis to ensure the cover's integrity. Currently, Pond 1 is included in the Annual Hill AFB Land Use Control (LUC) Assessment list for assessment of the Hill AFB Continuing Order (AFI 32-7020 HAFBSUP 1), Hill AFB Restricted Use Access Map (RUAM), and Utah Division of Water Rights (UDWR) groundwater restrictions (**Hill AFB, 2007**). | No |
| OU 9 | Complete remedial investigation and present results in RI report as scheduled in 2004. | **Complete**. The RI Report for OU 9 was finalized and presented to the public in April 2005 (CH2M HILL, 2005a). The FS has been completed (**CH2M HILL, 2005b**) and the ROD for Operable Unit 9 is in preparation. | No |
| | Continue institutional controls at sites under RI to limit human exposure to potential contamination. | **Ongoing.** Land use controls are implemented On-Base through Continuing Order AFI 32-7020 (Hill AFB Supplement 1, 18 February 2004) that states that no construction or other activity is permitted that will disturb groundwater in the restricted areas. Hill AFB will distribute a Restricted Areas Use Map to departments across the Base and will update and redistribute the map as necessary (**Hill AFB, 2006**). | No |
| Deferred Sites | Continue annual inventory of deferred facilities to determine when site characterization can be conducted. | **Ongoing.** An annual inventory of deferred sites is now required by the Site Management Plan for the Operable Unit 9 Deferred Sites (**CH2M HILL, 2002a**). Annual reports have been completed for Calendar Years 2001 through 2006. A revised Deferred Site List is provided in each annual report. The OU 9 CEVR Site Manager indicated in the FYR interview that Deferred Areas will no longer be part of the OU 9 ROD based on regulatory recommendation that actions cannot be deferred in a ROD. A program to investigate the deferred sites will be initiated in 2008 or 2009 (**CH2M HILL, 2007b**). This is further addressed under Section 8 of the 2008 five-year review report. | No |

**Notes:**

| | |
|---|---|
| FYR | Five-Year Review |
| AFB | Air Force Base |
| OU 9 | Operable Unit 9 |
| ROD | Record of Decision |

Table OU 9-4
# Operable Unit 9
# Five-Year Review Process

Reviewer: Victor Martinez

| | |
|---|---|
| **Introduction** | This 2008 five-year review for Hill AFB has been conducted in accordance with the EPA's Comprehensive Five-Year Review Guidance dated June 2001 (**EPA, 2001**). Administrative and community involvement components of the five-year review are described in **Section 2.0** of this report for the overall five-year review. In addition, interviews were conducted with relevant parties. A site inspection of OU 9 was performed. Documents reviewed for OU 9 as part of the 2008 five-year review are provided in **Appendix C**. Relevant site documents and applicable data covering the period of the five-year review were evaluated. The site interviews, site inspection, and data review are further discussed in the following sections. |
| **Interviews** | An interview for OU 9 was conducted with Shannon Smith/ CEVR site manager. Ms Smith provided responses via electronic mail on September 25, 2007. A copy of the Interview Record Form is provided in **Appendix D**.<br><br>Ms. Smith indicated that the only actions taken since the 2003 five-year review were groundwater monitoring and well installation to fill data gaps. She added that more data collection and installation of additional wells provides data needed for the final remedy. She mentioned the current sampling procedures for OU 9 can be found in the RI/FS work plan (July, 2006). She also mentioned that the completion of the ROD for OU 9 has been postponed until 2010.<br><br>With regards to the status of deferred sites (OT106), Ms. Smith pointed out that a program will be initiated in Fiscal Year 2008 or 2009 to investigate these sites.<br><br>She indicated that findings of the investigation to date were small plumes with low concentrations, as anticipated. Ms. Smith mentioned that sampling efforts have been optimized since the investigation was planned by conducting a full sample round twice a year and key (centerline, sentinel wells) sampling rounds quarterly.<br><br>Ms. Smith said that there has not been unexpected difficulties or cost associated with OU 9 since the 2003 five-year review. She was not aware of any ongoing community concerns regarding the activities at the site. |
| **Site Inspection** | The site inspection for OU 9 was conducted on September 25, 2007. The completed site inspection checklist is provided in **Appendix E**.<br><br>Based on the site inspection, OU 9 appears to be well maintained. No signs of vandalism were evident.<br><br>Operable Unit Conditions at OU 9 show that ICs are properly implemented and therefore, ICs are being fully enforced. The ICs currently associated with OU 9 are groundwater use restrictions, verification of leases, and unauthorized development or construction restrictions. Reporting is up-to-date and no violations have been reported. Hill AFB performs an annual evaluation of the ICs in place for the Base. This includes verification of orders, leases, groundwater use restrictions, and inspections of signage, fences, and monitoring wells. An annual land-use controls report is prepared documenting the results of this work. Results of the annual evaluation of the ICs are presented in detail in the Technical Assessment section, **Table OU 9-5**.<br><br>The site inspection checklist addressed four discussion topics. These discussion topics are presented below, followed by responses and general observations based on the site inspection. |

| | |
|---|---|
| | (1) Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).<br><br>A ROD has not been signed for OU 9, and a remedy has not yet been selected.<br><br>(2) Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.<br><br>Operable Unit 9 is currently in the RI/FS stage. A ROD has not yet been signed. However, monitoring wells are present at OU 9. One well in the 800/900 area lacked a well cover. This well was located in a street. Due to the large number of monitoring wells present, not all wells were inspected. The remaining wells that were inspected appeared to be in good condition and to be appropriately maintained.<br><br>(3) Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.<br><br>A remedy is not yet in place at OU 9.<br><br>(4) Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.<br><br>A remedy is not yet in place at OU 9. |
| **Data Review** | The data reviewed as part of the 2008 five-year review included groundwater samples from monitoring wells at the three areas of concern including: the 800/900, 1100, Pond 7, and Golf Course Area. A review on analytical data available in ERPIMS of the constituents of concern was conducted for monitoring wells that had detections above the PRGs identified in the draft record of decision for OU 9.<br><br>The following observations are presented based on data review of monitoring wells located in the Golf Course area. Trichloroethene concentrations appear to be decreasing at Monitoring Well U9-7-001. Trichloroethene concentrations appear to be stable at Monitoring Wells U11-013 and U9-7-005, while TCE concentrations at Monitoring Wells U9-7-008, U9-7-009 and U9-7-011 are variable. The remaining monitoring wells had traces of TCE below the PRGs or TCE was not detected. No increasing concentrations of TCE were observed in any of the monitoring wells at the Golf Course area. Perchloroethylene concentrations in the Golf Course area at Well U9-7-009 appear to be stable while PCE concentrations at Monitoring Well U9-7-008 appear to be decreasing PCE. The remaining monitoring wells had traces of PCE below the PRGs or PCE was not detected.<br><br>The following observations are presented based on data review of monitoring wells located in the 1110 area. TCE concentrations appear to be decreasing at Monitoring Well U9-11-001. TCE concentrations appear to be stable at monitoring wells U10-005, U9-11-004, U9-11-005 and U9-11-012, while TCE concentrations at Monitoring Well U9-11-009 are variable. The remaining monitoring wells had traces of TCE below the PRGs or TCE was not detected.<br><br>The following observations are presented based on data review of monitoring wells located in the 800/900 area. Trichloroethene concentrations appear to be decreasing at Monitoring Wells U9-020 while concentrations at U9-025 appear to be stable. The remaining monitoring wells had traces of TCE below the PRGs or TCE was not detected. Carbon Tetrachloride concentrations in the 800/900 area at Well U9-014 appear to be stable. The remaining monitoring wells had traces of Carbon Tetrachloride below the PRGs or Carbon Tetrachloride was not detected. |

| | |
|---|---|
| | In September 2006, Hill AFB presented to the public the Proposed Plan for OU 9. In the Proposed Plan, MNA was described as the proposed remedy for each of the OU 9 sites because it was found to be protective and represented the most cost-effective alternative. After a remedy is selected through public and regulatory input, a ROD will be prepared and signed for OU 9. Hill AFB and the EPA are currently discussing issues regarding the selection of MNA as a component of the remedy (**Hill AFB CEVR, 2007**). The ROD has been postponed until 2010 to collect more data and conduct an assessment of the natural attenuation of contaminants. |

Table OU 9-5
# Operable Unit 9
# Five-Year Review Technical Assessment

Reviewer: Victor Martinez

| | |
|---|---|
| **Introduction** | The five-year review must determine whether the remedy at a site is protective of human health and the environment. The EPA guidance describes three questions used to provide a framework for organizing and evaluating data and information and to ensure all relevant issues are considered when determining the protectiveness of a remedy (**EPA, 2001**). These questions are assessed for OU 9 in the following sections. The implementation of ICs is also described. At the end of this table is a summary of the technical assessment. |
| **Question A.** | **Is the remedy functioning as intended by the decision documents?**<br><br>A final remedy has not been implemented to-date at OU 9; however, the interim measures implemented at OU 9 appear to be functioning as intended. The documents that detail the actions in place at OU 9 are the *Final Action Memorandum Action for Pond 1*, (**CH2M HILL, 2002b**), *Pond 3 Action Memorandum* (**CH2M HILL, 2004b**), and *Pond 7 Area No Further Response Action Planned (NFRAP) Decision Document* (**CH2M HILL, 2005c**).<br><br>For Pond 1, contaminated sediments were consolidated under a soil cover in 2003. This action included excavation of the contaminated sediments, expansion of the south bank of the pond, consolidation of the contaminated sediments, placement of a soil cover over the contaminated sediments, installation of drainage improvement piping and structures, and grading and revegetation. The expansion of the pond was required to maintain the retention capacity lost due to the soil cover. Institutional Controls that have been implemented at Pond 1 include land use restrictions during which time the soil cover is monitored on an annual basis to ensure the cover's integrity. No issues were identified at Pond 1 during the site inspection (**CH2M HILL, 2005a**).<br><br>A removal action was performed to address sediment contamination at Pond 3. The removal action took place in the fall of 2003. Approximately 260 cubic yards of arsenic-contaminated sediments were removed from Pond 3 and disposed in a solid waste landfill due to low arsenic concentrations. The selected remedy resulted in closure and restoration of the site with no LTM or ICs (**CH2M HILL, 2005a**). The removal action met the remedy goal to eliminate the exposure pathways of the contaminated sediments to humans and the surrounding environment and is considered to be protective of human health and the environment.<br><br>A NFRAP was designated for all media associated with the Pond 7 Area. The NFRAP determination was based on the results of groundwater samples collected during the OU 9 RI and that concentrations of TCE detected during investigations in the late 1990s could not be confirmed. The *Pond 7 Area NFRAP Decision Document* stated that historical trends indicate that the isolated groundwater contaminant concentrations are declining, suggesting that contamination is naturally attenuating in this area. The soil and groundwater at the Pond 7 Area were determined to pose no unacceptable risk to human health or the environment; therefore, a no further response action decision was designated for this site (**CH2M HILL, 2005c**). |
| **Question B.** | **Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?**<br><br>A ROD has not been signed for OU 9, and a final remedy has not yet been selected. However, there have been no changes in exposure assumptions, toxicity data, cleanup levels, and remedial action objectives in relation to the interim actions conducted at Ponds 1 and 3. |

| | |
|---|---|
| **Question C.** | **Has any other information come to light that could call into question the protectiveness of the remedy?**<br><br>No. |
| **Institutional Controls** | Institutional controls are generally defined as non-engineered instruments such as administrative and legal tools that do not involve construction or physically changing the site, and that help minimize the potential for human exposure to contamination and/or protect the integrity of a remedy by limiting land and/or resource use (**EPA, 2005**). Institutional controls can be used for many reasons including restriction of site use, modifying behavior, and providing information to people (**EPA, 2000**). Institutional controls may include deed notices, easements, covenants, restrictions, or other conditions on deeds, and/or groundwater and/or land use restriction documents (**EPA, 2001**). The following paragraphs describe ICs implemented at OU 9, the potential affect of future land use plans on ICs, and any plans for changes to site contamination status.<br><br>Types of ICs in Place at the Site:<br><br>Although a remedy is not yet in place at OU 9, ICs have been implemented. The ICs currently associated with OU 9 are groundwater use restrictions, signs at Pond 1, verification of leases, and unauthorized development or construction restrictions. Reporting is up-to-date and no violations have been reported. Hill AFB performs an annual evaluation of the ICs in place for the Base. This includes verification of orders, leases, groundwater use restrictions, and inspections of signage, fences, and monitoring wells. An annual land-use controls report is prepared documenting the results of this work. Detailed information from the annual LUC Assessment report is presented in **Section 2.7**. Based on review of the most recent LUC Assessment report, LUCs at OU 9 were considered appropriate and no recommendations were made (**Hill AFB CERV, 2007**).<br><br>Effects of Future Land Use Plans on ICs:<br><br>No effects on ICs due to future land use were identified during this five-year review.<br><br>Plans for Changes to Site Contamination Status:<br><br>No changes to site contaminant status at OU 9 are anticipated in the near future. |
| **Summary of the Technical Assessment** | To date, a final remedy has not been selected for OU 9. Currently, groundwater monitoring and data collection is underway and additional wells are being installed to fill data gaps at OU 9. Data collected during the sampling events will be used to develop a database to reevaluate natural attenuation of contaminants at OU 9. On-Base groundwater use restrictions, unauthorized development or construction restrictions and signage at Pond 1 are currently in place at OU 9 (**CH2M HILL, 2007b**). Data review of selected monitoring wells show that there are no apparent increase in concentrations for COCs at wells where contaminants have been previously detected. The analytical data review shows that most monitoring wells appear to have either a variable or a decrease in concentrations.<br><br>Remedial actions implemented at Pond 1 and Pond 3 are considered to be protective of human health and the environment and the soil and groundwater at the Pond 7 Area and Building 786 were determined to pose no unacceptable risk to human health or the environment.<br><br>In September 2006, Hill AFB presented to the public the Proposed Plan for OU 9 which included MNA as the selected remedy at each of the OU 9 sites. Hill AFB and the EPA are currently discussing issues regarding the selection of MNA as a component of the remedy (**Hill AFB, 2007**). |

Table OU 9-6
## Operable Unit 9
## Technical Assessment Summary for OU 9

Reviewer: Victor Martinez

| Site ID | Remedy Description | Technical Assessment | | | Protectiveness | Next Five-Year Review |
|---|---|---|---|---|---|---|
| | | Question A* | Question B* | Question C* | | |
| SD023 | Removal and disposal of contaminated sediments | Yes | Yes | No | Protective | 2013 |
| SD034 | Soil cover | Yes | Yes | No | Protective | 2013 |
| SS092 | NFRAP | NA | NA | NA | Protective | Not required |
| OT106 | Not determined | NA | NA | NA | NA, no longer covered under Operable Unit (OU) 9 | NA |
| PT093 | NFRAP | Yes | Yes | No | Protective | Not required |
| SD040 | NFRAP | Yes | Yes | No | Protective | Not required |
| SS089 | Not determined | NA | NA | NA | NA, pending remedy selection | 2013 |
| SS090 | Not determined | NA | NA | NA | NA, pending remedy selection | 2013 |
| SS094 | NFRAP | Yes | Yes | No | Protective | Not required |
| SS095 | NFRAP | Yes | Yes | No | Protective | Not required |
| SS108 | Not determined | NA | NA | NA | NA, pending remedy selection | 2013 |
| OU9 | Removal and disposal of contaminated sediments,<br>Soil cover | Yes | Yes | No | Protective for Pond 1, 3 and 7.<br>NA for other sites, pending remedy selection | 2013 |

*Question A: Is the remedy functioning as intended by the decision documents?
*Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objective (RAOs) used at the time of the remedy still valid?
*Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
NA = Not Applicable
NFRAP = No Further Response Action Planned

Table OU 9-7
## Operable Unit 9
## Five-Year Review Issues, Recommendations and Follow-Up Actions, and Protectiveness Statement

Reviewer: Victor Martinez

| | |
|---|---|
| **Issues** | Based on document review, data review, site inspection, interviews, and the technical assessment, one issue is identified in the 2008 five-year review for OU 9 as described below:<br><br>1) In September 2006, Hill AFB presented to the public the Proposed Plan for OU 9 which included MNA as the selected remedy at each of the OU 9 sites. Hill AFB and EPA are currently discussing issues regarding the selection of MNA as a component of the remedy (**Hill AFB, 2007**). The OU 9 site manager indicated in the 2008 five-year review interview that the ROD has been postponed until 2010 to collect more data and conduct an assessment of the natural attenuation of contaminants (**CH2M HILL, 2007b**). |
| **Recommendations and Follow-Up Actions** | As described in the previous section, one issue was identified in the 2008 five-year review for OU 9. To address this issue, the following recommendations and follow-up actions have been defined.<br><br>1) Continue with collection of groundwater data to fill data gaps and reevaluate natural attenuation of contaminants at OU 9 (**CH2M HILL, 2007b**). Finalize selection of the remedy based on the conclusions of this evaluation as appropriate. |
| **Remedial Timeframe** | Not applicable. A remedial timeframe has not been determined because a remedy has not yet been selected for OU 9. |
| **Protectiveness Statement** | **The remedies completed at OU 9 are considered protective of human health and the environment in the short-term.** Remedial actions implemented at Pond 1 and Pond 3 are considered to be protective of human health and the environment. The soil and groundwater at the Pond 7 Area were determined to pose no unacceptable risk to human health or the environment (**CH2M HILL, 2005c**). Protectiveness for the remaining sites at OU 9, the 800/900 Area, 1100 Area, and Golf Course, is pending remedy selection. It should be noted that ICs have already been implemented at OU 9. ICs and land-use controls are assessed annually. Enforcement of ICs at OU 9 provides protectiveness in the short-term pending remedy selection. |
| **Next Five-Year Review** | Remedial actions at OU 9 will be reviewed in the next five-year review for Hill AFB to be completed during or before September 2013. |

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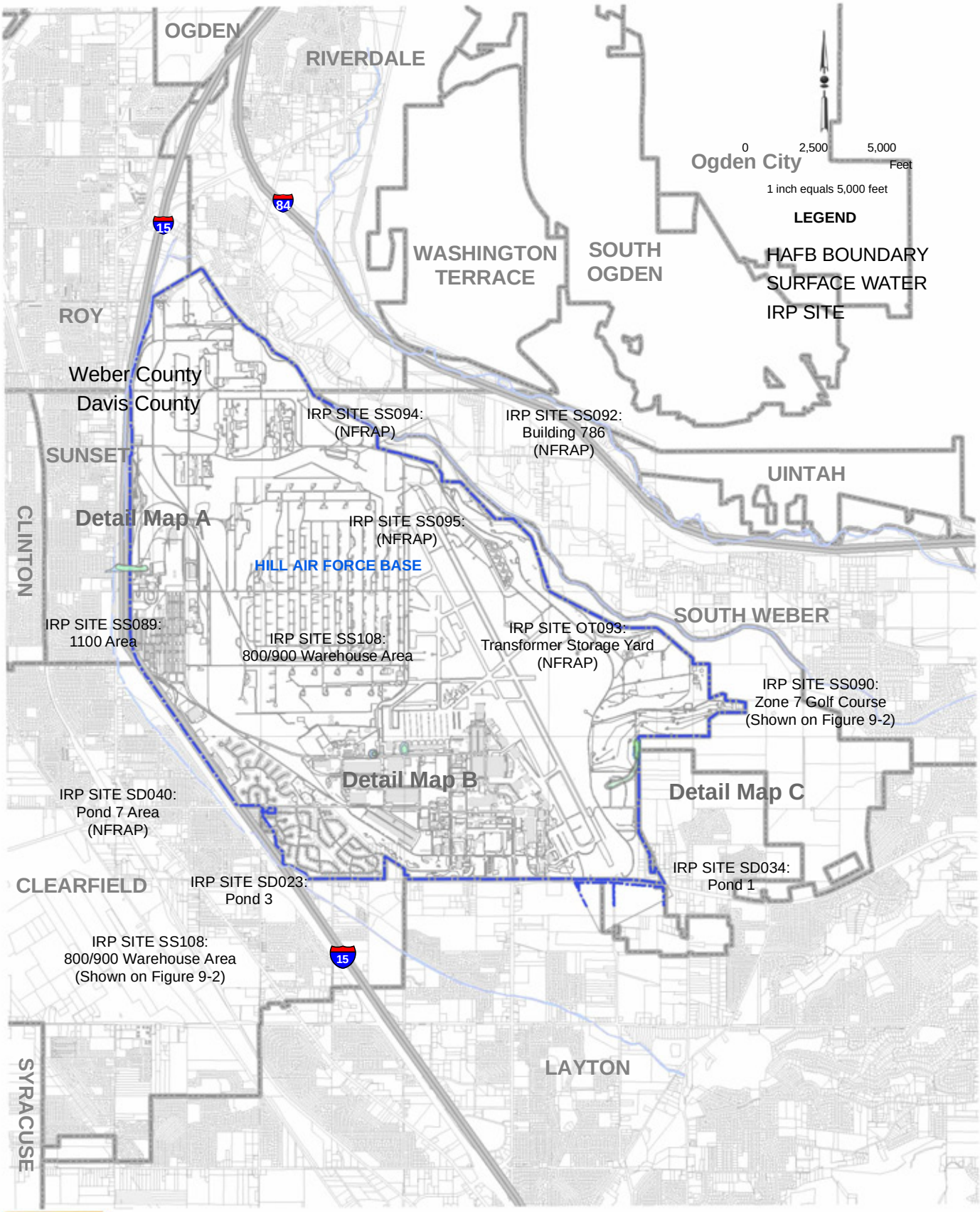


75th AIR BASE WING

FIGURE OU 9 - 1

**SITE FEATURES OF OPERABLE UNIT 9**

2008 FIVE-YEAR REVIEW

IRP SITES: SS094, SS092, SS095, SS089, SS108, OT093, SS090, SD040, SD023, SD034

HILL AIR FORCE BASE, UTAH

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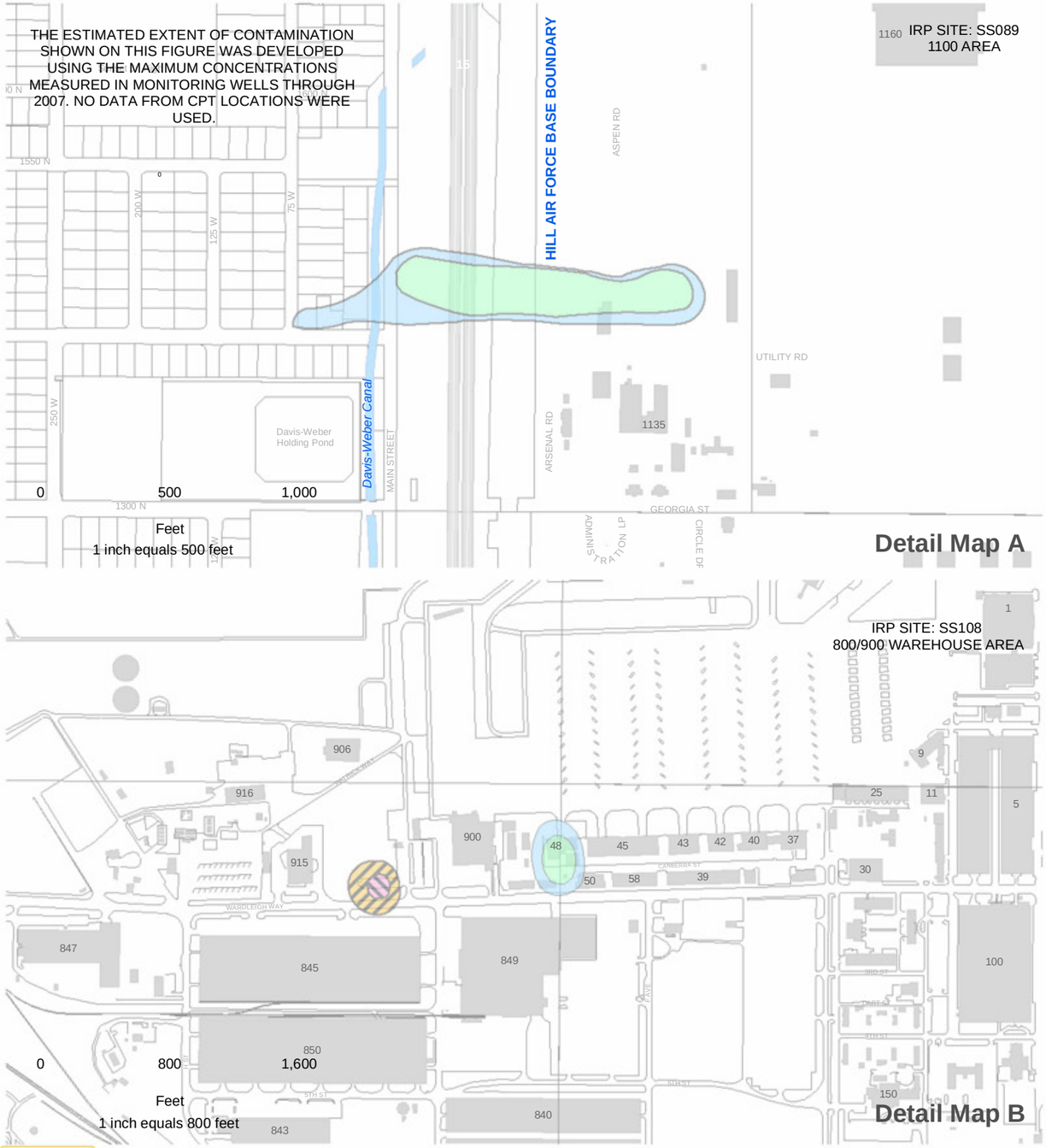
DFW \\CHUCKWAGON\GIS\NWOFILES\HILLAFB\MXD\OU9_GROUND_WATER_PLUMES.MXD NBHATTAC 04/11/08

THE ESTIMATED EXTENT OF CONTAMINATION SHOWN ON THIS FIGURE WAS DEVELOPED USING THE MAXIMUM CONCENTRATIONS MEASURED IN MONITORING WELLS THROUGH 2007. NO DATA FROM CPT LOCATIONS WERE USED.




## Detail Map A




## Detail Map B


## Detail Map C

**LEGEND**

ESTIMATED EXTENT OF PCE CONTAMINATION

5-10 µg/l

10-100 µg/l

ESTIMATED EXTENT OF TCE CONTAMINATION

5-10 µg/l

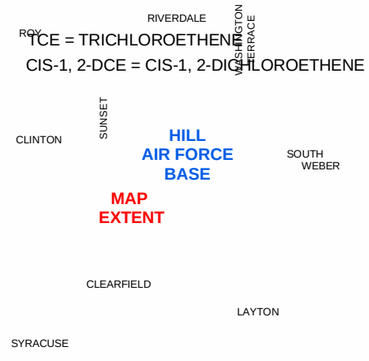
10-100 µg/l

ESTIMATED EXTENT OF CTCL CONCENTRATION

5-10 µg/l

10-100 µg/l

ESTIMATED EXTENT OF CONTAMINATION: SUMMER 2007




TCE = TRICHLOROETHENE

CIS-1, 2-DCE = CIS-1, 2-DICHLOROETHENE

75th AIR BASE WING

FIGURE OU 9 - 2

**GROUNDWATER PLUMES AT OPERABLE UNIT 9**

2008 FIVE-YEAR REVIEW

IRP SITES: SS089, SS108, SS090

HILL AIR FORCE BASE, UTAH

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Table OU 10-1
# Operable Unit 10
# Background Information

Reviewer: Kelly Taylor

<table>
<tr><td>Introduction</td><td>Operable Unit (OU) 10 is located along the western boundary of Hill AFB near the West Gate and is comprised of the soil and groundwater contamination associated with the 1200 Area. Since 1978, the buildings in the 1200 Area have been used primarily for administrative functions, vehicle maintenance, and storage and issuing of hazardous and non-hazardous missile components. Previous building functions at OU 10 included inert material and combat equipment warehouses for the Ogden Arsenal, a spray-painting booth, ordnance maintenance shops, an optical shop, and a boiler house. The only known source area for OU 10 (an oil water separator [OWS] located on the north side of Building 1244) was identified and removed, along with approximately 4.5 cubic yards of contaminated soil, in 2003. The OWS had approximately a 3,000-gallon capacity and received wastewaters from past operations in Building 1244 (CH2M HILL, 2007a). Two discrete groundwater plumes have been identified at OU 10: a shallow groundwater plume extending approximately 5,000 feet off-Base beneath the cities of Sunset and Clearfield, and a deep groundwater plume that may originate near the western Base boundary north of the West Gate and extends approximately 4,000 feet off-Base beneath the cities of Sunset, Clearfield, and possibly Clinton. Groundwater contamination in the shallow and deep plumes occurs at depths of approximately 20 to 120 feet and 180 to 290 feet below ground surface (bgs), respectively. Trichloroethene (TCE) and tetrachloroethene (PCE) are the primary constituents in the shallow groundwater plume while TCE is the primary constituent in the deep groundwater plume.<br><br>A list of the documents reviewed for OU 10 as part of the 2008 five-year review is provided in Appendix C.
<table>
<tr><th>IRP Identification</th><th>IRP Site Name</th><th>Status</th></tr>
<tr><td>SS109</td><td>1200 Area</td><td>RI/FS pending</td></tr>
</table>
</td></tr>
<tr><td>Site Chronology</td><td>Provided separately. See Table OU 10-2.</td></tr>
<tr><td>Background</td><td>Physical Characteristics. The subsurface geology at OU 10 is characterized by unconsolidated interbedded deposits of sand, sandy silt, silty sand, silt and clay that are laterally discontinuous. Depth to groundwater at OU 10 ranges from approximately 20 to 30 feet bgs on-Base and approximately 8 to 12 feet bgs off-Base. The shallow aquifer system at OU 10 consists of two water bearing zones, the Shallow Groundwater Zone and the Deep Groundwater Zone. The Shallow Groundwater Zone includes an aquifer unit composed primarily of fine to medium sand and a confining unit composed of silt and clay. This zone extends from approximately 20 to 120 feet bgs and groundwater flows to the southwest. The deep zone includes an aquifer composed of sand and silty sand and is underlain by a low-permeability unit that separates the shallow aquifer system from deeper drinking water aquifers. The deeper zone extends from approximately 150 to 350 feet bgs and groundwater flows towards the west-northwest (CH2M HILL, 2007a).</td></tr>
<tr><td></td><td>Land and Resource Use. As of the site inspection in 2007, land use in the 1200 Area is largely administrative, along with several vehicle maintenance facilities and the heating plant. The land use in the cities of Sunset and Clearfield (and possibly Clinton), where potential contamination has been tentatively delineated, is residential and commercial (URS, 2003). Overall, groundwater in the shallow aquifer system is of poor quality and used primarily for irrigation. The vast majority of the off-Base groundwater plumes reside beneath residential areas.</td></tr>
</table>

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| | **History of Contamination.** Based on the current Conceptual Site Model (CSM), soil contamination at OU 10 has been associated with the only known source area, the former OWS located on the north side of Building 1244. Sludge samples collected from the OWS in December 2002 identified concentrations of TCE at approximately 40 parts per million. The presence of nonaqueous phase liquid (NAPL) has not been identified in the suspected source zone at OU 10, and with the exception of sorbed contaminant mass, soil and groundwater data do not indicate additional continuing sources for the groundwater contamination (**CH2M HILL, 2006a**). |
| | **Initial Response**. In August 2003, the OWS and contaminated soil in the vicinity was removed. No other actions have been implemented; however, groundwater use restrictions are in place that encompass the known extent of the plume (**Hill AFB, 1998**). |
| | **Basis for Taking Action.** Not applicable. SS109, the 1200 Area, is still under remedial investigation and no remedy has been selected. |
| **Remedial Actions** | **Remedy Selection (ie. ROD/ESDs).** A final ROD for OU 10 has not been signed; therefore, a remedy has not been selected. However, several alternatives for groundwater remediation at OU 10 were evaluated in 2006. Technologies identified as being applicable to address TCE contamination of the shallow groundwater at OU 10 include groundwater extraction, in-situ chemical reduction, reactive or biological barriers, and/or enhanced in-situ anaerobic bioremediation (**CH2M HILL, 2006a**). The RI report has not been completed to-date but is due July 2008. |
| | **Remedy Implementation**. To-date, no remedy has been implemented. However, groundwater use restrictions are in place that encompass the known extent of the plume (**Hill AFB, 1998**). In addition, two treatability studies are being conducted to investigate the alternatives discussed above. |
| | **Operations and Maintenance.** Not applicable. |
| **Progress Since Last FYR** | The 2003 five-year review evaluated this site though no remedy had yet been selected (**URS, 2003**). Recommendations based on the second five-year review are presented in **Table OU 10-3** along with the status of each recommendation.<br><br>**Current Status**. Since the 2003 five-year review, a deeper portion of the OU 10 plume was discovered. Efforts are currently focused on further characterization of the deep plume. Additionally, the CSM for the shallow plume was further refined (**CH2M HILL, 2007b**, and **CH2M HILL, 2006b**). Additional monitoring wells are being installed to investigate the leading edges of each plume and the draft remedial investigation report is due in July 2008.<br><br>As recommended during the 2003 five-year review, indoor air sampling was conducted at houses potentially impacted by the OU 10 plumes (**MWH, 2004**). As a result, one residential indoor air mitigation system was installed (**MWH, 2005**) in November 2004.<br><br>During 2006 and 2007, field activities included monitoring well installations, aquifer age dating and downhole profiling, cone penetrometer testing (CPT), as well as initial groundwater sampling during and after monitoring well installations. Monitoring wells were installed on and off-Base to monitor and evaluate the shallow and deep groundwater plumes. Aquifer age dating and downhole profiling was performed to evaluate if the shallow and deep groundwater plumes are distinguishable and hydraulically connected. Deep groundwater flow rates and recharge zones for both the shallow and deep groundwater zones were also evaluated (**CH2M HILL, 2007a**). Forty-seven monitoring wells were installed to further characterize and monitor contamination in the deep zone. Soil and groundwater samples were conducted during this effort. Hydropunch groundwater samples were collected during CPT investigations in potential source areas within and near the 1200 Area. Additionally, groundwater age dating and downhole profiling were conducted on a select number of wells to evaluate the connectivity between the shallow and deep groundwater plumes, groundwater flow rates and potential recharge zones for both plumes, and evidence of natural attenuation within the deep plume. Results of this effort suggest that (1) groundwater in the deep and shallow aquifers flows independently, (2) recharge for the shallow and deep zones likely originates in the fields |

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| | east of the 1200 Area or farther east in the munitions and missile storage area, (3) recharge history (modern precipitation) for both the shallow and deep zones is similar, (4) the anaerobic environment in the deep aquifer is favorable for natural attenuation, and (5) the presence of the TCE degradation daughter products cis-DCE, trans-DCE, 1,1-DCE, and vinyl chloride provide evidence that natural attenuation of TCE is occurring in the deeper zone of the shallow aquifer (**CH2M HILL, 2007a**).<br><br>Ongoing investigation of the shallow and deep groundwater plumes will target: (1) the extent of TCE contamination near the leading edge of the shallow plume, (2) the extent of PCE contamination in the shallow plume, and (3) the extent of TCE contamination near the leading edge of the deep plume. |

Table OU 10-2

# Chronology of Site Events for Operable Unit 10

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 10 | OU 10 | 9 | 2003 | 2003 Five-Year Review | A protectiveness statement was not presented for OU 10 because no remedial action had occurred at the time of this review. | Final CERCLA Five-Year Review. September 2003. |
| 10 | OU 10 | 3 | 2006 | Feasibility Study | Remediation Technology Screening and Treatability Study completed. Screening evaluation of technologies applicable for remediation of the shallow trichloroethene (TCE) groundwater plume at OU 10 (OU 10) | Remediation Technology Screening and Treatability Study Recommendations for the Shallow Groundwater Plume, Operable Unit 10. |
| 10 | SS109 | 12 | 1995 | Remedial Investigation | Field data was collected between Dec 1995 and Mar 1998 for various OU 9 investigation sites. | Final Data Summary Report and Preliminary Conceptual Model for OU 9 Investigation Areas |
| 10 | SS109 | | 1995 | Remedial Investigation | OU 9 North Area Site Inspection conducted. SI approach was designed to focus on the 311 facilities most likely to have released contaminants to the environment. The objective was to evaluate whether environmental contamination was present at each facility of potential concern, and to categorize each facility according to its threat to human health and the environment. | North Area Preliminary Assessment Report, June 1995, Final |
| 10 | SS109 | 9 | 2000 | Transfer to Different Operable Unit | Redesignation of groundwater contamination plumes identified during OU 9 investigations. SS109, the 1200 Area, redesignated as OU 10. | OU10 Remedial Investigation/Feasibility Study OU 10 Analytical Data Report, May 1 2001 - January 31 2002 |
| 10 | SS109 | 5 | 2001 | Remedial Investigation | Sampling being conducted in potentially contaminated area in the cities of Sunset and Clearfield. | OU 10 RI/FS, Operable Unit 10 Analytical Data Report, May 1, 2001 - January 31, 2002 |
| 10 | SS109 | | 2006 | Remedial Investigation | Forty-seven monitoring wells were installed to further characterize and monitor contamination in the deep zone. | Final 2006 Analytical Data Report January 2006 through January 2007, Hill AFB. |
| 10 | SS109 | 1 | 2008 | Remedial Investigation | The RI/FS report is due April 2008. | |

Table OU 10-2

# Chronology of Site Events for Operable Unit 10

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|

**Notes**

| | |
|---|---|
| AFB | Air Force Base |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| EPA | United States Environmental Protection Agency |
| IWTP | industrial wastewater treatment plant |
| NPL | National Priorities List |
| OU | Operable Unit |
| RI/FS | remedial investigation/feasibility study |
| ROD | Record of Decision |
| TCE | trichloroethene |
| UDEQ | Utah Department of Environmental Quality |

Table OU 10-3

## Progress Since Last Five Year Review - Status of Recommendations and Follow-Up Actions at OU 10

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Site | 2003 Five-Year Review Recommendations | Current Status | Carry Over to Next FYR? |
|---|---|---|---|
| 1200 Area (SS109) | Continuing remedial investigation work to identify the sources and extent of the groundwater contamination. | **Ongoing.** Remedial investigation has continued since the last five-year review. According to the CEVR Site Manager, a deeper portion of the Operable Unit (OU) 10 plume was discovered. Efforts are currently focused on characterizing this plume, though the extent of contamination in this deep plume is thought to be relatively well characterized. Additionally, the conceptual site modal for the shallow plume was further refined (**CH2M Hill, 2007b** and **CH2M HILL, 2006b**). The last five wells are being installed to investigate the toes of each plume and the draft remedial investigation report is due in April 2008. | No |
| | Evaluate the selected remedy for protectiveness of human health and the environment on the next FYR scheduled in 2008. | **Ongoing.** A Record of Decision (ROD) has not yet been signed for OU 10. | Yes |
| | Conducting air sampling on off-Base residences to determine if the new action level for trichloroethylene (0.43 parts per billion by volume) in indoor air warrants mitigation measures in off-Base residential areas. | **Complete.** Indoor air sampling was conducted at houses potentially impacted by the OU 10 plumes (**MWH, 2004**). As a result, one residential indoor air mitigation system was installed in a residence (**MWH, 2005**) in November 2004. Indoor air issues are being address under the Indoor Air Program. | No |

**Notes**

OU = operable unit

ROD = record of decision

Table OU 10-4
# Operable Unit 10
# Five-Year Review Process

Reviewer: Kelly Taylor

| | |
|---|---|
| **Introduction** | This 2008 five-year review for Hill AFB has been conducted in accordance with the United States EPA Comprehensive Five-Year Review Guidance dated June 2001 (**EPA, 2001**). Administrative and community involvement components of the five-year review are described in **Section 2.0** of this report for the overall FYR. In addition, interviews were conducted with relevant parties. A site inspection of OU 10 was performed. Relevant site documents and applicable data covering the period of the five-year review were evaluated. The site interviews, site inspection, and data review are further discussed in the following sections. |
| **Interviews** | An interview for OU 10 was conducted with Shannon Smith/CEVR Site Manager. A copy of the Interview Record Form is provided in **Appendix D**.<br><br>Shannon Smith was interviewed on September 27, 2007 and indicated that a deeper portion of the OU10 plume has been discovered, and investigations have been focused on characterizing this plume. The extent of contamination in the deep OU 10 plume is pretty well defined and the conceptual site model has been further refined for the shallow plume.<br><br>Community interviews were also conducted as part of this five-year review. Interviews were conducted with Chad Bangerter/Sunset City Council, Mickey Hennessee/Sunset City RAB representative, and Mr. Gregg Benson, Clearfield City RAB representative. Copies of the Interview Record Forms are provided in **Appendix B**.<br><br>Mr. Chad Bangerter was interviewed on December 14, 2007. He indicated that as a council member, he said he feels more informed and is impressed with the effort and appreciates what is being done to remedy the problem; however, as a resident, he does not see as much information about the cleanup as he did several years ago. He said site operations have had very little impact on the community. His concerns focused on the use of tax-payer dollars, health concerns of citizens, and the inconvenience of quarterly indoor air sampling.<br><br>Mr. Mickey Hennessee was interviewed on December 12, 2007. He indicated that he is very satisfied with the current efforts conducted by the Air Force. The environmental team and contractors associated with the cleanup effort are aware and sensitive to the communities needs, concerns and are always striving to keep the public informed of the cleanup process and its progress. The use of the internet and websites in public notification/communication has drastically improved getting the word out. He did indicate that he would like current contact information on field supervisors and personnel associated with contractors and sub-contractors as notification about current activities is not as thorough as previous years.<br><br>Mr. Gregg Benson was interviewed on December 18, 2007. He indicated that the cleanup effort seems to be moving forward, and the staff at Hill AFB have been very informative and easy to work with. They have also been a great resource to the RAB in guiding them through the process and time table of cleaning up the various sights. There are still concerns and fears in the community, specifically in regard to health effects; however, Hill AFB has made every effort to keep the cities and residents informed. As more information is presented and the city and residents are educated the fears seem to subside. |

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| **Site Inspection** | The site inspection for OU 10 was conducted on September 27, 2007. The completed site inspection checklist is provided in **Appendix E**.<br><br>According to the Site Inspection notes, there are plans for redevelopment on the west side of the Base. This is currently in the planning phase. It is anticipated that a private developer will be allowed to use portions of the western area of the Base for commercial and/or light industrial redevelopment.<br><br>The site inspection checklist addressed four discussion topics. These discussion topics are presented below, followed by responses and general observations based on the site inspection.<br><br>(1) Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).<br><br>A ROD has not been signed for OU 10, and a remedy has not yet been selected.<br><br>(2) Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.<br><br>OU 10 is currently in the RI/FS stage. A ROD has not yet been signed. However, monitoring wells are present at OU 10. Due to the large number of monitoring wells present, not all wells were inspected. The remaining wells that were inspected appeared to be in good condition and to be appropriately maintained.<br><br>(3) Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.<br><br>A remedy is not yet in place at OU 10.<br><br>(4) Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.<br><br>A remedy is not yet in place at OU 10. |
| **Data Review** | Because a ROD has not been signed, and a remedy not yet selected, data were not reviewed in terms of the performance of a remedy. However, the data reviewed as part of the 2008 five-year review included the comparison of currently understood plume extent with groundwater rights restrictions. The plume map generated as part of this FYR was compared to the water rights map presented in the land use controls report (**Hill AFB CEVR, 2007**) to ensure that all areas of the plume were within the current water rights restricted areas. It was determined that a small portion of the recently identified deep plume borders at the edge of the area protected by water use restrictions. If it is determined that this plume extends into Clinton, an area with no water rights restrictions, additional water rights should be implemented as necessary. Additional investigation efforts to delineate the toe of this deep plume are ongoing. |

Table OU 10-5
# Operable Unit 10
# Five-Year Review Technical Assessment

Reviewer: Kelly Taylor

| | |
|---|---|
| **Introduction** | The five-year review must determine whether the remedy at a site is protective of human health and the environment. The EPA guidance describes three questions used to provide a framework for organizing and evaluating data and information and to ensure all relevant issues are considered when determining the protectiveness of a remedy (**EPA, 2001**). However, a remedy has not yet been implemented for OU 10. |
| **Question A.** | **Is the remedy functioning as intended by the decision documents?**<br><br>A remedy has not been implemented to-date at OU 10. |
| **Question B.** | **Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?**<br><br>A ROD has not been signed for OU 10, and a remedy is not yet in place. |
| **Question C.** | **Has any other information come to light that could call into question the protectiveness of the remedy?**<br><br>A remedy is not yet in place at OU 10. |
| **Institutional Controls** | Institutional controls (ICs) are generally defined as non-engineered instruments such as administrative and legal tools that do not involve construction or physically changing the site, and that help minimize the potential for human exposure to contamination and/or protect the integrity of a remedy by limiting land and/or resource use (**EPA, 2005**). ICs can be used for many reasons including restriction of site use, modifying behavior, and providing information to people (**EPA, 2000**). ICs may include deed notices, easements, covenants, restrictions, or other conditions on deeds, and/or groundwater and/or land use restriction documents (**EPA, 2001**). The following paragraphs describe ICs implemented at OU 10, the potential affect of future land use plans on ICs, and any plans for changes to site contamination status.<br><br>Types of ICs in Place at the Site:<br><br>A remedy has not been selected; however, current groundwater use restrictions are in place that ensure protectiveness as presented in the land use controls annual assessment report (**Hill AFB CEVR, 2007**). It should be noted that at the end of this five-year review period a small portion of the deep plume bordered an area without water use restrictions. However, in light of the known extent of this deep plume, additional water rights restrictions were applied in January 2008 to ensure protectiveness.<br><br>While the ICs have not officially been implemented based on a ROD, this OU is evaluated as part of the Annual LUC Assessment, as discussed in **Section 2** (**Hill AFB CEVR, 2007**). This includes verification of orders, leases, groundwater use restrictions, and inspections of signage, fences, and monitoring wells. Based on the most recent LUC review, no recommendations were made for OU 10.<br><br>Effects of Future Land Use Plans on ICs:<br><br>Not applicable; however, there are plans for redevelopment on the west side of the Base. This is currently in the planning phase. It is anticipated that a private developer will be allowed to use portions of the western area of the Base for commercial and/or light industrial redevelopment. |

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| | Plans for Changes to Site Contamination Status:<br><br>None. |
| **Summary of the Technical Assessment** | A remedy has not been selected for OU 10; however, current groundwater use restrictions are in place that ensure protectiveness as presented in the Annual LUC Assessment report (**Hill AFB CEVR, 2007**). It should be noted that at the end of the five-year review period, a small portion of the deep plume bordered an area without water use restrictions. In January 2008, additional water rights were applied to account for the known extent of this deep plume. |

Table OU 10-6
## Operable Unit 10
## Technical Assessment Summary for OU 10

Reviewer: Kelly Taylor

| Site ID | Remedy Description | Technical Assessment | | | Protectiveness | Next Five-Year Review |
|---|---|---|---|---|---|---|
| | | Question A* | Question B* | Question C* | | |
| SS109 | Remedy not yet selected. | NA | NA | NA | Not applicable, pending remedy selection. | 2013 |

*Question A: Is the remedy functioning as intended by the decision documents?
*Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objective (RAOs) used at the time of the remedy still valid?
*Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
NA = Not Applicable

Table OU 10-7

# Operable Unit 10
# Five-Year Review Issues, Recommendations and Follow-Up Actions, and Protectiveness Statement

Reviewer: Kelly Taylor

| | |
|---|---|
| **Issues** | Remedial Investigation activities are ongoing at OU 10, and a ROD has yet to be signed. Consequently, a remedy at OU 10 is not in place. While a ROD has not been signed, OU 10 was reviewed as part of this five-year review. One issue was identified in the 2008 five-year review for OU 10.<br><br>1) Because RI activities are ongoing, the RI/FS needs to be completed so that a remedy can be selected and a ROD signed. |
| **Recommendations and Follow-Up Actions** | To address this issue, the following recommendation has been defined:<br><br>1) Because RI activities are ongoing, the RI/FS should be completed and a ROD should be signed. The remedy should then be reviewed for protectiveness during the next five-year review. |
| **Remedial Timeframe** | Not applicable. A remedial timeframe has not been determined because a remedy has not yet been selected. |
| **Protectiveness Statement** | **Not applicable, pending remedy selection.** SS109, the 1200 Area, is still under remedial investigation and no remedy has been selected. The IAP addresses potential exposures to soil vapor in this area and groundwater use restrictions are in place per the map provided in the land use controls report (**Hill AFB CEVR, 2007**). Because the deep groundwater plume is bordering at the edge of the Clinton boundary which did not previously have water rights restrictions in place (per the LUC map mentioned above), water rights restrictions were applied to this area in January 2008. ICs and land-use controls are assessed annually. |
| **Next Five-Year Review** | Remedial actions at OU 10 will be reviewed in the next five-year review for Hill AFB to be completed during or before September 2013. |

DFW\\CHUCKWAGON\GIS\NWOFILES\HillAFB\MXD\OU10_SITE_FEATURES.MXD SWACHAL 04/04/08

THE ESTIMATED EXTENT OF CONTAMINATION SHOWN ON THIS FIGURE WAS DEVELOPED USING THE MAXIMUM CONCENTRATIONS MEASURED IN MONITORING WELLS THROUGH 2007. NO DATA FROM CPT LOCATIONS WERE USED

CLINTON

SUNSET

CLEARFIELD

BUILDING 1244 OWS

IRP SITE SS109:
1200 Area

HILL AFB
WEST GATE

DAVIS-WEBER CANAL

HILL AIR FORCE BASE BOUNDARY

0 700 1,400

Feet

1 inch equals 700 feet

**LEGEND**

ONLY KNOWN SOURCE AREA

ESTIMATED EXTENT OF PCE CONTAMINATION

10-100 µg/l

ESTIMATED EXTENT OF TCE CONTAMINATION

5-10 µg/l

10-100 µg/l

100 - 1,000 µg/l

ESTIMATED EXTENT OF DEEP TCE CONTAMINATION

5-10 µg/l

10-100 µg/l

100 - 1,000 µg/l

ROY

RIVERDALE

WASHINGTON TERRACE

CLINTON

SUNSET

SOUTH WEBER

HILL AIR FORCE BASE

MAP EXTENT

CLEARFIELD

LAYTON

SYRACUSE

75th AIR BASE WING

FIGURE OU 10 - 1
**SITE FEATURES OF OPERABLE UNIT 10**
2008 FIVE-YEAR REVIEW
IRP SITE: SS109
HILL AIR FORCE BASE, UTAH

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Table OU 11-1
# Operable Unit 11
# Background Information

Reviewer: Victor Martinez

<table>
<tr><td>Introduction</td><td>Operable Unit 11 is located within the southern, industrial area of Hill AFB. OU 11 is composed of one active IRP Site to address groundwater contamination associated with the UST at former Building 454 (UST Site 454) (see Figure OU 11-1). The RI identified UST Site 454 as the primary source of groundwater contamination at OU 11. The main contaminants detected in the groundwater at OU 11 include benzene, toluene, ethylbenzene, xylenes, and naphthalene (BTEXN), methyl tert-butyl ether (MTBE), and TCE. A LNAPL plume is present at the site and is currently being remediated using SVE and passive free-product skimmers as part of the Hill AFB UST program. (CH2M HILL, 2005). Currently, measurable NAPL is only present in one (U11-009) of the four monitoring wells being monitored at OU 11 in the source area (CH2M HILL, 2007a). Groundwater contaminant plumes at OU 11 do not extend off-Base as depicted on Figure OU 9-1.<br><br>A list of the documents reviewed for OU 11 as part of the 2008 five-year review is provided in Appendix C.
<table>
<tr><th>IRP Identification</th><th>IRP Site Name</th><th>Status</th></tr>
<tr><td>OT097</td><td>Building 454 (UST Site 454)</td><td>RI/FS phase</td></tr>
</table>
</td></tr>
<tr><td>Site Chronology</td><td>Provided separately. See Table OU 11-2.</td></tr>
<tr><td>Background</td><td>Physical Characteristics. The sediments underlying OU 11 can be generalized into two stratigraphic zones, the shallow and deep zones. These zones consist of unconsolidated deposits of gravel, sand, silty sand, sandy silts, and clay. The shallow zone, considered to be the upper 80 feet of sediments, is comprised of sparse sandy gravels, sand, and silty sand with thinly interbedded, laterally discontinuous layers of clay and silty clay. The shallow zone transitions into a low-permeability clay zone (deep zone) that consists of clay and silty clay with interbedded, laterally discontinuous units of silty sand and sandy silt. The aquifers underlying Hill AFB consist of a shallow water-bearing zone located near the interface of the Provo and Alpine Formations, and two drinking water aquifers, the Sunset and the Delta aquifers. The Sunset and the Delta aquifers are the most widely used drinking water aquifers in the area. They are located in the western portions of Hill AFB at depths of about 250 to 400 ft and 450 to 750 ft bgs, respectively (CH2M HILL, 2005).</td></tr>
<tr><td></td><td>Land and Resource Use. Various types of military support operations are performed within the OU 11 area. Buildings and businesses within the immediate vicinity of the OU 11 site include: the Autopride Service Station, a restaurant, the Base Exchange, the Commissary, and a bank (CH2M HILL, 2005). No residential areas share a common property boundary with the site (URS, 2003). The nearest surface water in the OU 11 area is Pond 3 located approximately 2,000 feet southwest of the site. Pond 3 has been investigated as part of OU 9.The nearest drinking water well to OU 11 is the Base Supply Well #5, located approximately 2,200 feet west of the Autopride Service Station. This well was installed in 2001 and is screened in the Delta Aquifer from 970 to 1,030, 1,145 to 1,245, and 1,315 to 1,435 feet bgs. No other drinking water wells are located within a half-mile radius of OU 11. The Clearfield Well #2 is located about 4,000 feet southwest of the site near the Base boundary and is screened in the Delta Aquifer from 675 to 875 feet bgs (CH2M HILL, 2005). No land use changes were observed on-Base during the 2008 five-year review Site Inspection (CH2M HILL 2007c).</td></tr>
</table>

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| | **History of Contamination.** Building 454 is the former site of a Base gas station that was renovated into an auto repair facility in the early 1980s. Between 1957 and 1980, the site contained two 10,000-gallon gasoline USTs and one 500-gallon waste oil UST. The original pump island was located south of the building. The building also contained four maintenance bays and an OWS. As part of the renovation in 1980, a third 10,000-gallon gasoline UST and three new pump islands were added to the facility. In August 1995, the four USTs and associated piping were removed, and three new gasoline USTs were installed in a new location north of Building 454. Building 454 and the north pump island were demolished in the winter of 1999, and a new Hill AFB Autopride Service Station (Building 420) was constructed. New pump islands were placed south of Building 420. Source area investigations for OU 11 were performed during the mid 1990s as part of the South Area Site Inspection for OU 9 and the UST Program. The source of the fuel-related groundwater contamination at OU 11 was the leaking USTs that were removed and replaced in 1995. The OWS located at the former Building 454 is a likely source for the chlorinated solvent contamination at the site. Other than the activities associated with the USTs and former Building 454, no other sources of groundwater contamination have been identified at the site. In May 1999, free product (LNAPL) was discovered in the groundwater during the installation of a monitoring well. The monitoring well (U9-454-001) is located downgradient from the former Building 454 (**CH2M HILL, 2005**). |
| | **Initial Response.** In 1993, Hill AFB initiated a series of subsurface investigations at several UST locations that included Building 454. Collection of closure soil samples at Building 454 took place in the fall of 1995 after the removal of the original USTs. Soil sample results indicated a single detection of benzene and multiple detections of toluene, ethylbenzene, and xylene (BTEX). Several of the samples collected had significant detections of TPH in the form of both diesel and gasoline. An SVE system was installed in December 1995 to remediate the area where the closure soil samples had been collected. The SVE well remained in operation until spring 1998, when collection of soil samples indicated that all contaminants were below the UST closure criteria.<br><br>In 1995, an investigation at Building 454 was conducted as part of a separate CERCLA investigation associated with the OU 9 South Area Site Inspection. Results from the OU 9 SI indicated contamination in the soil and in the perched groundwater. In 1996, three monitoring wells (U9-005, U9-007, and U9-011) were installed downgradient of soil contamination areas. TCE was detected at monitor well U9-005. The detection of chlorinated compounds in groundwater triggered further investigation under the OU 9 RI. Five piezometers were installed in 1999 around Building 454 to monitor groundwater levels. One monitoring well, U9-454-001, was installed downgradient of the former building in May of 1999. LNAPL was observed in this monitoring point. A decision was made that free-product and soil (vadose zone) contamination would be addressed under the leaking underground storage tank (LUST) section of UDEQ, Division of Environmental Response and Remediation (DERR), while the groundwater contamination would be addressed under CERCLA. A Corrective Action Plan (CAP) was submitted and approved by the UDEQ in August 2002 for Site 454. The CAP was approved and an SVE system was installed in September 2002 for free product remediation at Site 454. Passive free product skimmers are also used at Site 454 as a method to enhance free product recovery. Groundwater contamination at OU 11 has been investigated under CERCLA since the spring of 2001. Groundwater monitoring wells have been installed to characterize and delineate the extent of groundwater contamination at the site (**CH2M HILL, 2005**).<br><br>A review of benzene, TCE and MTBE concentrations from monitoring wells within and along their respective plume boundaries was conducted as part of the RI, completed in 2005, to assess plume stability. The RI indicated results of the review suggested that the benzene plume is receding. The decline in benzene concentration was concluded to result from both natural processes and the SVE remediation ongoing under the Site 454 UST Program. The RI indicated review of TCE data showed either decreasing or stable concentrations of TCE with some slight fluctuations over time, although the data review was performed on a limited number of |

| | |
|---|---|
| | groundwater samples from downgradient monitoring wells. The review of MTBE data suggested that the plume may be expanding. Overall, monitoring wells within the core of the MTBE plume showed decreasing concentrations of MTBE over time. The decrease in concentrations was concluded to likely be the result of plume expansion rather than a decline in concentration due to natural attenuation (**CH2M HILL, 2005**). Currently, groundwater monitoring and data collection is underway and additional wells are being installed to fill data gaps.<br><br>Institutional Controls are in place for OU 11 to provide groundwater use restrictions. The restrictions on water well drilling and use of shallow groundwater is enforced by the Utah Division of Water Rights. Hill AFB performs an annual evaluation of the ICs in place for the Base. This includes verification of orders, leases, groundwater use restrictions, and inspections of signage, fences, and monitor wells. An annual LUC assessment report is prepared documenting the results of this work. The LUC assessment is conducted to ensure LUCs are performing their intended function as described in the ROD or other decision document for each OU. |
| | **Basis for Taking Action.** A final ROD has not yet been signed for OU 11. Interim actions were implemented under the UDEQ UST program to remediate soils and address LNAPL. ICs, in the form of groundwater and land use restrictions, are in place to prevent exposure to contaminated soil and groundwater until a final remedy for OU 11 is selected (**CH2M HILL, 2005**). Additional groundwater monitoring and data collection is underway and additional wells are being installed to fill data gaps. |
| **Remedial Actions** | **Remedy Selection (ie. ROD/ESDs)**. Currently a Record of Decision has not been signed and no remedial actions are established for OU 11. A draft of the FS is scheduled for February 2008. Groundwater monitoring and well installation to fill data gaps are the only actions taken since the 2003 five-year review. Both actions are anticipated to provide the data needed for selection of the final remedy (**CH2M HILL, 2007b**). |
| | **Remedy Implementation.** No remedial actions are currently established at OU 11. Groundwater use restrictions on-Base are in place at OU 11 (**CH2M HILL, 2007c**). |
| | **Operations and Maintenance.** Currently, Operation and Maintenance activities at OU 11 are conducted on the SVE system as part of the Hill AFB UST program. |
| **Progress Since Last FYR** | Recommendations and follow up actions defined for OU 11 in the 2003 five-year review are presented in **Table OU 11-3** along with the current status of each recommendation.<br><br>Current Status: OU 11 is currently in the RI/FS phase of the CERCLA process. The RI Report for OU 11 was finalized and presented to the public in April 2005. The FS is currently being developed and a draft of the FS is expected to be completed in January 2009. The ROD for OU 11 is expected to be completed by 2010. Currently, groundwater monitoring and data collection is underway and additional wells are being installed to fill data gaps. On-Base groundwater use and land restrictions are the only ICs for OU 11. |

Table OU 11-2

## Chronology of Site Events OU 11

*2008 Five -Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| | | | 1987 | Hill AFB placed on the National Priorities List (NPL) | The U.S. EPA placed HAFB on the NPL under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). | Final Record of Decision for Operable Unit 5, Hill Air Force Base, Utah. |
| 11 | OU11 | 9 | 2000 | Transfer to Another Operable Unit | Zone 7 - Golf Course Area (Site SS090) and Former Building 454 (IRP site OT097) were redefined as OU 11 instead of OU 9. The re-designation was a result of efforts to optimize investigation procedures and more clearly define operable units with similar completion time frames. | Final Analytical Data Report (ADR) For Operable Unit 9 Investigation Areas 1 May Through 10 October 2000 |
| 11 | OU11 | | 2002 | Transfer to Another Operable Unit | At one point, the golf course, 800&900 warehouse buildings, and Building 454 were all a part of OU 11. After further delineation of the contamination, the golf course and the 800&900 warehouse buildings were placed back into OU 9 because they had low levels of TCE contamination and will likely have similar remedies. The contaminants, contaminant levels, and potential remedies for Building 454 are different and more complex than the other two sites, so it remained in OU 11. A letter was sent to the regulators on 30 September 2002 proposing this realignment between OUs 11 and 9. Verbal concurrence was received from the regulators in a subsequent meeting. | Personal Communication with Sheri Rolfsness, OU 11 Project Engineer (EMR), on 12/31/02 |
| 11 | OU11 | 9 | 2003 | Five Year Review | The second Five-Year Review Hill AFB stated that the protectiveness at OU 11 cannot be determined or evaluated until the remedial investigation is complete and a remedy, if required, is selected and implemented | Final CERCLA Five-Year Review Report, Second Five-Year Review Report for Hill Air Force Base, Utah. |
| 11 | OU11 | 4 | 2005 | Remedial Investigation | Remedial Investigation Report for OU 11 published. The RI identified UST Site 454 as the primary source of groundwater contamination at OU 11. | Remedial Investigation Report for Operable Unit 11, Hill Air Force Base, Utah. |
| 11 | OT097 | | 1957 | Historical Operations | Building 454 was located in the South Area of Hill AFB, UT and served as the Base Exchange Service Station, Auto Care, and Auto Parts facility between 1957 and 1999. | Final Draft Abatement and Initial Site Characterization Report Building 454, Site EIHG |
| 11 | OT097 | | 1963 | Historical Operations | The station (Building 454) was upgraded around 1963 to add two maintenance bays on the west end of the building and to construct an additional pump island on the east end of the building. | Building 454 Investigation Tech Memo Operable Unit 9 Final |
| 11 | OT097 | | 1980 | Historical Operations | The site was renovated in 1980 by relocating all three pump islands to the north of the building. At this time, the station had three fuel storage tanks just north of the east end of the building. The tanks consisted of an 8,000-gallon "regular" gasoline UST, a 6,000-gallon "premium" gasoline UST, an 8,000-gallon "no-lead" gasoline UST, and a 500-gallon waste oil UST. | Building 454 Investigation Tech Memo Operable Unit 9 Final |
| 11 | OT097 | 8 | 1993 | Historical Operations | A possible release was detected on August 23 and 24, 1993, during environmental soil sampling near the operating tanks. Hydrocarbon odors were noted and | Final Draft Abatement and Initial Site Characterization Report Building 454, Site EIHG |
| 11 | OT097 | | 1993 | Remedial Investigation | In 1993, Hill AFB initiated a preliminary subsurface investigation at several of the UST locations to evaluate the potential for petroleum contamination in soils as a result of leaks, spills, and overfills (Dames and Moore, 1994). | Final Draft Abatement and Initial Site Characterization Report Building 454, Site EIHG |
| 11 | OT097 | 8 | 1995 | Interim Action | In August 1995, the original USTs and associated piping were removed and (1) 12,000-gallon and (2) 10,000-gallon fuel tanks were installed, replacing the previous tanks. | Building 454 Investigation Tech Memo Operable Unit 9 Final |
| 11 | OT097 | 12 | 1995 | Interim Action | The USTs were removed in 1995 and five soil vapor probes and one horizontal soil vapor extraction well were installed in the tank basin under the UST program (DM, 1996). The horizontal SVE well was installed to a depth of 10.5 feet bgs and was located 43 feet north from (perpendicular to) the north side of the building. The SVE system was in operation from December 1995 until February 1998. The LUST site (EIHG) was closed with no further action required. | Draft Subsurface Investigation Report and Corrective Action Plan for Building 454, LUST Site EIHG |
| 11 | OT097 | | 1995 | Remedial Investigation | Another potential 25,000 gallon UST was identified in the South Area Preliminary Assessment Report. However, no evidence of this site was found during the South Area OU 9 Site Inspection site visit, no further action was recommended. | Work Plan for South Area of Operable Unit 9 Site Inspection Volume 1: Report and Appendices A-D |
| 11 | OT097 | 2 | 1999 | Historical Operations | During demolition of Building 454 in February 1999, a tractor-trailer loaded with regular gasoline pulled into the site parking lot and brushed a tree, pulling off a valve cover that resulted in a release of unleaded fuel. In a spill report filed shortly thereafter, it was estimated that 5 gallons were released into the storm drain. Remaining surface fuel was picked up and overpacked. | Comprehensive Event Report |

Table OU 11-2
## Chronology of Site Events OU 11
*2008 Five -Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 11 | OT097 | | 1999 | Historical Operations | Building 454 and the north pump island were demolished in 1999, and the new Base "Auto Pride" gasoline station (Building 420) was constructed with new pump islands south of the new building. | Building 454 Investigation Tech Memo Operable Unit 9 Final |
| 11 | OT097 | 8 | 2000 | Historical Operations | In August, 2000, a fourth 10,000-gallon tank was installed due to fuel demand at the Auto Pride gas station. | Building 454 Investigation Tech Memo Operable Unit 9 Final |

**Notes**

| | |
|---|---|
| AFB | Air Force Base |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| EPA | United States Environmental Protection Agency |
| IRP | Installation Restoration Program |
| NPL | National Priority List |
| OU 11 | Operable Unit 11 |
| PRGs | Preliminary Remediation Goals |
| RI | Remedial Investigation |
| ROD | Record of Decision |
| SVE | Soil Vapor Extraction |
| TCE | Trichloroethylene |
| USTs | Underground Storage Tanks |

Table OU 11-3

## Progress Since Last Five Year Review - Status of Recommendations and Follow-Up Actions at OU 11

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Site | 2003 Recommendations/Follow-Up Actions | Current Status | Carry over to next FYR |
|---|---|---|---|
| OU 11 | Perform a comprehensive groundwater characterization for contaminants of concern in the groundwater. Compile characterization information in the RI report and generate FS. | **Complete, in terms of the RI.** The RI Report for OU 11 was finalized and presented to the public in April 2005 (**CH2M HILL, 2005**). The CEVR Site Manager indicated in the 2008 FYR interview that the FS is currently being developed; this is addressed in the next recommendation in terms of remedy selection. | No |
| OU 11 | Select and implement a remedy, if required, in accordance with CERCLA criteria. | **In Progress**. Preparation of the FS is in progress, and additional work to address data gaps is ongoing. A ROD will be prepared once remedial alternatives have been evaluated. | Yes |

**Notes:**

CERCLA Comprehensive Environmental Response, Compensation, and Liabilities Act
FS Feasibility Study
OU 11 Operable Unit 11
RI Remedial Investigation

Table OU 11-4
# Operable Unit 11
# Five-Year Review Process

Reviewer: Victor Martinez

| | |
|---|---|
| **Introduction** | This 2008 five-year review for Hill AFB has been conducted in accordance with the EPA's Comprehensive Five-Year Review Guidance dated June 2001 (**EPA, 2001**). Administrative and community involvement components of the five-year review are described in **Section 2.0** of this report. In addition, interviews were conducted with relevant parties. A site inspection of OU 11 was performed. Documents reviewed for OU 11 as part of the 2008 five-year review are provided in **Appendix C**. Relevant site documents and applicable data covering the period of the five-year review were evaluated. The site interviews, site inspection, and data review are further discussed in the following sections. |
| **Interviews** | An interview for OU 11 was conducted with Shannon Smith/CEVR Site Manager. Ms Smith provided responses via electronic mail on September 25, 2007. A copy of the Interview Record Form is provided in **Appendix D**.<br><br>Ms. Smith indicated that the only actions taken since the 2003 five-year review were groundwater monitoring and well installation to fill data gaps. She mentioned that more data collection and installation of additional wells provides data needed for the final remedy. She mentioned the current sampling procedures for OU 11 can be found in the RI/FS work plan (July 2006) and addendums. She added that sampling efforts have not been optimized at this stage since they are still trying to collect enough data to evaluate trends.<br><br>With regards to the status of the groundwater plumes investigation, Ms. Smith indicated that wells are being currently installed and more data is being collected. She pointed out that the FS is scheduled for completion in February 2008. Ms. Smith mentioned that RI findings showed the MTBE plume bigger and deeper than anticipated.<br><br>Ms. Smith said there has not been unexpected difficulties or cost associated with OU 11 since the 2003 five-year review. She was not aware of any ongoing community concerns regarding the activities at the site. |
| **Site Inspection** | The site inspection for OU 11 was conducted on September 25, 2007. The completed site inspection checklist is provided in **Appendix E**.<br><br>Based on the site inspection, OU 11 appears to be well maintained. No evidence of vandalism was found onsite.<br><br>Institutional Controls are currently in place at OU 11. The ICs currently associated with OU 11 are groundwater use restrictions, and unauthorized development or construction restrictions. HAFB performs an annual evaluation of the ICs in place for the Base. This includes verification of orders, leases, ground water use restrictions, and inspections of signage, fences, and monitoring wells. An annual land-use controls report is prepared documenting the results of this work. Reporting is up-to-date and no violations have been reported. Results of the annual evaluation of the ICs are presented in the Technical Assessment section, **Table OU-11-5.**<br><br>No ROD has been signed for OU 11 to date.<br><br>The site inspection checklist addressed four discussion topics. These discussion topics are presented below, followed by responses and general observations based on the site inspection. |

| | |
|---|---|
| | (1) Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).<br>A ROD has not been signed for OU 11, and a remedy has not yet been selected.<br>(2) Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.<br>OU 11 is currently in the RI/FS stage. A ROD has not yet been signed. However, monitoring wells are present at OU 11. Due to the large number of monitoring wells present, not all wells were inspected. The wells that were inspected appeared to be in good condition and to be appropriately maintained.<br>(3) Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.<br>A remedy is not yet in place at OU 11.<br>(4) Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.<br>A remedy is not yet in place at OU 11. |
| **Data Review** | Operable Unit 11 is currently in the RI/FS phase of the CERCLA process. The RI Report for OU 11 was finalized and presented to the public in April 2005. The FS is currently being developed and a draft of the FS is expected to be completed in February 2008.<br>Groundwater contamination at OU 11 originated from sources associated with activities at the former Building 454 Gas Station. Activities included the use of USTs for vehicle refueling and an OWS used as part of the vehicle maintenance bay. Investigations were performed as part of the OU 11 RI/FS to characterize the extent of groundwater contamination (**CH2M HILL, 2005**). An LNAPL plume is present in the vicinity of the source area and is approximately 50 feet in diameter. The OU11 RI reported that the MTBE plume has migrated approximately 800 feet southwest of the source area, where it has been detected in multiple sand units at depths ranging from 30 to 90 feet bgs. Also, the benzene plume was reported to have migrated approximately 300 feet to the southwest from the source area. According to the RI, the plume had not migrated vertically beyond the sands of the shallow zone and into the upper units of the clay zone (**CH2M HILL, 2005**). The OU 11 RI suggested that the MTBE plume may be expanding, and recent sampling data indicate that the MTBE plume may be as long as 1,000 feet (**SES, 2005**). A document for the Evaluation of the Environmental Fate and Transport, Biodegradation Potential, and Treatment Technologies for MTBE-Contaminated Sites was performed by Select Engineering Services. The document was prepared to review the current state of site characterization techniques and remediation technologies for MTBE-contaminated sites, and provide a future reference to aid in evaluation of appropriate remediation technology(s) for OU 11 (**SES, 2005**). The document concluded that extensive site characterization may be necessary in order to determine the appropriate remediation technology at MTBE-contaminated sites in general, and OU 11 in specific (**SES, 2005**). A more recent report (**CH2M HILL, 2007d**), summarizing analytical data obtained from LNAPL sampling conducted at OU 11, indicates the MTBE plume now extends approximately 1,200 feet southwest from the source area, confirming that the plume is expanding on-Base. |

Table OU 11-5
# Operable Unit 11
# Five-Year Review Technical Assessment

Reviewer: Victor Martinez

| | |
|---|---|
| **Introduction** | The five-year review must determine whether the remedy at a site is protective of human health and the environment. The EPA guidance describes three questions used to provide a framework for organizing and evaluating data and information and to ensure all relevant issues are considered when determining the protectiveness of a remedy (**EPA, 2001**). These questions are assessed for OU 11 in the following sections. The implementation of ICs is also described. At the end of this table is a summary of the technical assessment. |
| **Question A.** | **Is the remedy functioning as intended by the decision documents?**<br><br>A remedy has not yet been selected for OU 11. |
| **Question B.** | **Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?**<br><br>A remedy has not yet been selected for OU 11. |
| **Question C.** | **Has any other information come to light that could call into question the protectiveness of the remedy?**<br><br>A remedy has not yet been selected for OU 11. |
| **Institutional Controls** | Institutional controls are generally defined as non-engineered instruments such as administrative and legal tools that do not involve construction or physically changing the site, and that help minimize the potential for human exposure to contamination and/or protect the integrity of a remedy by limiting land and/or resource use (**EPA, 2005**). Institutional controls can be used for many reasons including restriction of site use, modifying behavior, and providing information to people (**EPA, 2000**). Institutional controls may include deed notices, easements, covenants, restrictions, or other conditions on deeds, and/or groundwater and/or land use restriction documents (**EPA, 2001**). The following paragraphs describe ICs implemented at OU 11, the potential affect of future land use plans on ICs, and any plans for changes to site contamination status.<br><br><u>Types of ICs in Place at the Site:</u><br><br>Although a remedy is not yet in place at OU 11, ICs have been implemented. The ICs currently associated with OU 11 are groundwater use restrictions, and unauthorized development or construction restrictions. Reporting is up-to-date and no violations have been reported. Currently the plume does not extend beyond the groundwater use restriction area. Hill AFB performs an annual evaluation of the ICs in place for the Base. This includes verification of orders, leases, groundwater use restrictions, and inspections of signage, fences, and monitor wells. An annual land-use controls report is prepared documenting the results of this work. Detailed information from the annual LUC Assessment report is presented in **Section 2.7**. Based on review of the most recent LUC Assessment report, LUCs at OU 11 were considered appropriate and no recommendations were made (**Hill AFB CEVR, 2007**). |

| | |
|---|---|
| | Effects of Future Land Use Plans on ICs:<br><br>No effects on ICs due to future land use were identified during this FYR.<br><br>Plans for Changes to Site Contamination Status:<br><br>No changes to site contaminant status at OU 11 are anticipated in the near future. |
| **Summary of the Technical Assessment** | Operable Unit 11 is currently in the RI/FS phase of the CERCLA process. Although a remedy has not yet been selected or implemented for OU 11, ICs have been implemented to provide protectiveness to human health and the environment.<br><br>The 2005 OU 11 RI reported that the MTBE plume has migrated approximately 800 feet southwest of the source area, where it has been detected in multiple sand units at depths ranging from 30 to 90 feet bgs. According to the RI, the benzene plume had migrated approximately 300 feet to the southwest from the source area. The plume had not migrated vertically beyond the sands of the shallow zone and into the upper units of the clay zone (**CH2M HILL, 2005**). The OU 11 RI suggested that the MTBE plume may be expanding, and sampling data collected after the RI report indicate that the MTBE plume may be as long as 1,000 feet (**SES, 2005**). A more recent report (**CH2M HILL, 2007d**), summarizing analytical data obtained from LNAPL sampling conducted at OU 11, indicates the MTBE plume now extends approximately 1,200 feet southwest from the source area, confirming that the plume is expanding on-Base. Data collection to address data gaps is ongoing. |

Table OU 11-6
## Operable Unit 11
## Technical Assessment Summary for OU 11

Reviewer: Victor Martinez

| Site ID | Remedy Description | Technical Assessment | | | Protectiveness | Next Five-Year Review |
|---|---|---|---|---|---|---|
| | | Question A* | Question B* | Question C* | | |
| OT097 | Remedy not yet selected. | NA | NA | NA | Not applicable, pending remedy selection. | 2013 |
| OU 11 | Remedy not yet selected. | NA | NA | NA | Not applicable, pending remedy selection. | 2013 |

*Question A: Is the remedy functioning as intended by the decision documents?
*Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objective (RAO) used at the time of the remedy still valid?
*Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
NA = Not Applicable

Table OU 11-7

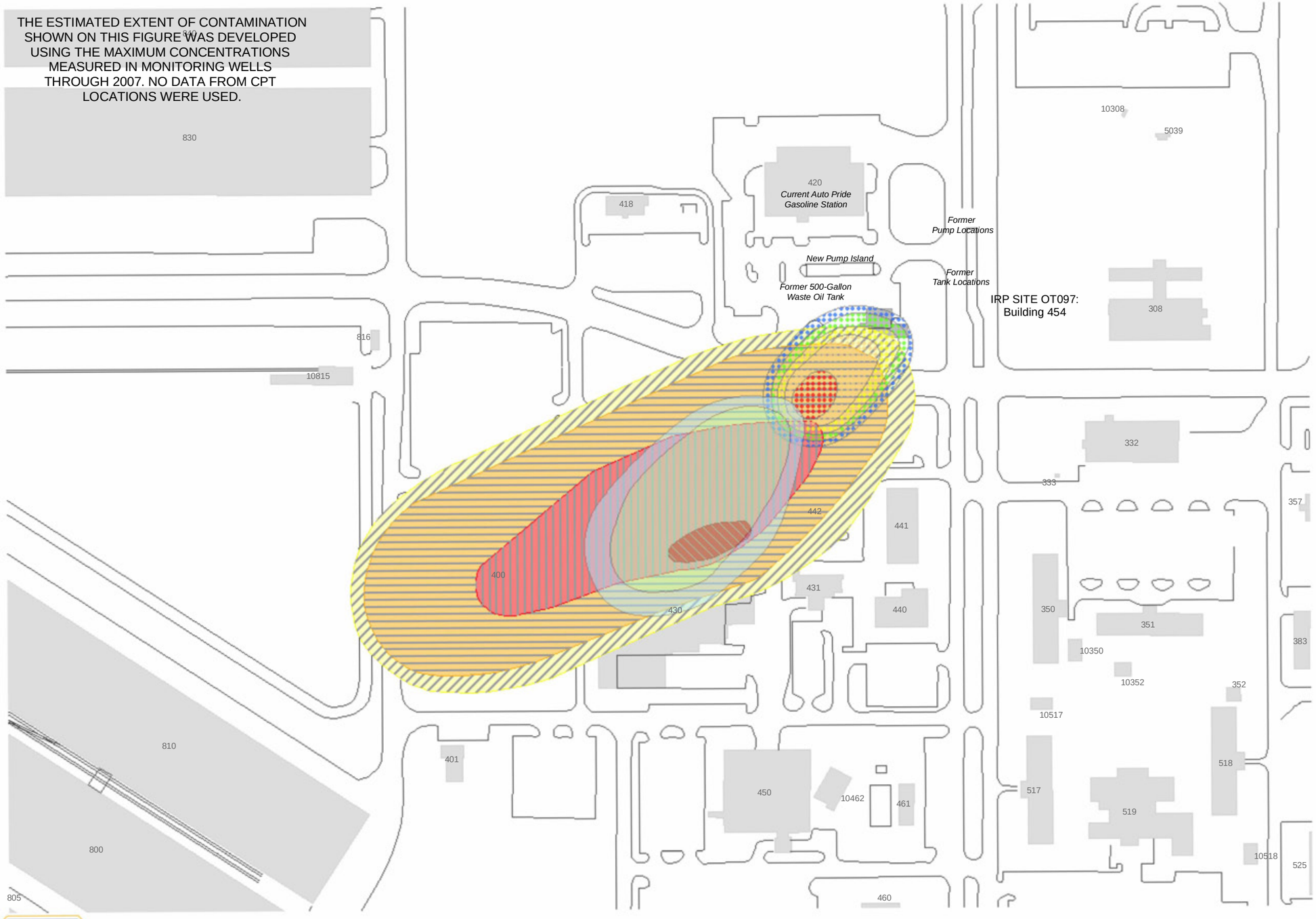
# Operable Unit 11
# Five-Year Review Issues, Recommendations and Follow-Up Actions, and Protectiveness Statement

Reviewer: Victor Martinez

| | |
|---|---|
| **Issues** | Based on document review, data review, site inspection, interviews, and the technical assessment, two issues are identified in the 2008 five-year review for OU 11 as described below:<br><br>1) The FS is currently being developed. According to the 2008 five-year review interview record, a draft is expected in 2008. Additional data collection to address data gaps is ongoing.<br><br>2) The RI reported that the MTBE plume has migrated approximately 800 feet southwest from the source area, and is likely expanding. It has been detected in multiple sand units at depths ranging from 30 to 90 feet bgs. A more recent report (**CH2M HILL, 2007d**), summarizing analytical data obtained from LNAPL sampling conducted at OU 11, indicates the MTBE plume now extends approximately 1,200 feet southwest from the source area, confirming that the plume is expanding on-Base. Additional data collection to address data gaps is ongoing. |
| **Recommendations and Follow-Up Actions** | As described in the previous section, two issues were identified in the 2008 FYR for OU 11. To address these issues, the following recommendations and follow-up actions have been defined.<br><br>1) Complete ongoing data collection and based on the findings, finalize the FS Report. Select and implement a remedy based on the findings.<br><br>2) Verify that the extent of the MTBE plume has been fully delineated and incorporate results in the FS Report. Additional analyses should be conducted to evaluate MTBE plume stability and the plume center of mass over time. |
| **Remedial Timeframe** | Not applicable. A remedial timeframe has not been determined because a remedy has not yet been selected for OU 11. |
| **Protectiveness Statement** | **Not applicable, pending remedy selection.** It should be noted that ICs have already been implemented at OU 11. Enforcement of ICs at OU 11 provides protectiveness in the short-term pending remedy selection. ICs and land-use controls are assessed annually. |
| **Next Five-Year Review** | Remedial actions at OU 11 will be reviewed in the next FYR for Hill AFB to be completed during or before September 2013. |

DFW\\CHUCKWAGON\GIS\NWOFILES\HILLAFB\MXD\OU11_SITE_FEATURES.MXD NBHATTAC 04/09/08

THE ESTIMATED EXTENT OF CONTAMINATION SHOWN ON THIS FIGURE WAS DEVELOPED USING THE MAXIMUM CONCENTRATIONS MEASURED IN MONITORING WELLS THROUGH 2007. NO DATA FROM CPT LOCATIONS WERE USED.




0 200 400

Feet

1 inch equals 200 feet

LEGEND

ESTIMATED EXTENT OF BTEXN CONTAMINATION

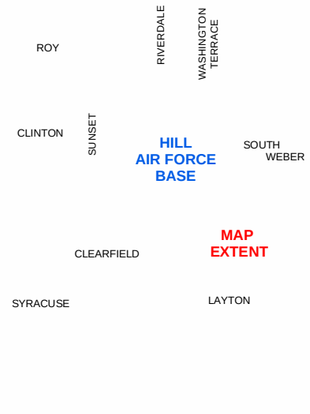
- 5-10 µg/l
- 10-100 µg/l
- 100 - 1,000 µg/l
- 1,000 -10,000 µg/l
- 10,000 - 100,000 µg/l

ESTIMATED EXTENT OF SHALLOW TCE CONTAMINATION

- 5-10 µg/l
- 10-100 µg/l

ESTIMATED EXTENT OF MTBE CONTAMINATION

- 20 -100 µg/l
- 100-1,000 µg/l
- 1,000-10,000 µg/l
- 10,000-100,000 µg/l




75th AIR BASE WING

FIGURE OU 11 - 1
**SITE FEATURES OF OPERABLE UNIT 11**
2008 FIVE-YEAR REVIEW
IRP SITE: OT097
HILL AIR FORCE BASE, UTAH

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Table OU 12-1
# Operable Unit 12
# Background Information

Reviewer: Victor Martinez

<table>
<tr><td>Introduction</td><td>Operable Unit 12 is located in the northwest region of Hill AFB. Operable Unit 12 is a groundwater and soil OU composed of one active IRP Site to address groundwater and soil contamination associated with the Aspen Avenue Disposal Area (AADA). Contaminated groundwater is present beneath the AADA on-Base and extends off-Base beneath the cities of Sunset and Roy, Utah (Figure OU 12-1). The RI identified two suspected sources of contamination: the AADA, and possibly the former on-Base Wastewater Treatment Plant (WWTP). The AADA is the primary source of contamination at OU 12 and was divided into the Northern and Southern Debris Areas due to differences in the physical characteristics and subsequent investigations performed. Groundwater contamination consists primarily of dissolved-phase VOCs, principally TCE. Soil contamination is limited to the AADA and consists of TCE-contaminated soil and asbestos. The former WWTP is believed to be a historical source of carbon tetrachloride because carbon tetrachloride has been detected in groundwater downgradient of the facility and was detected in soil gas samples collected within the facility land-use footprint. The selected remedy at OU 12 addressed the groundwater plume and on-Base soil contamination. The remedy includes the following components for groundwater: (a) continued operation of existing Base Boundary Hydraulic Containment System (HCS) and off-Base PRB; (b) extension of the Base Boundary HCS through installation of four additional extraction wells; (c) groundwater monitoring to track VOC concentrations; and (c) continued implementation of institutional controls (ICs). The selected remedy includes the following components for soil: (a) implementation, monitoring, and enforcement of ICs to prohibit land use and restrict future contact with contaminated soil; (b) fencing/signage to restrict access; c) contamination at source areas in the AADA is to be excavated and removed with disposal at appropriate facilities; and (d) visible asbestos removed from the Southern and Northern Debris Areas (where asbestos extends deeper than one foot, all material in the top one foot removed and any deeper materials left in place and covered with soil).<br>(Hill AFB CEVR, 2007c).<br><br>A list of the documents reviewed for OU 12 as part of the 2008 five-year review is provided in Appendix C.
<table>
<tr><th>IRP Identification</th><th>IRP Site Name</th><th>Status</th></tr>
<tr><td>SS107</td><td>Aspen Ave. Disposal Area Site Map</td><td>Remediation ongoing</td></tr>
</table>
</td></tr>
<tr><td>Site Chronology</td><td>Provided separately. See Table OU 12-2.</td></tr>
<tr><td>Background</td><td>Physical Characteristics. Subsurface stratigraphy in OU 12 consists of interbedded and laterally discontinuous silty sand, sandy silt, silt, and clay. The shallow unconfined aquifer and deeper confined water supply aquifers are separated by several hundred feet of clay. For the most part, the shallow unconfined aquifer consists of silty fine-grained sand interbedded with silt. A low-permeability clayey silt unit underlies the shallow unconfined aquifer, and appears to be laterally continuous across the length and width of the OU 12 groundwater plume. The low permeability unit limits vertical contaminant migration at OU 12. Contaminants have migrated both vertically and horizontally through the higher permeability sand and silty-sand units from on-Base sources to off-Base areas beneath the City of Roy. Depth to groundwater at OU 12 varies from approximately 3 feet bgs in the vicinity of 2700 West off Base in Roy to approximately 110 feet bgs on-Base beneath the Northern Debris Area of the AADA. Groundwater flow is predominantly from east to west with local flow directions toward the</td></tr>
</table>

| | |
|---|---|
| | north and northwest on-Base beneath the AADA. (**Hill AFB CEVR, 2007c)**. Hydraulic factors that may affect groundwater flow directions and contaminant migration at OU 12 include leakage from surface-water impoundments, areal recharge from precipitation, areal recharge from irrigation (including lawn watering), leakage from water and wastewater lines, discharge to wastewater lines, possible leakage from the Davis-Weber Canal, discharge to field drains, discharge to seeps and springs, and evapotranspiration (**MWH Americas, 2005a**) |
| | **Land and Resource Use.** The on-Base portion of OU 12 consists primarily of sparsely vegetated open fields, which appear to have been altered over time by activities related to gravel mining and dumping of debris. Land use in the off-Base areas of OU 12, which primarily includes the City of Roy, includes residential neighborhoods and commercial businesses. This area has undergone rapid residential and commercial development over the last 10 years, eliminating areas formerly used for agricultural purposes. Currently, land use for the on-Base portion of OU 12 is industrial. Hill AFB is expected to remain under the jurisdiction of the DoD for the foreseeable future and therefore, the future land use of the on-Base portion of OU 12 is most likely industrial. However, in 2006, the Air Force entered into an agreement to use the west side of the Base, including the OU 12 area, for an Enhanced Use Leasing Project that could include development of a business park. As a result of this agreement, future land use may be commercial. (**MWH, 2007**). No land use changes were observed on-Base or off-Base during the 2008 FYR Site inspection (**CH2M HILL 2007a**). However, there are plans to turn over property along the western portion of the Base to a private commercial developer(s) to redevelop this portion of the Base for various uses. No residential development will be allowed that would be in conflict with the privatized housing. Development will most likely consist of commercial and light industrial, but no heavy industrial. It is anticipated that most will be commercial, office space with the idea of a technology park as the center of the development and supporting restaurants and hotels but plans are still being developed (**Loucks, 2007**). |
| | **History of Contamination.** OU 12 is located in an area that has not experienced significant industrial development over time. A WWTP was located near the southern end of OU 12. The former WWTP was constructed during the period 1941 to 1942 and received wastewater for treatment until at least 1945, and possibly until 1959 when it was demolished. The AADA is located immediately north of the former Wastewater Treatment Plant. No records showing disposal activities at the AADA have been found; however, site inspections and trenching activities in the area have identified construction debris, concrete, bricks, clay pipes, drums, residential waste, and other debris. Historical aerial photos of this disposal area do not show any buildings erected in this area and only a few dirt roads crossing the area were identified. The AADA is sparsely vegetated with shrubs and grasses, and the terrain appears to have been altered over time by activities related to gravel mining and dumping of debris. Man-made mounds, depressions, and linear trenches remain on site throughout the AADA (**MWH, 2007**). |
| | **Initial Response.** Hill AFB implemented several early removal actions at OU 12 prior to completion of the RI/FS. Actions implemented at OU 12 include: installation of the Base Boundary HCS, the Off-Base PRB, indoor air mitigation systems, and drum removal from the AADA. Institutional controls to restrict the use of shallow groundwater across OU 12 were also implemented. The Action Memorandum prepared for the non-time-critical removal action in association wit the PRB was presented in October 2004. The Action Memorandum at OU 12 was intended to provide stabilization of the TCE plume until a final site remedy can be implemented. RAOs developed to meet the scope include the following: (1) to reduce the potential for further downgradient degradation of groundwater quality by preventing the uncontrolled movement of the existing plume; (2) to reduce the potential for further degradation of indoor air quality that can be attributed to the OU 12 groundwater contaminant plume; and (3) to minimize impacts to the community during remedy construction and operation (**Hill AFB, 2004**). The COCs and removal action goals are listed in **Table OU 12-5**. |

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| | Construction of the Base Boundary HCS began in October 2002 and system operations began in April 2003. The Base Boundary HCS was installed as part of a Treatability Study to capture contaminated groundwater, associated with the OU 12 source area, within the area defined by the 100 mg/L TCE contour at the Base boundary. The Base Boundary HCS prevents the higher concentration portion of the plume from migrating off-Base. The cumulative TCE mass removal for the first year of operation of this interim action was estimated to be 7.5 pounds.<br><br>The off-Base PRB was installed in November 2004. The off-Base PRB was installed as a non-time-critical removal action and is located on the Utah Transit Authority (UTA) corridor between 2700 West and 2775 West in the City of Roy as shown in **Figure OU 12-1**. Construction of the off-Base PRB was intended to reduce contaminant concentrations in groundwater to less than their MCLs at the downgradient performance monitoring points, and to be consistent with any existing and future remedial activities.<br><br>Indoor air mitigation systems were installed in twelve residences at OU 12 between August 2002 and November 2004 to reduce/eliminate the contamination in indoor air caused by vapor migration from the contaminated shallow groundwater into soil and indoor air. Owners and/or occupants of residences in OU 12 where indoor air concentrations exceed Hill AFB Mitigation Action Levels (MALs) are encouraged to have an indoor air mitigation system installed in their homes (**MWH, 2005a**). |
| | **Basis for Taking Action.** Removal actions conducted at OU 12 were implemented in an effort to reduce the potential future risks to on-Base and off-Base receptors and minimize potential contaminant migration. A final ROD has not been signed for OU 12. A draft ROD has been prepared that addresses groundwater and soil contamination at OU 12 through various response actions that have already been implemented. The proposed remedy for OU 12 incorporates and adds to these initial response actions, which would continue as part of this remedy (**MWH, 2007a**). |
| **Remedial Actions** | **Remedy Selection (i.e. ROD/ESDs)**. A final ROD has not been signed for OU 12. The proposed remedy for OU 12 is discussed in the draft final ROD dated April 2007. The proposed remedy for OU 12 addresses the principal threats posed by the site by minimizing or preventing direct contact with contaminated groundwater and soil through implementation of ICs. The OU 12 proposed remedy for groundwater consists of implementation of the following: (1) continued operation of existing remedial systems; Base Boundary HCS and off-Base PRB; (2) implementation of ICs; (3) extension of the Base Boundary HCS through installation of four additional extraction wells; and (4) groundwater monitoring to track VOC concentrations. For soil, the draft final ROD describes a remedy consisting of: (1) implementation, monitoring, and enforcement of ICs to prohibit land use and restrict future contact with contaminated soil; (2) fencing/signage to restrict access to contaminated soils; (3) contaminated soil at source areas A, B and C in the AADA is to be excavated and removed with disposal at appropriate facilities, and (4) removal of visible asbestos from the Southern and Northern Debris Areas (**MWH, 2007**). Hill AFB responded to the EPA comments on the draft/final ROD and Hill AFB is currently waiting for the EPA responses/approval to Hill AFB responses to comments. The Final ROD is scheduled to be signed in 2008 followed by the implementation of the remaining components of the remedial action, also planned for 2008. |
| | **Remediation Goals.** Remedial action objectives and remediation goals were established in the draft ROD to address potential future risks to human health and the environment from unacceptable risk scenarios. RAOs associated with OU 12 are presented below (**MWH, 2007**):<br><br>**Groundwater RAOs**. The proposed RAOs for remediation of groundwater are: to prevent human exposure to contaminated groundwater above PRGs; and achieve PRGs within a reasonable time frame (e.g., 30 to 40 years). |

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| | The only complete exposure pathway to contaminated groundwater at OU 12 identified in the BRA at the present that creates a risk greater than one-in-one million ($1 \times 10^{-6}$) is through indoor air in off-Base residences (**MWH, 2007**). |
| | **Remedy Implementation.** Although a ROD has not been signed for OU 12, interim remedial actions and removal actions have been implemented at OU 12. The Base Boundary HCS was constructed to capture groundwater contaminated in excess of 100 ug/L of TCE at the Base boundary and prevent further offsite contamination of groundwater from the source area. The PRB was constructed to reduce contaminant concentrations to below their respective MCLs in the downgradient portions of the plume. Indoor air mitigation systems have been installed in twelve residences to prevent exposure to contaminants in indoor air through vapor intrusion (**MWH, 2007**). |
| | **Operations and Maintenance.** Operations and maintenance activities at OU 12 Base Boundary HCS are performed by Hill AFB Environmental Management (EM). The facility currently extracts and discharges groundwater at a flow rate of up to approximately 28 gpm. Groundwater from the extraction system is discharged directly (untreated) to the sanitary sewer for treatment at the NDSD WWTP. Currently there are no plans to treat the groundwater prior to discharge to the sanitary sewer because the contaminant concentrations are below the applicable permit limits for the contaminants of concern. Systematic inspection and monitoring is required to insure that system components are functioning properly. Individual system components are inspected for flaws. Routine system O&M tasks are executed on a regular basis to achieve proper system function, optimal operation, and minimize system downtime. Maintenance activities associated with normal system operation includes the following: routine inspection and housekeeping, preventive maintenance, and corrective maintenance (**MWH, 2007**). Currently the Base Boundary HCS is effective at achieving hydraulic capture on-Base. Well heads at the Base Boundary HCS represent an O&M difficulty because the conveyance piping cannot be accessed at the well head. Scaling in the conveyance piping is also a recurring issue that is being addressed through acidizing and pneumatic purging. The O&M contractor for the Base Boundary HCS reported that there are issues with restrictions in the piping, but they are being worked through (**CH2M HILL, 2007b**).<br><br>Performance monitoring of the PRB includes quarterly sampling of 21 monitoring wells. The wells are sampled for VOCs, cations, anions, TOC, alkalinity, field parameters, and water levels (**CH2M HILL, 2007c**). The PRB has been effective but is having some performance issues. Contaminant concentrations in monitoring wells down-gradient of the PRB have started to increase after initially decreasing following the installation of the PRB. Still, the PRB is reducing the mass overall downgradient of the PRB. There are several hypotheses that are being evaluated regarding the PRB performance issues. It is believed that preferential flow-paths may have developed in the PRB, and thus the contaminated groundwater residence time in the PRB is not adequate (**CH2M HILL, 2007d**). Another suspected problem being considered is that there were probably issues during the trenching/installation of the PRB associated with smearing of the fine-grained materials in the front and back walls of the trench. This may have caused the water table to mound in front of the PRB. This mounding has resulted in an increased hydraulic gradient and higher than anticipated groundwater flow velocities across the PRB. There is also concern that natural geochemistry of the OU 12 groundwater (sulfate, nitrate, etc.) may be competing with TCE for reduction as the groundwater flows through the PRB. Field investigations, groundwater modeling, geochemical modeling, and laboratory studies are being conducted to test these hypotheses (**CH2M HILL, 2007c**).<br><br>The current O&M manuals and as-built drawings for the PRB and the Base Boundary HCS are maintained through CEVR's Dynamic Documents system. All changes are managed and updated electronically through this system. There are plans to make some modifications at the Base Boundary HCS to the well head construction and conveyance piping to make maintenance and pump replacement easier (**CH2M HILL, 2007a**). |

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| | **Progress Since Initiation of Remedial Action.** All removal actions specified by the decision documents are in place. As of May 31, 2007, 12.54 pounds of volatile halogenated organic compounds (VHOC) have been removed from the aquifer using the BBHC system, and approximately 31,675,111 gallons of groundwater have been extracted since the start of operations (**AEEC, 2007**). Monitoring and data analysis has been conducted at OU 12 as specified in the PSVPlan. |
| **Progress Since Last FYR** | Recommendations and follow up actions presented in the 2003 five-year review for OU 12 are presented in **Table OU 12-3** along with the current status of each recommendation.<br><br>Current Status: All removal actions, including the PRB and Base Boundary HCS systems are in place. The RI Report for OU 12 was finalized and presented to the public in April 2005. The RI concluded that contamination at OU 12 is from two suspected sources of contamination: the AADA, and the former on-Base WWTP (**MWH Americas, 2005a**). Following completion of the OU 12 RI, Hill AFB performed a FS as part of the CERCLA process, which was presented to the public in July 2005 (**MWH Americas, 2005b**). A draft final ROD for OU12 was prepared in April 2007. The Final ROD is scheduled to be signed in 2008 followed by the implementation of the remaining components of the remedial action, also planned for 2008. The proposed remedy for OU 12 addresses the principal threats posed by the site by minimizing or preventing direct contact with contaminated groundwater and soil through implementation of institutional controls. The proposed remedy also includes active remedial components for the removal of contaminant mass through groundwater extraction at the Base boundary and through dechlorination of TCE at the off-Base PRB (**MWH, 2007**). A PSVPlan for Operable Unit 12 was prepared in November 2006.<br><br>Performance issues associated with the PRB are currently under investigation. Several studies have been conducted and additional work is planned to address issues related to the PRB performance. Coring into the PRB and testing of the PRB material was performed. The core samples obtained confirmed that iron was mostly equally distributed through the vertical extent of the PRB. Laboratory studies indicated that there was some carbonate precipitation on the iron, but not more than would be expected for a PRB in operation for three years. Batch reactivity tests results showed that there had been some minor losses in reactivity of the iron compared to the original iron used during installation. A flow and transport model is being performed to validate the conceptual model for the PRB. In addition, there are plans to perform geochemical modeling on the PRB using native groundwater from site wells. Polyethylene diffusion bags are currently sampled in the core of the plume to determine if there is variability in TCE concentrations with depth near the PRB. There is also some suspicion that contamination bypasses underneath the PRB. A tracer test may be conducted in the future to evaluate zones of higher groundwater velocity and fine scale heterogeneities near the PRB. If the PRB performance issues hypotheses are verified based on the additional investigations, modeling efforts, and laboratory studies, then augmentation of the PRB with additional iron to increase treatment capacity may be performed. |

Table OU 12-2

## Chronology of Site Events OU 12

*2008 Five -Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| | | 7 | 1987 | Hill Air Force Base (AFB) placed on the National Priorities List (NPL) | The U.S. EPA placed HAFB on the NPL under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). | Remedial Investigation Report Operable Unit 5 Sites SS17, SD16 Volume 1 - Text |
| 12 | OU12 | 1 | 1999 | Remedial Investigation | Investigations performed throughout OU 9 between 1996 and 1998 identified the existence of a VOC GW plume (now known as the Zone 16 plume) in OU 5 substantially larger than that addressed in the 1995 OU 5 RI. This reopened investigation lead to a separate OU 12 RI that was scheduled to be complete in draft form by mid-summer 2003. | Draft Conceptual Model for Operable Unit 5, May 2001 |
| 12 | OU12 | 10 | 2001 | Transfer to Another Operable Unit | The northern groundwater contamination plume within OU 5 is designated OU 12. This plume was discovered in 2000 during additional environmental investigations for the re-opened OU 5 RI. | Final Operable Units 5 and 12 Historic Site and Source Area Review, March 2002 |
| 12 | OU12 | 9 | 2002 | Remedial Investigation | Final Conceptual Model for Operable Units 5 and 12 completed. This document provides a conceptual model for the fate and transport of contaminants in groundwater at Operable Units 5 and 12. It interprets and presents the results of investigation tasks performed at OUs 5 & 12 by MWH and other contractors as part of the revised RI (not yet complete) including: Monitoring well installation, groundwater and surface water sampling, CPT and direct-push groundwater sampling, field drain sampling, aquifer testing, in-situ permeability testing, soil sampling, water-level monitoring, residential air and water sampling, historic site review, low-flow sampling study, active soil-gas survey, etc. | Final Conceptual Model for Operable Units 5 and 12 |
| 12 | OU12 | 9 | 2003 | Five-Year Review | The second Five-Year Review stated that the remedy at OU 12 is not protective. The current remedy is not intended to be protective of human health but is a treatability study meant to prevent highly contaminated groundwater from migrating off-Base. Remedial measures for the contaminated groundwater will be addressed after completion of the RI/FS and ROD and are scheduled to be in place by 2007. | Final CERCLA Five-Year Review Report, Second Five-Year Review Report for Hill Air Force Base, Utah. |
| 12 | OU12 | 11 | 2004 | Start of installation of an Off-Base Permeable Reactive Barrier in the City of Roy, Utah | An off-Base PRB was installed in November 2004. The Off-Base PRB was installed as a non-time-critical removal action and is located on the UTA corridor between 2700 West and 2775 West in the City of Roy | Technical Installation Report for Permeable Reactive Barrier Wall Operable Unit 12. Innovative Technical Solutions, Inc. March 2006. |
| 12 | OU12 | 4 | 2005 | Remedial Investigation | Remedial Investigation Report for OU 12 published. The remedial investigation (RI) identified two suspected sources of contamination: the AADA, and possibly the former on-Base Wastewater Treatment Plant (WWTP). | Final Remedial Investigation Report for Operable Unit 12, Hill Air Force Base, Utah. April, 2005. |
| 12 | OU12 | 7 | 2005 | Feasibility Study | Feasibility Study Report for OU 12 published. The FS developed four remedial alternatives for groundwater and five alternatives for soil. The RAOs for groundwater are:<br>• Prevent human exposure to contaminated groundwater above preliminary remediation goals (PRGs)<br>• Achieve PRGs in a reasonable time frame.<br>The RAO for soil is:<br>• Prevent human exposure to contaminated soil above PRGs. | Final Feasibility Study Report for Operable Unit 12, Hill Air Force Base, Utah. July, 2005. |

Table OU 12-2
Chronology of Site Events OU 12
*2008 Five -Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| 12 | OU12 | 10 | 2006 | Airborne asbestos sampling at the Aspen Avenue Disposal Area (AADA) | Asbestos sampling was performed at the AADA in order to determine if potential airborne asbestos fibers are migrating from the AADA. Forty-four samples including quality assurance/quality control samples were collected from ten monitoring stations over the four-day sampling period. Based on the results of the sampling program, additiona background monitoring for asbestos will not be performed since there is no identifiable risk to human health or the environment that would warrant further sampling. However, because soils will be disturbed during remedial actions, additional airborne asbestos sampling and meteorological monitoring will be performed during the remedial actions. | Final Data Summary Report for Airborne Asbestos Monitoring at the Operable Unit 12 Aspen Avenue Disposal Area, Hill Air Force Base, Utah, January 2007 |
| 12 | OU12 | 11 | 2006 | Performance Standard Verification Plan (PSVPlan) | The Performance Standard Verification Plan (PSVPlan) for Operable Unit 12 was prepared in November 2006. The PSVPlan for OU 12 consists of the following four PMPs;<br>• Base Boundary Hydraulic Containment System (BBHCS),<br>• Off-Base Permeable Reactive Barrier (PRB),<br>• OU 12 Groundwater Plume, and<br>• On-Base Soil | Hill Air Force Base, Utah Performance Standard Verification Plan for Operable Unit 12 |
| 12 | OU 12 | 4 | 2007 | Draft Record of Decision | A draft final Record of Decision (ROD) for OU12 was prepared in April 2007. The selected remedy for OU 5 addresses the principal threats posed by the site by minimizing or preventing direct contact with contaminated groundwater and soil through implementation of institutional controls. | Draft Final I Record of Decision for Operable Unit 12 Hill Air Force Base, Utah |
| 12 | OU12 | 9 | 2007 | Coring and analysis of PRB | Coring of the Hill Air Force Base (AFB) Operable Unit (OU) 12 Permeable Reactive Barrier (PRB) was conducted in order to obtain samples of the PRB material (i.e., iron and sand). The objective of the investigation is to provide data to assess and identify the cause of the reduced performance of the OU 12 PRB in treating groundwater contaminated with trichloroethene (TCE). Two borings were performed. | Letter Work Plan for Permeable Reactive Barrier Performance Evaluation (Coring and Analysis) Operable Unit 12, Hill Air Force Base, Utah |
| 12 | SD034 | 4 | 2004 | Engineering Evaluation / Cost Analysis | The removal action proposed in the Engineering Evaluation/Cost Analysis (EECA) was to be located in the OU 12 off-Base groundwater plume at the railroad corridor property situated between 2700 West and 2775 West in the City of Roy. Construction of a removal action on this property minimizes impacts to the community in terms of residents affected, constructability, and cost. | Final Engineering Evaluation and Cost Assessment (EE/CA) for Operable Unit 12. Hill Air Force Base, Utah. April 2004. |
| 12 | SS107 | 6 | 2002 | Remedial Investigation | Final Operable Units 5 and 12 Active Soil-Gas Survey Source Area Investigation Report completed. Soil-gas investigation conducted to define source areas in OU 5 and 12. This investigation indicated that the source area for OU 12 was north of the former Waste Water Treatment Plant WWTP. | Final Operable Units 5 and 12 Active Soil-Gas Survey Source Area Investigation Report |

**Notes**

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| AADA | Aspen Avenue Disposal Area |
| AFB | Air Force Base |
| BBHCS | Base Boundary Hydraulic Containment System |
| EPA | United States Environmental Protection Agency |
| EECA | Engineering Evaluation/Cost Analysis |
| FS | Feasibility Study |
| NFRAP | No Further Response Action Planned |
| NPL | National Priority List |
| OU 12 | Operable Unit 12 |
| PRGs | Preliminary Remediation Goals |
| PRB | Permeable Reactive Barrier |
| RAOs | Remedial Action Objectives |
| RI | Remedial Investigation |
| ROD | Record of Decision |
| TCE | Trichloroethylene |
| WWTP | Waste Water Treatment Plant |

Table OU 12-3

## Progress Since Last Five Year Review - Status of Recommendations and Follow-Up Actions at OU 12

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Site | 2003 Five-Year Review Recommendations | Current Status | Carry over to the next FYR |
|---|---|---|---|
| OU 12 | Delineate and remove the source area. | **In Progress.** The source area was delineated as described in the Remedial Investigation at OU 12 completed in 2005 (**MWH America, 2005a)**, MWH America, 2005b12 Hill Air Force Base (AFB). An FS identifying remedial options was also completed in 2005. Preparation of the ROD is in progress. | Yes |
| OU 12 | Continue with installation of the Base Boundary Hydraulic Containment Treatability Study System, as it should allow for continuing work to remove and investigate the source area without concern of contaminant migration off-Base. | **Complete.** Construction of the Base Boundary Hydraulic Containment System (HCS) began in October 2002 and system operations began in April 2003 (**MWH, 2003**). This system is designed to capture the 100 ug/L plume of TCE. Operations and Maintenance (O&M) of the Base Boundary HCS are ongoing. The OU 12 Site Manager indicated in the FYR interview that plans to expand the system to capture TCE above the MCL are in progress. (**CH2M HILL, 2007d**) | No |
| OU 12 | Consider the possibility of an early action to address the area of the plume off-Base where basements are being affected. | **Complete**. An off-Base PRB was installed. Construction began in November 2004 and the final inspection of the PRB was on August 3, 2005. The off-Base PRB was installed as a non-time-critical removal action and is located on the UTA corridor between 2700 West and 2775 West in the City of Roy. Construction of the off-Base PRB was intended to reduce contaminant concentrations in groundwater to less than their MCLs at the downgradient performance monitoring points, and to be consistent with any existing and future remedial activities | No |
| OU 12 | Determine areas of potential risk for indoor air contamination and develop a sampling plan to catch and address any contamination early. Any indoor air samples should be collected during winter months when vapor intrusion will reach its maximum. | **Ongoing**. Residential indoor air sampling is included as part of the Basewide Indoor Residential Air Sampling Program. Residences overlying contaminated groundwater or within the immediate vicinity of groundwater plumes have been contacted annually since 2003 for indoor air sampling (**MWH, 2004**). This issue is further addressed under the Indoor Air Program. | No |
| OU 12 | Institute a sampling plan for the location off-Base where groundwater surfaces to identify any contamination, if it exists, as early as possible. | **Complete**. The groundwater seep was removed during construction of the PRB in 2005 (**CH2M HILL, 2006**). | No |

**Notes:**

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| AFB | Air Force Base |
| BBHCS | Base Boundary Hydraulic Containment System |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liabilities Act |
| EPA | United States Environmental Protection Agency |
| FS | Feasibility Study |
| PRB | Permeable Reactive Barrier |
| OU 12 | Operable Unit 12 |
| O&M | Operations and Maintenance |
| RI | Remedial Investigation |

Table OU 12-4
## Operable Unit 12
## Five-Year Review Process

Reviewer: Victor Martinez

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| **Introduction** | This 2008 five-year review for Hill AFB has been conducted in accordance with the United States EPA's Comprehensive Five-Year Review Guidance dated June 2001 (**EPA, 2001**). Administrative and community involvement components of the FYR are described in **Section 2.0** of this report for the overall five-year review. In addition, interviews were conducted with relevant parties. A site inspection of OU 12 was performed. Documents reviewed for OU 12 as part of the 2008 five-year review are provided in **Appendix C**. Relevant site documents and applicable data covering the period of the five-year review were evaluated. The site interviews, site inspection, and data review are further discussed in the following sections. |
| **Interviews** | Interviews for OU 12 were conducted with Oscar Torres/75 Civil Engineering Group/ Environmental Management, Restoration Division (CEG/CEVR) site O&M project manager, Mark Roginske/75 CEG/CEVR site manager, Steve Parkinson/AEEC O&M technician, Brad Thein/AEEC O&M project manager, and Hhan Olsen/ MWH, PRB Contractor. Copies of the Interview Record Forms are provided in **Appendix D**.<br><br>Mr. Torres and Mr. Roginske were interviewed on September 26, 2007. They indicated that the PRB has been effective since the 2003 five-year review, but it is having some performance issues. There is work ongoing to evaluate and determine the cause of these issues so they can be corrected. By design, the BBHCS currently only captures the 100 µg/L contour of the plume and is meeting this performance objective. Four new extraction wells will be installed and connected to the existing BBHCS in order to capture the 5 µg/L contour areas of the plume once the ROD is signed. Mr. Parkinson and Mr. Thein mentioned that the system maintains hydraulic capture on-Base.<br><br>Mr. Torres and Mr. Roginske added that despite problems with the PRB, mass at the toe of the plume, downgradient of the PRB, has been cut in half, so it has also been effective. Contaminant concentrations in monitoring wells down-gradient of the PRB have started to increase after initially decreasing following the installation of the PRB. Still, the PRB is reducing the mass overall downgradient of the PRB. They suggested that preferential flow-paths may have developed in the PRB and that the contaminated water residence time in the PRB is not adequate.<br><br>In addition to the previously noted problems with the PRB, Mr. Parkinson and Mr. Thein mentioned that well heads at the BBHCS are an O&M difficulty since the conveyance piping cannot be accessed at the well head. Scaling in the conveyance piping is an issue. Scaling is addressed through acidizing and pneumatic purging. Mr. Torres and Mr. Roginske indicated that there are plans to change the well head construction at the BBHC wells.<br><br>Mr. Olsen was interviewed on September 27, 2007. He indicated that one suspected problem with the performance of the PRB system is that there were probably issues during the trenching/installation of the PRB associated with smearing of the fine-grained materials in the front and back walls of the trench. This has caused the water table to mound in front of the PRB. This mounding has resulted in an increased hydraulic gradient that may cause higher than anticipated groundwater flow velocities across the PRB. A higher groundwater flow velocity could cause lack of residence time in the PRB to completely treat TCE to below MCLs. The highly heterogeneous stratigraphy (thin sand/silt layers) with variable hydraulic conductivities may also provide preferential flow pathways through different vertical horizons of the PRB. He mentioned that there is also concern that natural geochemistry of the OU 12 groundwater |

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| | (sulfate, nitrate, etc.) may be competing with TCE for reduction as the groundwater flows through the barrier. He added that field investigations, groundwater modeling, geochemical modeling, and laboratory studies are being conducted to test these hypotheses.<br><br>Community interviews were also conducted as part of this five-year review. Interviews were conducted with Mrs. Agnes Bojanski/Roy resident, Mr. Dale K. Searcy/Roy City RAB representative, and Mr. Joe Ritchie/Roy City Mayor. A copy of the Interview Record Form is provided in **Appendix B.**<br><br>Mrs. Agnes Bojanski was interviewed on December 21, 2007. She indicated that she is concerned that the cleanup efforts conducted in the area may affect her ability to sell her home. She indicated that she and her neighbors have been inconvenienced by indoor air sampling efforts and are concerned about potential health problems. She also feels that Hill AFB could do a better job communicating with the neighborhood, and if they did, more community members would participate in the process.<br><br>Mr. Dale K. Searcy indicated that the cleanup effort is going very well, and the impact on the communities involved with the cleanup has been minimal. He feels that Hill Air Force Base has done an outstanding job of informing the public and also Base employees about cleanup procedures and possible health risks. He also believes that the cleanup procedures are the best currently available, and that the Air Force will adjust or change these procedures whenever better technologies are discovered.<br><br>Mr. Joe Ritchie, Roy City Mayor was interviewed on December 17, 2007 and indicated that the cleanup effort is "marvelous, outstanding and effective." The Air Force has reinstalled a positive feeling and the comfort zone of residents has been high. Because of the cleanup, there have been some negative impacts, such as construction zones, but these have all been corrected. He indicated that well sampling and indoor air sampling on his property have been thorough and informative. |
| **Site Inspection** | The site inspection for OU 12 was conducted on September 26, 2007. The completed site inspection checklist is provided in **Appendix E**.<br><br>Based on the site inspection, OU 12 appears to be well maintained. No signs of vandalism were observed.<br><br>Access and ICs are currently in place at OU 12. No fence is present at the Base Boundary HCS. The building is kept locked. Signs are present and in good condition.<br><br>Settlement was not evident in the PRB. Performance monitoring is conducted quarterly.<br><br>Groundwater remedies were in good condition. Pumps, wellhead plumbing, and electrical enclosures were in good condition. Extraction system pipelines, valves, valve boxes, and other appurtenances were located and in good condition. The pitless adapters are located at 10 ft bgs, which makes it challenging to perform maintenance to pipelines at the well heads. Spare parts and equipment are readily available and in good condition. Back-up pumps are maintained at site.<br><br>Long-term monitoring wells are properly secured/locked. Due to large number of wells present, not all were inspected. All wells that were inspected appeared to be in good condition.<br><br>A ROD has not been signed for OU 12.<br><br>The site inspection checklist addressed four discussion topics. These discussion topics are presented below, followed by responses and general observations based on the site inspection.<br><br>(1) Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.). |

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| | Based on the site inspection, all components of the interim remedy appear to be functioning as designed. However, CEVR staff noted that there are problems with TCE contaminated groundwater by-passing the PRB or not being treated completely in the PRB. Issues related to the PRB are currently being investigated.<br><br>(2) Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.<br><br>Operation and maintenance at OU 12 includes O&M of the Base Boundary HCS, performance monitoring for the PRB, groundwater monitoring, implementation and enforcement of ICs, and compliance monitoring. Documentation of the groundwater monitoring activity has not yet been provided.<br><br>(3) Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.<br><br>There are no indications of potential remedy failure based on the site inspection. However, CEVR has recognized that data show there are performance issues with the PRB. The cause and remedy of this is currently under investigation.<br><br>(4) Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.<br><br>No opportunities to optimize the remedy for OU 12 were identified as part of the site inspection. Operation and maintenance contractors make recommendations to optimize performance and/or reduce costs. No optimization opportunities were identified as part of the site inspection. The O&M contractor has recommended reconstruction of the wellheads and pitless adaptors for the Base Boundary HCS. The current construction makes maintenance activities difficult. |
| **Data Review** | The data reviewed as part of the 2008 five-year review included groundwater samples, effluent discharge samples, and system flow data. Groundwater data were collected on an annual, semiannual, and quarterly basis at OU 12 monitoring wells during the review period. Discharge samples were collected on a monthly basis.<br><br>Based on the data review hydraulic containment of TCE is being achieved by the Base Boundary HCS. Containment of the dissolved phase TCE plume at concentrations greater than 100 µg/L is maintained as demonstrated by declining TCE concentrations in downgradient monitoring wells. However, a performance objective of the Bases Boundary HCS is to maintain a pumping rate that contains the higher concentration portion of the TCE plume but does not cause excessive drawdown. The total average pumping rate of the Base Boundary HCS was below the acceptable range (currently 11 to 20 gallons per minute [gpm] as stipulated in the PSVPlan) from January through March 2007. Containment of the TCE plume was maintained during this period, but in order to prevent further migration of the TCE plume at concentrations greater than 100 µg/l downgradient of the Base Boundary HCS location, the pumping rate at each of the extraction wells should be maintained within acceptable ranges as specified in the PSVPlan. Part of the problem in achieving the required pumping rates is due to scaling in the conveyance piping of the Base Boundary HCS, as reported by the O&M personnel. Since June 2003, the Base Boundary HCS has shutdown on more than 90 occasions as a result of temporary power outages requiring total system restarts. All together, these power failures represent a downtime of approximately 1600 hours of system operation (172 hrs in 2003, 1032 hrs in 2004, 300 hours in 2005, and 117 hours in 2006). The Draft ROD states that the restoration time frame for off-Base groundwater in the OU 12 plume is estimated to be 30 to 40 years. This timeframe assumes constant operation of the Base Boundary HCS and the PRB. Discharge water from the Base Boundary HCS is piped to a control building and is ultimately |

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| | discharged directly (untreated) to the sanitary sewer for treatment at the off-Base NDSD Wastewater Treatment Plant. As of March 2007, the Base Boundary HCS has extracted 31,675,111 of groundwater and 12.54 pounds of TCE have been removed. Currently, discharge permit requirements, listed in **Table OU 12-6**, for Total Toxic Organic (TTO) concentrations are being met prior to discharge to the NDSD Wastewater Treatment Plant.<br><br>The PRB is a passive treatment system where groundwater contaminated with VOCs passes through the reactive zone of the barrier and the contaminants are chemically transformed to a non-toxic state. The scope of the removal action proposed in the Final Action Memorandum for Installation of a Permeable Reactive Barrier at OU 12 was intended to provide stabilization of the TCE plume until a final site remedy can be implemented. Removal action objectives developed to meet the scope include the following: (1) to reduce the potential for further downgradient degradation of groundwater quality by preventing the uncontrolled movement of the existing plume; (2) to reduce the potential for further degradation of indoor air quality that can be attributed to the OU 12 groundwater contaminant plume; (3) to minimize impacts to the community during remedy construction and operation (**Hill AFB, 2004**). The PSVPlan established five performance objectives for the PRB including: (1) intercept and treat all TCE-contaminated groundwater flowing through the PRB to concentrations less than the MCL of 5 micrograms per liter; (2) ensure that TCE-contaminated groundwater is not by-passing the PRB by monitoring TCE concentrations in PRB sentinel wells located north and south of the PRB; (3) monitor geochemical influence on the PRB and assure no deleterious impacts to groundwater beyond 30 feet downgradient of the PRB; (4) to monitor the hydraulic gradient across the PRB; and (5) to monitor the regional hydraulic gradient in the vicinity of the PRB (**Hill AFB CEVR, 2007a**).<br><br>Based on the data review and document review, the PRB is not performing as expected. Performance monitoring indicates that the PRB is treating TCE contaminated groundwater, however concentrations below the MCL have not been achieved downgradient of the PRB. Data review from sampling performed between 2005 and 2007 indicate that TCE concentrations downgradient of the PRB have been slowly increasing during this period of time. As previously mentioned in the inspection, several investigations have been performed in order to evaluate the performance problem with the PRB and more studies will follow. Several theories on the causes affecting the performance of the PRB have been formulated including the development of preferential flow-paths in the PRB, the natural geochemistry of the OU groundwater, or that contamination may be bypassing underneath the PRB. Modifications will be made to increase the treatment capacity of the PRB and optimize the system performance based on the results of the studies and additional investigation currently being planned and/or performed.<br><br>Institutional controls, in the form of groundwater and land use controls, both on- and off-Base, have been implemented to restrict future access to contaminated soils and groundwater at OU 12.<br><br>Based on document and data review, the removal action at OU 12 associated with the Base Boundary HCS is currently achieving the performance objectives as specified in the PSVReport. The PRB is currently meeting the RAOs as specified in the Action Memorandum (**Hill AFB, 2004**) which is the document that details the remedial decisions of the PRB. However, the PRB is not achieving all the performance objectives specified in the PSVPlan. While the performance objectives of the PRB are not currently being achieved, this issue does not affect the protectiveness of the remedy, although it needs to be addressed to ensure continued protectiveness. |

Table OU 12-5

# Chemicals of Concern and Removal Action Goals at OU 12

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Media | Chemical of Concern | Remediation Goal | Units |
|---|---|---|---|
| Groundwater | Carbon Tetrachloride | 5 | ug/L |
| | Cis-1,2-Dichloroethene (cis-1,2-DCE) | 70 | ug/L |
| | Tetrachloroethene (PCE) | 5 | ug/L |
| | Trichloroethene (TCE) | 5 | ug/L |

**Notes:**

Unless otherwise specified, the concentrations for ground and surface water are maximum contaminated levels (MCLs) established under the Safe Drinking Water Act and/or Utah Primary Drinking Water Standards

ug/L = micrograms per liter

Table OU 12-6

## OU 12 System Effluent Discharge Limits for Discharge to the North Davis Sewer District

*2008 Five-Year Review*

*Hill Air Force Base, Utah*

| Analyte | Discharge Limit | Units |
|---|---|---|
| Total VOCs | 2.13 | mg/L |
| Arsenic | 0.1 | |
| Nickel | 0.6 | mg/L |
| Zinc | 1.5 | mg/L |
| pH | 6.5-11.0 | |
| Temperature | <140 | °F |

Notes:

mg/L milligrams per liter

VOCs = volatile organic compounds

Permit dates: November 1, 2004 through December 31, 2008

Table OU 12-7
# Operable Unit 12
# Five-Year Review Technical Assessment

Reviewer: Victor Martinez

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| **Introduction** | The five-year review must determine whether the remedy at a site is protective of human health and the environment. The EPA guidance describes three questions used to provide a framework for organizing and evaluating data and information and to ensure all relevant issues are considered when determining the protectiveness of a remedy (**EPA, 2001**). These questions are assessed for OU 12 in the following sections. The implementation of ICs is also described. At the end of this table is a summary of the technical assessment. |
| **Question A.** | **Is the remedy functioning as intended by the decision documents?**<br>A final remedy has not been implemented to-date at OU 12. However, removal actions have been implemented at OU 12 and these remedial actions were evaluated.<br>The documents that detail the remedial decisions of the removal actions for the PRB is the 2004 Final Action Memorandum for Installation of a Permeable Reactive Barrier at OU 12 (**Hill AFB, 2004**).<br>The removal action associated with the PRB is achieving the RAOs specified in the Final Acton Memorandum.<br>The interim action at OU 12 associated with the Base Boundary HCS is currently achieving the performance objectives as specified in the PSVPlan.<br>The OU 12 Base Boundary HCS has been in operation since April 2003, and includes three extraction wells, a control/treatment building, and a discharge pipeline. Discharge water from the extraction wells is piped to a control building and is directly discharged (without treatment) to the sanitary sewer for treatment at the off-Base NDSD Wastewater Treatment Plant. The current objective of the OU 12 Base Boundary HCS is to contain contaminated groundwater within the area defined by the 100 µg/L TCE contour at the Base boundary, thus preventing the higher concentration portion of the plume from migrating off Base. An additional objective of the Base Boundary HCS is to meet discharge permit requirements for TTO concentrations before discharge to the NDSD Wastewater Treatment Plant, in accordance with the NDSD Statement of Basis for Hill AFB. Hydraulic containment of TCE is currently being achieved by the Base Boundary HCS. Containment of the dissolved phase TCE plume at concentrations greater than 100 µg/l is maintained as shown by declining TCE concentrations in downgradient monitoring wells.<br>The off-Base PRB was installed in November 2004. The Off-Base PRB was installed as a non-time-critical removal action and is located on the UTA corridor between 2700 West and 2775 West in the City of Roy. Construction of the off-Base PRB was intended to reduce contaminant concentrations in groundwater to less than their MCLs at the downgradient performance monitoring points, and to be consistent with any existing and future remedial activities. Preliminary system performance monitoring indicates that the PRB is treating TCE contaminated groundwater, reducing contaminant mass, and controlling plume migration. However concentrations below the MCL have not been achieved downgradient of the PRB. Several studies and investigations are currently being conducted in order to optimize the system performance of the PRB and increase the treatment capacity.<br><u>Opportunities for Optimization:</u><br>O&M contractors regularly make recommendations to optimize performance and/or reduce costs. The O&M contractor has recommended reconstruction of the wellheads and pitless adaptors for the Base Boundary HCS. The current construction makes maintenance activities and pump replacement a difficult task to perform. |

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| | Early Indicators of Potential Remedy Problems:<br>There are no indications of potential remedy failure relative to the Base Boundary HCS. With the exception of the previously noted performance issues with the PRB, there are no other early indicators of potential remedy problems associated with the PRB. |
| **Question B.** | **Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?**<br>Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics:<br>A final remedy has not yet been selected for OU 12. There have been no changes in exposure assumptions, toxicity data, cleanup levels, and RAOs used since the removal actions were implemented.<br>Changes in Applicable or Relevant and Appropriate Requirements:<br>Not applicable. |
| **Question C.** | **Has any other information come to light that could call into question the protectiveness of the remedy?**<br>Examples of other information that might call into question the protectiveness of the remedy include potential future land use changes in the vicinity of the site or other expected changes in site conditions or exposure pathways.<br>Plans are being evaluated to turn over property along the western portion of the Base to a private commercial developer(s) to redevelop that portion of the Base for various uses. No residential development will be allowed that would be in conflict with the privatized housing. Development will most likely consist of commercial and light industrial, but no heavy industrial. |
| **Institutional Controls** | Institutional Controls are generally defined as non-engineered instruments such as administrative and legal tools that do not involve construction or physically changing the site, and that help minimize the potential for human exposure to contamination and/or protect the integrity of a remedy by limiting land and/or resource use (**EPA, 2005**). ICs can be used for many reasons including restriction of site use, modifying behavior, and providing information to people (**EPA, 2000**). ICs may include deed notices, easements, covenants, restrictions, or other conditions on deeds, and/or groundwater and/or land use restriction documents (**EPA, 2001**). The following paragraphs describe ICs implemented at OU 12, the potential affect of future land use plans on ICs, and any plans for changes to site contamination status.<br>Types of ICs in Place at the Site:<br>ICs, in the form of groundwater and land use controls, have been implemented to restrict future access to contaminated soils and groundwater at OU 12. Hill AFB performs an annual evaluation of the ICs in place for the Base. This includes verification of orders, leases, groundwater use restrictions, and inspections of signage, fences, and monitoring wells. An annual land-use controls report is prepared documenting the results of this work. Detailed information from the annual LUC Assessment report is presented in **Section 2.7**. Based on review of the most recent LUC Assessment report, LUCs at OU 12 were considered appropriate and no recommendations were made (**Hill AFB CERV, 2007b**).<br>Effects of Future Land Use Plans on ICs:<br>There are plans for redevelopment on the west side of the Base. This is currently in the planning phase. It is anticipated that a private developer will be allowed to use portions of the western area of the Base for commercial and/or light industrial redevelopment.<br>Plans for Changes to Site Contamination Status:<br>No changes to site contaminant status at OU 12 are anticipated in the near future. |

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| **Summary of the Technical Assessment** | The technical assessment, based on the data review, site inspection, technical evaluation, and interviews indicates that the removal action associated with installation of the PRB generally appear to be functioning as intended by the Action Memorandum. In addition implementation of the interim action (Base Boundary HCS) generally appears to be working as specified by the PSVPlan. Hydraulic containment of TCE is currently being achieved by the Base Boundary HCS. The total average pumping rate of the Base Boundary HCS was below the acceptable range (currently 11 to 20 gpm as stipulated in the PSVPlan) from January through March 2007. However, TCE concentrations in downgradient monitoring wells are below 100 µg/l as intended by the PSVPlan.<br><br>Preliminary system performance monitoring indicates that the PRB is treating TCE contaminated groundwater, reducing contaminant mass, and controlling plume migration. These are the RAOs outlined for the PRB in the Action Memorandum. However, concentrations below the MCL have not been achieved downgradient of the PRB. Achieving the MCLs downgradient of the PRB is one of the performance objectives outlined in the PSVPlan. Analytical data review from sampling performed between 2005 and 2007 shows that TCE concentrations in wells downgradient of the PRB have been slowly increasing.<br><br>The performance objectives that are not currently being achieved do not affect the protectiveness of the removal actions in place, although they need to be addressed to ensure continued protectiveness. |

Table OU 12-8
## Operable Unit 12
## Technical Assessment Summary for OU 12

Reviewer: Victor Martinez

| Site ID | Remedy Description | Technical Assessment | | | Protectiveness | Next Five-Year Review |
|---|---|---|---|---|---|---|
| | | Question A* | Question B* | Question C* | | |
| SS107 | Removal Action<br>Base Boundary HCS | Yes | Yes | No | Removal Actions associated with the Base Boundary HCS are considered to be protective in the short term. | 2013 |
| SS107 | Removal Action<br>Off-Base PRB | Yes | Yes | No | Removal Actions associated with the PRB are considers to be protective in the short term because ICs are being enforced even though there are performance issues with the PRB. | 2013 |
| OU 12 | Removal Action consisting of Base Boundary HCS, off-Base PRB | Yes | Yes | No | Protective in the short term, pending remedy selection. | 2013 |

*Question A: Is the remedy functioning as intended by the decision documents?
*Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objective (RAOs) used at the time of the remedy still valid?
*Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
NA = Not Applicable

Table OU 12-9

# Operable Unit 12
# Five-Year Review Issues, Recommendations and Follow-Up Actions, and Protectiveness Statement

Reviewer: Victor Martinez

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| **Issues** | Operation and maintenance (O&M) activities are ongoing at Operable Unit (OU) 12. Based on the document review, data review, site inspection, interviews, and the technical assessment, it appears the remedy has been implemented as planned. The Base Boundary Hydraulic Containment System (HCS) is functioning as intended by the decision documents in the short term. The removal action associated with the Permeable Reactive Barrier (PRB) is achieving the remedial action objectives (RAOs) specified in the Final Acton Memorandum (**Hill AFB, 2004**). To ensure continued protectiveness, two issues are identified in the 2008 five-year review for OU 12, as described below. These issues do not currently affect the protectiveness of the remedy, although they need to be addressed to ensure continued protectiveness. These issues are:<br><br>1) The 2003 five-year review recommended delineating and removing the Source Area at OU 12. The Remedial Investigation and Feasibility Study have been completed and the source areas have been delineated. Removal and disposal of contamination from source areas is pending completion of the record of decision (ROD).<br><br>2) The OU 12 Environmental Management, Restoration Division (CEVR) Site and O&M managers indicated in their interviews for the 2008 five-year review that the PRB has been effective but is currently having performance issues. Following the installation of the PRB, contaminant concentrations in monitoring wells downgradient of the PRB initially decreased. However, contaminant concentrations have started to slowly increase at those wells. Environmental Management, Restoration Division site managers and O&M contractors believe that preferential flow-paths may have developed in the PRB and/or that the contaminated water residence time in the PRB is not adequate. Investigations are currently ongoing to determine the problems affecting the performance of the PRB. |
| **Recommendations and Follow-Up Actions** | As described in the previous section, two issues were identified in the 2008 five-year review for OU 12. To address these issues, the following recommendations and follow-up actions have been defined.<br><br>1) Finalize and sign the ROD and proceed with the removal and disposal of the source areas.<br><br>2) Continue with current investigations and identify the cause of the performance issues for the PRB. Make modifications to PRB based on the findings of the investigation to optimize the system performance. |
| **Remedial Timeframe** | **Table 3-3** in **Section 3.1.4** presents the remedial timeframe estimates for OU 12. The remedial timeframe for the On-Base plume and soils is indefinite. Remediation associated with the Off-Base plume is estimated to be complete sometime during the 2040's. |

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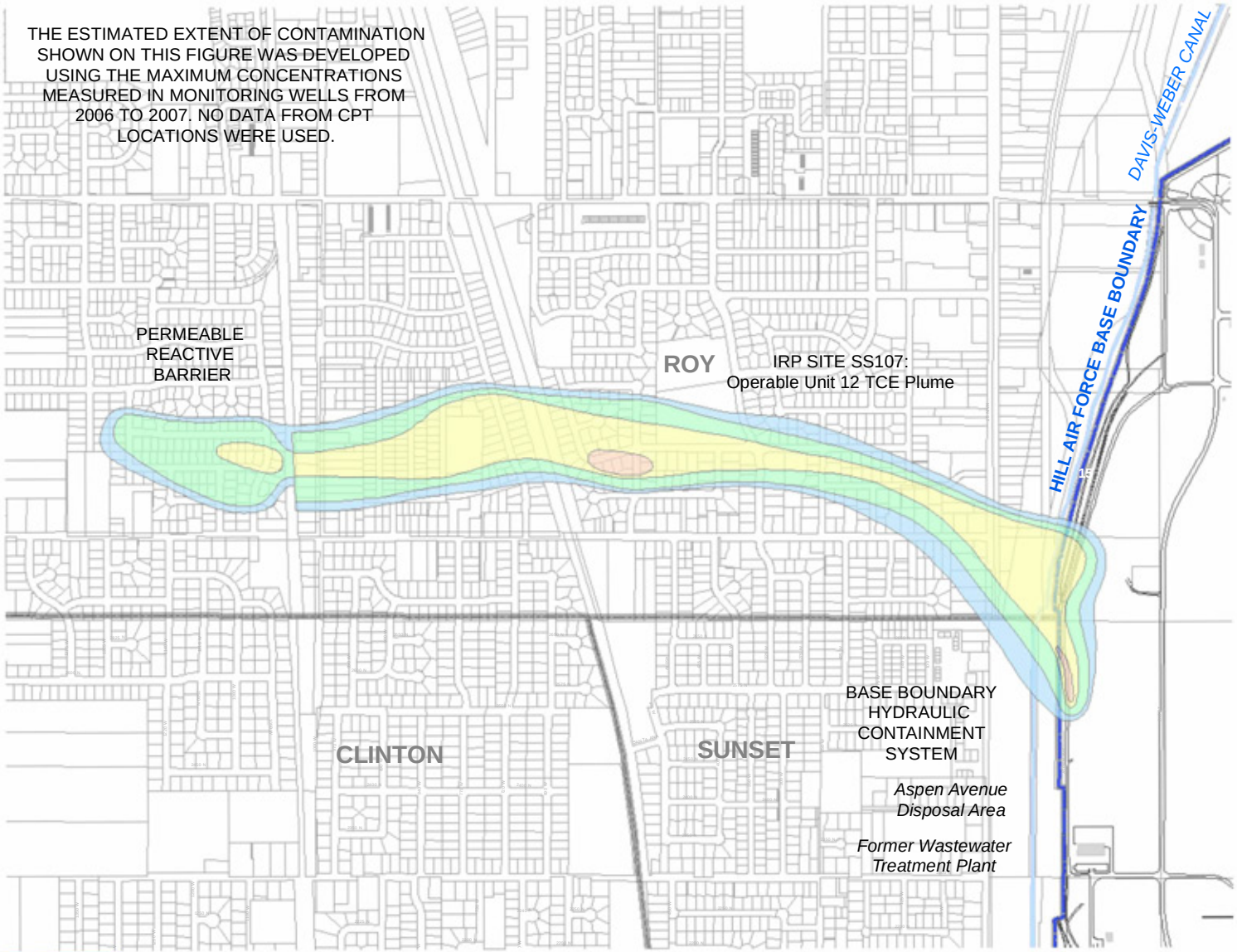
| **Protectiveness Statement** | **While there is not yet a remedy in place, removal actions and interim actions implemented at OU 12 are considered to be protective of human health and the environment in the short-term.** The interim action at OU 12 associated with the Base Boundary HCS is currently achieving the performance objectives as specified in the PSVPlan. However, the removal action associated with the PRB is not performing as expected. The PRB is currently meeting the RAOs as specified in the Action Memorandum (**Hill AFB, 2004**), but it is not achieving the performance goal of reducing TCE concentrations downgradient to less than the MCL as specified in the performance standard verification plan (PSVPlan) (**Hill AFB CEVR, 2007c**). Institutional controls are currently in place to limit human exposure to potential groundwater contamination. ICs and land-use controls are assessed annually. The remedy selected for OU 12 will be protective of human health and the environment once the ROD is signed and remedial actions outlined in the ROD are implemented. Interim measures implemented at OU 12 will continue to be protective if the recommendations and follow-up items identified in this five-year review are addressed. |
| **Next Five-Year Review** | Remedial actions at OU 12 will be reviewed in the next five-year review for Hill AFB to be completed during or before September 2013. |

DFW \\CHUCKWAGON\GIS\NWOFILES\HILLAFB\MXD\OU12_SITE_FEATURES.MXD SWACHAL 4/11/2008




0 625 1,250
Feet

1 inch equals 1,250 feet

**LEGEND**

TREATMENT SYSTEM

ESTIMATED EXTENT OF CONTAMINATION

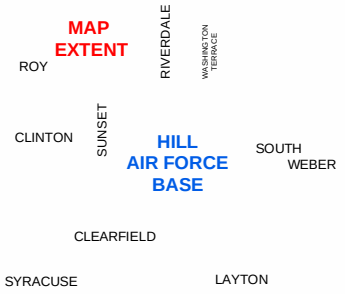
5-10 µg/l

10-100 µg/l

100 - 1,000 µg/l

1,000 -10,000 µg/l

CONCENTRATIONS ARE FOR TCE




75th AIR BASE WING

FIGURE OU 12 - 1

**SITE FEATURES OF OPERABLE UNIT 12**

2008 FIVE-YEAR REVIEW

IRP SITE: SS107

HILL AIR FORCE BASE, UTAH

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Table OU 13-1
# Operable Unit 13
# Background Information

Reviewer: Victor Martinez

<table>
<tr><td>Introduction</td><td>Operable Unit 13 is comprised of Upper Area F of the Base Military Housing, located along the southwest boundary of Hill AFB. Upper Area F consists of approximately 100 residential units (50 duplexes) that were constructed in the mid-1970s, a youth center, and communal areas (e.g., playgrounds and parks) (Figure OU 13-1). During a renovation project in Upper Area F in late 2006 and early 2007, soil within the housing complex grounds was sampled and analyzed for pesticides, which are known to have been used in the area. Analysis for PCBs was performed and indicated that PCBs (Araclor 1260) at concentrations up to 27 milligrams per kilogram (mg/kg) are present in soil at the housing complex. Renovation activities were postponed and Hill AFB initiated an investigation to assess potential risks to residents and to determine the lateral and vertical extent of PCBs in soil. The purpose of the investigation was to: (1) assess potential risks to residents that may result due to potentially contaminated surface soil and (2) to determine the nature and preliminary extent of soil contamination laterally across the site and vertically to depths of 3 to 5 feet bgs. A Draft Action Memorandum for PCB's Removal Action at Upper Area F of the residential Military Housing was prepared in August 2007 to conduct a time-critical removal action and address the PCBs in OU 13 soil (HILL AFB CEVR, 2007).<br><br>A list of the documents reviewed for OU 13 as part of the 2008 five-year review is provided in Appendix C.
<table>
<tr><th>IRP Identification</th><th>IRP Site Name</th><th>Status</th></tr>
<tr><td>SS112</td><td>Upper Area F Housing PCB Site</td><td>Removal Action</td></tr>
</table>
</td></tr>
<tr><td>Site Chronology</td><td>Provided separately. See Table OU 13-2</td></tr>
<tr><td>Background</td><td>Physical Characteristics. Upper Area F is located on the southwest edge of a former Pleistocene Epoch delta that formed in historic Lake Bonneville. The surficial deposits at Upper Area F consist primarily of silty-sands and sand interbedded with varying amounts of gravel. Based on hand-augured boreholes and CPT performed in the area, the sand and silty-sands with gravel extend to approximately 10 to15 feet bgs, where a layer of silt and silty-clay is encountered that varies in thickness from 10 to 20 feet. The depth to groundwater is approximately 75 feet bgs; however, a thin layer of perched groundwater may be present above the silt and silty-clay layer. The topography at Upper Area F generally slopes from the northeast to the southwest, with an average grade of approximately 0.05 feet per foot (ft/ft) prior to construction of residential units. Currently the topography is highly terraced for building foundations but still has an overall slope from the northeast to the southwest (MWH, 2007b).</td></tr>
<tr><td></td><td>Land and Resource Use. Upper Area F consist of the Base Military Housing and is located along the southwest boundary of Hill AFB. The area consists of approximately 100 residential units (50 duplexes) that were constructed in the mid-1970s. No land use changes were observed on-Base or off-Base during the 2008 Five-Year Review Site inspection (CH2M HILL 2007b).</td></tr>
<tr><td></td><td>History of Contamination. In 2005 the DoD privatized the military housing at Hill AFB. The military housing developer, Boyer Hill Military Housing L.C. (BHMH), agreed to an aggressive development plan to be implemented within the first 6 years of their lease. In 2006, BHMH began renovations to some of the structures at Upper Area F. During renovation activities, soil within the housing complex was sampled and analyzed for pesticides. Based on the pesticide analysis and chromatograph results from December 2006 and January 2007, the analytical laboratory recommended additional analysis for PCBs. The results indicated that PCBs, specifically Aroclor 1260, were present at three locations in soil at Upper Area F at a maximum concentration of 27 mg/kg or ppm. The source of contamination is unknown; however, it is suspected that the PCBs originated from the DRMO former open storage yard and were</td></tr>
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| | distributed across Upper Area F as fill when the open storage yard was closed and the housing area was constructed (**HILL AFB CEVR, 2007**). |
| | **Initial Response.** An extensive two phase investigation was conducted between February and June 2007 to determine the extent of PCB contamination at Upper Area F. Phase I investigations were performed in late February and early March 2007 following a quasi-random sampling approach. The objective of this phase was to provide screening data for Upper Area F (primarily in surface soil from 0.0 to 0.5 feet bgs) to assess potential risks to residents. Phase II investigations were performed between March and June 2007 following a defined systematic sampling approach (grid sampling) expanding off of the data results from Phase I. There were five main objectives of Phase II, including: (1) defining areas where PCBs were detected at concentrations greater than 1 ppm; (2) evaluating areas where PCBs were detected at concentrations less than 1 ppm; (3) verifying the concentrations detected during renovation activities; (4) conducting vertical profiling at locations that were not sampled during Phase I; and (5) investigating areas based on possible historical use. Based on these investigations, a time-critical removal action was initiated. |
| | **Basis for Taking Action.** The purpose of the non-time critical removal action being conducted at OU 13 is to protect public health and welfare in relation to six areas. The areas have exposure assumptions associated with residential land use (ingestion, inhalation, and dermal contact), where PCB concentrations are greater than or equal to 1 ppm. PCBs are relatively non-volatile and immobile in the environment and thus, there are no known threats to the environment through migration to air or groundwater beyond the six areas with PCB at concentrations greater than or equal to 1 ppm. If PCBs at concentrations greater than or equal to 1 ppm are not addressed by implementing the proposed removal action, there could be a direct endangerment to human health at the six residential locations where the contamination is known to be present. The proposed removal action will include soil excavation within the six areas from ground surface to a maximum depth of 4 feet bgs, as defined by the results from investigations and confirmation sampling. The removal action goal is to remove PCB concentrations in soil that present an unacceptable risk to human health. The Project Clean-Up Goals for the removal action are: (1) prevent human exposure to PCB contaminated soil at concentrations greater than or equal to 1 ppm between ground surface and a depth of 2 feet bgs; (2) prevent human exposure to PCB contaminated soil at concentrations greater than or equal to 1 ppm but less than 10 ppm to a depth between 2 and 3 feet bgs; (3) prevent human exposure to PCB contaminated soil at concentrations greater than 10 ppm to a depth between 3 and 4 feet bgs; and (4) ensure public safety and minimize impacts to the community during soil removal activities (**HILL AFB CEVR, 2007**). Following completion of the removal action, a RI/FS will be conducted and a final remedy selected. |

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| **Remedial Actions** | **Remedy Selection (ie. Record of Decision [ROD]/Explanation of Significant Differences [ESDs]).** A ROD for OU 13 has not yet been prepared. Response actions at OU 13 are being completed as a time-critical removal action based on the draft action memorandum dated August 6, 2007. The selected action involves excavation of PCB contaminated soils as outlined above under basis for taking action, disposal of the soils at an approved facility, backfilling the excavations with clean soil, and LUCs. Hill AFB and BHMH will be responsible for imposing restrictions through the LUCs/ICs. AFI 32-7020 (Hill AFB Supplement 1, 18 February 2004) requires that no construction or other activity will disturb soils within the boundaries of IRP sites or OUs without concurrence of the Hill AFB CEVR department. The LUCs/ICs will be implemented for all of Upper Area F, including the six areas where removal actions will occur. To prevent exposure to potentially undiscovered PCB contamination that could pose a health risk to construction workers or residents, the following measures will be implemented:<br>• All planned development activities involving excavation in areas that have not been previously investigated (under streets, sidewalks, etc.), or in areas previously investigated but not at the proposed construction depths (i.e., at depths greater that the removal action excavation depth) will be managed through a Memorandum of Understanding (MOU) or Memorandum of Agreement (MOA) between Hill AFB and BHMH. The MOU/MOA will provide protocols for construction work orders, preconstruction sampling (if necessary), and excavation and soil handling procedures in Upper Area F. In addition, it will allow Hill AFB CEVR to review all proposed construction activities in order to ensure that the proper measures are implemented to protect construction workers and residents.<br>• All housing lease agreements will provide specific language describing the potential for PCBs in soil and restrictions on certain tenant activities such as planting trees and vegetable gardens within the housing area.<br>• For Upper Area F, including the six areas that require removal action, Hill AFB will distribute a Restricted Areas Use Map to BHMH and organizations across the Base who may have requirements to excavate soil. This map will be updated and redistributed as necessary.<br>• Annual LUC/IC audits and inspections will be used to determine conformance to the LUC/IC plan.<br>Following completion of the removal action, a RI/FS will be conducted and a final remedy selected. |
| | **Remedy Implementation.** Implementation of the time-critical removal action began in late September 2007. It is anticipated that the removal action will be completed in November 2007. Following completion of the removal action, a RI/FS will be conducted and a final remedy selected. |
| | **Operations and Maintenance.** Specific O&M requirements have not been established for OU 13. However, Hill AFB is responsible for implementing, monitoring, maintaining, reporting on, and enforcing the LUCs/ICs within their control, including specific actions as described in the Base Master Plan and the Restricted Areas Use Map. If Hill AFB determines that specific LUC/IC requirements are not being met, it is understood that the remedy may be reconsidered and that additional measures may be required to ensure the protection of human health and the environment. Hill AFB will maintain ultimate responsibility for remedy integrity. |

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| | Hill AFB will make prompt (as soon as practicable but no longer than 10 days after the Base becomes aware of the breach) notifications to regulators of: (1) any remedy deficiency or failure that presents or could present an actual risk to human health or the environment, (2) any activity that is inconsistent with the LUC/IC objectives or use restrictions, and (3) any other action that may interfere with the effectiveness of the LUCs/ICs. Notification also will state any corrective actions taken or planned to address such deficiencies or failures. Hill AFB will conduct annual monitoring (inspection) and submit to the United States EPA and the UDEQ an annual monitoring report summary describing the status of the controls and identifying any deficiencies and how they have been addressed. The annual monitoring reports will be used in preparation of the five-year review to evaluate the effectiveness of the remedy.<br><br>Hill AFB will notify the EPA and UDEQ 45 days in advance of any proposed land use changes that are inconsistent with LUCs/ICs objectives. Hill AFB will provide notice to the EPA and UDEQ at least 6 months prior to any transfer or sale of Upper Area F so that the EPA and UDEQ can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective LUCs/ICs. If it is not possible for the facility to notify EPA and UDEQ at least 6 months prior to any transfer or sale, then the facility will notify EPA and UDEQ as soon as possible but no later than 60 days prior to the transfer or sale of any property subject to LUCs/ICs. In addition to the land transfer notice and discussion provisions above, Hill AFB further agrees to provide EPA and UDEQ with similar notice, within the same time frames, as to federal-to-federal transfer of property. Hill AFB shall provide a copy of executed deed to EPA and UDEQ.<br><br>Hill AFB will not modify or terminate LUCs/ICs, implementation actions, or modify land use without approval by the EPA and UDEQ. Hill AFB shall seek prior concurrence before any anticipated action that may disrupt the effectiveness of the LUCs/ICs or any action that may alter or negate the need for LUCs/ICs. |
| **Progress Since Last FYR** | Operable Unit 13 was first identified in 2006 and was not covered by the 2003 five-year review. The non time-critical removal action being conducted at OU 13 is in progress and anticipated to be completed in 2008. |

Table OU 13-2

# Chronology of Site Events OU 13

*2008 Five -Year Review*

*Hill Air Force Base, Utah*

| Operable Unit | Site ID | Event Month | Event Year | Event | Event Comments | Reference Name |
|---|---|---|---|---|---|---|
| | | | Mid 1970's | Housing complex construction. | Approximately 100 residential units (50 duplexes), youth center, and communal areas (e.g., playgrounds and parks) constructed in the mid-1970s, | |
| | | 7 | 1987 | Hill Air Force Base (AFB) placed on the National Priorities List (NPL) | The U.S. EPA placed Hill Air Force base (AFB) on the NPL under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). | Remedial Investigation Report Operable Unit 5 Sites SS17, SD16 Volume 1 - Text |
| 13 | Area F | 9 | 2003 | Five-Year Review | OU 13 was identified in 2006 and was not covered by the Second Five-Year Review | |
| 13 | Area F | | 2005 | Military housing privatized at Hill AFB | In 2005 the Department of Defense (DoD) privatized the military housing at Hill AFB. | |
| 13 | Area F | | 2006 | Renovations to some of the structures at Upper Area F began. | The military housing developer, Boyer Hill Military Housing L.C. (BHMH), agreed to an aggressive development plan to be implemented within the first six years of their lease. In 2006, BHMH began renovations to some of the structures at Upper Area F, which included demolition, site grading, and reconstruction of selected units. During renovation activities, soil within the housing complex was sampled and analyzed for pesticides, which are known to have been used in the area. | |
| 13 | Area F | 2 | 2007 | Base Housing Complex Soil Investigation Phase I | Phase I of the investigation was performed in late February and early March 2007 following a quasi-random sampling approach. The main objective of Phase I was to provide screening data for the entire housing area to define the extent of polychlorinated biphenyl (PCBs) in surface soil (i.e., 0.0 to 0.5 feet bgs) so that subsequent investigations could be designed. | Final Base Military Housing Upper Area F PCB Soil Investigation Summary Report, Hill Air Force Base, Utah July 2007 |
| 13 | Area F | 3 | 2007 | Base Housing Complex Soil Investigation Phase II | Phase II of the investigation was performed between March and June 2007. The investigations conducted during Phase II followed a defined systematic approach for collection of soil samples, expanding off of the data results from Phase I investigations. | Final Base Military Housing Upper Area F PCB Soil Investigation Summary Report, Hill Air Force Base, Utah July 2007 |
| 13 | Area F | 7 | 2007 | Base Housing Complex Soil Investigation Summary | A summary of the analytical results from the Phase I and II investigation identified six areas where PCB contamination exceeds the PRGs. To prevent human exposure, it was recommended that these six areas (totaling approximately 17,830 square feet) be included for future remedial actions. | Final Base Military Housing Upper Area F PCB Soil Investigation Summary Report, Hill Air Force Base, Utah July 2007 |
| 13 | Area F | 8 | 2007 | Draft Action Memorandum for PCBs Removal Action at Upper Area F | The purpose of this Action Memorandum is to request and document approval of the proposed removal action described herein for Upper Area F of the Base Military Housing at Hill AFB, Utah. The purpose of the proposed response action was to mitigate threats to human health posed by the presence of PCB contaminated soil at six locations in Upper Area F. | Final Action Memorandum for Polychlorinated Biphenyls Removal Action at Upper Area F of the Residential Military Housing, Hill Air Force Base, Utah September 2007 |

**Notes**

| | |
|---|---|
| AFB | Air Force Base |
| BHMH | Boyer Hill Military Housing L.C. , |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| EPA | United States Environmental Protection Agency |
| NPL | National Priority List |
| OU 13 | Operable Unit 13 |
| PCB | polychlorinated biphenyl |
| PRGs | Preliminary Remediation Goals |

Table OU 13-3
Operable Unit 13
Five-Year Review Process

Reviewer: Victor Martinez

| | |
|---|---|
| **Introduction** | This 2008 five-year review for Hill AFB has been conducted in accordance with the EPA's Comprehensive Five-Year Review Guidance dated June 2001 (**EPA, 2001**). Administrative and community involvement components of the five-year review are described in **Section 2.0** of this report for the overall five-year review. In addition, interviews were conducted with relevant parties. A site inspection of OU 13 was performed. Documents reviewed for OU 13 as part of the 2008 five-year review are provided in **Appendix C**. Relevant site documents and applicable data covering the period of the five-year review were evaluated. The site interviews, site inspection, and data review are further discussed in the following sections. |
| **Interviews** | An interview for OU 13 was conducted with Ray Spencer/ Site Manager, Investigation and Remedial Action Planning. Mr. Spencer provided responses via telephone on December 13, 2007. A copy of the Interview Record Form is provided in **Appendix D**.<br><br>Mr. Spencer indicated that he was pleased overall with the work performed so far at OU 13. The initial scope-of-work for the remediation had been completed as planned. However, he stated that two small areas, identified based on confirmation sampling, still required remediation. The removal action project had run out of funding and the end of the construction season (due to weather) had been reached. Mr. Spencer stated that the additional work was planned for the Spring of 2008.<br><br>Mr. Spencer stated that he did not think there were a lot of problems encountered during the removal action remediation at OU 13. Seven of the 16 families affected by the work (residents living within 40 feet of an excavation) accepted the relocation offer. He indicated there was some inconvenience associated with living at or near a construction site. Mr. Spencer indicated that he received no complaints during the work. The contractor performing the work had a good public relations plan in place to handle the resident's issues and concerns related to the project. He also mentioned that Hill AFB performed a good deal of public relations work as part of the removal action. Information fairs were held. He specifically mentioned that these were attended by an expert, Dr. Philips from the University of Colorado, in the area of risk assessment to discuss these issues with residents.<br><br>Mr. Spencer indicated that when the remediation began, they did not know the complete extent of the areas requiring excavation. This was anticipated though. The initial sampling efforts were performed to provide an estimate of the extent for purposes of bidding the project and designing the initial excavation areas. The final extent of each excavation was based on the confirmation sampling results collected during the remediation work. Nothing occurred that was unanticipated.<br><br>Mr. Spencer stated that underground utilities presented some problems during completion of the remediation work. There were more utilities present than expected, and some buried utilities were found that they did not know about. There was also a buried high voltage cable running to a transformer that was not properly protected by today's standards (placed in conduit or cement). This required scheduling a power outage to allow for the work associated with this excavation to proceed safely. Soil requiring excavation around all utilities had to be dug by hand to protect the utilities. Due to the number of utilities, the schedule was delayed by approximately 5 days. |

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| | Mr. Spencer stated that there were no concerns regarding the implementation of a remedy at OU 13. The only issue, with the exception of the extra utilities, was that there were delays in the return of confirmation sampling results, which also delayed the schedule some. The schedule delays resulted in the project running out of time due to weather.<br><br>Mr. Spencer indicated that soil investigation for the RI will start in the early spring of 2008. A draft RI Report is scheduled for late 2008, with the final RI Report anticipated in 2009.<br><br>Mr. Spencer mentioned that he was not aware of any community concerns. He stated that the local residents were good with what was being done. The additional work will be communicated to the residents in the form of a newsletter that will be mailed out prior to the start of the work. Also, a project website was set up to communicate work activities to the residents, and a phone number was made available to the residents to answer any questions during the work.<br><br>Mr. Spencer stated that he hoped to finish up the work in the spring, and to complete the RI on schedule. He indicated that there will be ongoing LUCs at OU 13. This will require CEVR to support the private developer (Boyer-Hill) in implementation of the LUCs. A Memorandum of Understanding is being drafted to address this. When additional construction/demolition is performed, there will be the need to perform addition sampling. No samples have been collected under the streets, house, or along utility corridors. Some sampling in these areas is planned as part of the RI. |
| **Site Inspection** | The site inspection for OU 13 was conducted on September 27, 2007. The completed site inspection checklist is provided in **Appendix E**.<br><br>Based on the site inspection, OU 13 appears to be well maintained. No signs of vandalism were observed onsite. Temporary fencing around excavation sites is present and in good condition.<br><br>Excavation and disposal activities are taking place at OU 13. Removal Action Site-Specific Health and Safety Plan and Contingency plan/emergency response plan regarding are readily available. Operation and maintenance and Occupational Safety and Health Administration (OSHA) training records are available and maintained by CH2M HILL Human Resources.<br><br>Institutional controls are adequate at OU 13. Hill AFB performs an annual evaluation of the ICs in place for the Base. This includes verification of orders, leases, gw use restrictions, and inspections of signage, fences, and monitoring wells. An annual land-use controls report is prepared documenting the results of this work. Operable Unit 13 should be included in the assessment for 2008. The ICs included in the draft Action Memorandum provide for land use controls, soil management, property redevelopment, construction, and IC monitoring and enforcement.<br><br>The site inspection checklist addressed four discussion topics. These discussion topics are presented below, followed by responses and general observations based on the site inspection. |

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| | (1) Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).<br><br>The draft Action Memorandum to perform the time-critical removal action contained four clean-up goals: (1) prevent human exposure to PCB contaminated soil at concentrations greater than or equal to 1 ppb between ground surface and a depth of 2 feet below ground surface (bgs); (2) prevent human exposure to PCB contaminated soil at concentrations greater than or equal to 1 ppb but less than 10 ppb between a depth of 2 feet bgs and 3 feet bgs; (3) prevent human exposure to PCB contaminated soil at concentrations greater than 10 ppb between a depth of 3 feet bgs and 4 feet bgs; and, (4) ensure public safety and minimize impacts to the community during soil removal activities. The remedy includes excavation and disposal of PCB contaminated soils at a permitted disposal facility.<br><br>Institutional controls are planned to maintain the integrity of the remedy and to restrict access to portions of the site remedy.<br><br>(2) Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.<br><br>No O&M is required for OU 13. Monitoring, implementation, and enforcement of the ICs will be necessary O&M for OU 13.<br><br>(3) Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.<br><br>No O&M is required for OU 13; the time-critical removal action is ongoing.<br><br>(4) Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.<br><br>No O&M is required for OU 13; the time-critical removal action is ongoing. |
| **Data Review** | The time-critical removal action is not yet complete for OU 13. Upon completion, a RI/FS should be completed which incorporates the data collected during the removal action for use in remedy selection. |

Table OU 13-4
# Operable Unit 13
# Five-Year Review Technical Assessment

Reviewer: Victor Martinez

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| **Introduction** | The five-year review must determine whether the remedy at a site is protective of human health and the environment. The Unites States EPA guidance describes three questions used to provide a framework for organizing and evaluating data and information and to ensure all relevant issues are considered when determining the protectiveness of a remedy (**EPA, 2001**). However, a remedy has not yet been implemented for OU 13. |
| **Question A.** | **Is the remedy functioning as intended by the decision documents?**<br><br>A time-critical removal action was initiated in 2007 to mitigate threats to human health posed by the presence of PCB contaminated soil at six locations in Upper Area F. The removal action goal is to remove PCB concentrations in soil that present an unacceptable risk to human health. The draft Action Memorandum which describes the time-critical removal action includes four clean-up goals: (1) prevent human exposure to PCB contaminated soil at concentrations greater than or equal to 1 ppb between ground surface and a depth of 2 feet bgs; (2) prevent human exposure to PCB contaminated soil at concentrations greater than or equal to 1 ppb but less than 10 ppb between a depth of 2 ft bgs and 3 feet bgs; (3) prevent human exposure to PCB contaminated soil at concentrations greater than 10 ppb between a depth of 3 feet bgs and 4 feet bgs; and, (4) ensure public safety and minimize impacts to the community during soil removal activities (**HILL AFB CEVR, 2007**).<br><br>The initial scope-of-work for the time-critical removal action has been completed as planned. Two additional areas identified based on confirmation sampling need to be addressed. Additional work to complete the removal action is planned for 2008. A report describing the work completed is not yet available. A determination of whether or not the removal action is functioning as intended can not be made until the removal action is completed and results documented. |
| **Question B.** | **Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?**<br><br>Because a final remedy has not yet been selected, these issues were not evaluated as part of this five-year review. The RI/FS process should be used to confirm the assumptions made in selection of goals for the non-time critical removal action, and these assumptions used to select final RAOs in a ROD. |
| **Question C.** | **Has any other information come to light that could call into question the protectiveness of the remedy?**<br><br>No information has come to light that could call into question the protectiveness of the intended remedy. However, a full determination can not be made until the final remedy is selected. |

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| **Institutional Controls** | Institutional controls are generally defined as non-engineered instruments such as administrative and legal tools that do not involve construction or physically changing the site, and that help minimize the potential for human exposure to contamination and/or protect the integrity of a remedy by limiting land and/or resource use (**EPA, 2005**). Institutional controls can be used for many reasons including restriction of site use, modifying behavior, and providing information to people (**EPA, 2000**). Institutional controls may include deed notices, easements, covenants, restrictions, or other conditions on deeds, and/or groundwater and/or land use restriction documents (**EPA, 2001**). The following paragraphs describe ICs implemented at OU 13, the potential affect of future land use plans on ICs, and any plans for changes to site contamination status.<br><br>Types of ICs in Place at the Site:<br><br>The ICs included in the draft Action Memorandum provide for land use controls, soil management, property redevelopment, construction, and IC monitoring and enforcement (**HILL AFB CEVR, 2007**). Annual LUCs and ICs audits and inspections will be used to determine conformance to the LUCs/ICs plan.<br><br>Effects of Future Land Use Plans on ICs:<br><br>No effects on ICs due to future land use were identified during this five-year review at OU 13.<br><br>Plans for Changes to Site Contamination Status:<br><br>No changes to site contamination status at OU 13 are anticipated in the near future. |
| **Summary of the Technical Assessment** | The initial scope-of-work for the time-critical removal action has been completed as planned. Two additional areas identified based on confirmation sampling need to be addressed. Additional work to complete the removal action is planned for 2008. Institutional controls will be implemented in accordance with the Action Memorandum.<br><br>Based on the description of the planned removal action and the results of the five-year review interviews, it appears the removal action, once completed, will be protective of human health and the environment. A final remedy will need to be selected following completion of the RI/FS for this OU. |

Table OU 13-5
## Operable Unit 13
## Technical Assessment Summary for OU 13

Reviewer: Victor Martinez

| Site ID | Remedy Description | Technical Assessment | | | Protectiveness | Next Five-Year Review |
|---|---|---|---|---|---|---|
| | | Question A* | Question B* | Question C* | | |
| SS112 | Time-critical removal action consisting of the excavation of PCB contaminated soils and disposal of the soils | NA | NA | NA | Removal actions performed are considered protective of human health and the environment in the short term, pending selection of a final remedy | 2013 |
| OU 13 | Time-critical removal action consisting of the excavation of PCB contaminated soils and disposal of the soils | NA | NA | NA | Protective of human health and the environment in the short term, pending selection of a final remedy | 2013 |

*Question A: Is the remedy functioning as intended by the decision documents?
*Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objective (RAOs) used at the time of the remedy still valid?
*Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
NA = Not Applicable, pending completion of the time-critical removal action and selection of a final remedy.

Table OU 13-6

# Operable Unit 13
# Five-Year Review Issues, Recommendations and Follow-Up Actions, and Protectiveness Statement

Reviewer: Victor Martinez

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| **Issues** | Based on the document review, data review, site inspection, interviews, and the technical assessment, two issues are identified in the 2008 five-year review for OU 13:<br><br>1) The CEVR site manager for OU 13 indicated in the 2008 five-year review interview that the initial scope-of-work for the time-critical removal action consisting of the excavation of PCB contaminated soils and disposal of the soils at an approved facility had been completed as planned. However, he stated that two small areas, identified based on confirmation sampling, still require remediation. The site manager stated that additional work was planned for the spring of 2008. The ICs included in the draft Action Memorandum provide for land use controls, soil management, property redevelopment, construction, and IC monitoring and enforcement, and are currently in place.<br><br>2) The CEVR site manager also indicated that a RI to confirm the extent of contamination remaining following the time-critical removal is planned for 2008. The RI and subsequent FS will support selection of a final remedy. |
| **Recommendations and Follow-Up Actions** | As described in the previous section, two issues have been identified in this 2008 five-year review for OU 13. To address these issues, the following recommendations and follow-up actions have been defined:<br><br>1) Complete the time-critical removal action for PCB contaminated soil and document the findings in a removal action report.<br><br>2) Complete the RI as planned to confirm the extent of contamination remaining following the time-critical removal action, and proceed with remedy selection as appropriate. |
| **Remedial Timeframe** | Not applicable. A remedy has not yet been selected for OU 13. |
| **Protectiveness Statement** | **The removal actions being performed at the site will be protective of human health and the environment once the removal action is completed.** Enforcement of ICs at OU 13 provides protectiveness in the short-term pending completion of the removal action and final remedy selection. ICs and land-use controls are assessed annually. |
| **Next Five-Year Review** | Remedial actions at OU 13 will be reviewed in the next five-year review for Hill Air Force Base to be completed during or before September 2013. |


0 150 300

Feet

1 inch equals 150 feet

**LEGEND**

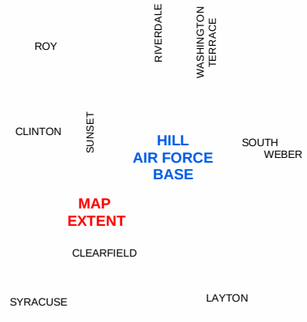
**SAMPLE CATEGORY**
**(Indicated by symbol size)**

- Surface soil sample (0.0 to 0.5 feet bgs)
- Shallow subsurface soil sample (0.5 to 2.0 feet bgs)
- Deep subsurface soil sample ( > 2.0 feet bgs)

**SAMPLE CONCENTRATION**
**(Indicated by symbol color)**

- PCBs > 10 ppm
- PCBs 1 ppm to 10 ppm
- PCBs < 1 ppm
- PCBs not detected
- Excavate to 2 ft bgs
- Excavate to 4 ft bgs

| | |
|---|---|
| DRMO | Defense Reutilization Marketing Office |
| bgs | Below ground surface |
| ppm | Parts per million |
| PCB | Polychlorinated biphenyl |




75th AIR BASE WING

FIGURE OU 13 - 1
**SITE FEATURES OF OPERABLE UNIT 13**
2008 FIVE-YEAR REVIEW
IRP SITE: SS112
HILL AIR FORCE BASE, UTAH

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Table IAP-1
# Indoor Air Sampling and Mitigation Program Background Information

Reviewer: Victor Martinez

**Introduction**

The Basewide indoor air sampling program and installation of indoor air mitigation systems (IAP) was developed to address the migration of VOCs detected in the shallow groundwater associated with Hill AFB into overlying residences. There are several OUs where portions of the contaminated groundwater plumes underlie residential communities at less than 25 feet bgs. Due to direct impacts to off-Base residences, Hill AFB considered the installation of indoor air mitigation systems to be "Time Critical" under the Superfund Removal Procedures Action Memorandum Guidance (EPA/540/P-90/004, 1990) (**MWH, 2004**). The indoor air sampling program started in OU 12 and was expanded to include all OUs.

The off-Base portions of the OUs at Hill AFB have been divided into distinct analytical areas for the Basewide indoor air sampling program. These areas were determined by evaluating the detectable concentrations of contaminants in underlying groundwater plumes using data from January 2000 to January 2004 (**MWH, 2004**). A Mitigation Action Level (MAL) list of chemicals was then developed. Hill AFB MALs were derived from generic screening levels from the EPA guidance document, Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils or from background concentrations. The Hill AFB MALs are discussed in detail in the Final Basewide Air Sampling and Analysis Plan Indoor Residential Air Sampling. (**MWH, 2004**).

Indoor air mitigation systems were initially installed at off-Base residences overlying the OU 12 VOC plume at Hill AFB in late 2002. Indoor air at residences was impacted by VOC migration from the contaminated shallow groundwater to the vapor phase at OU 12. The long-term applicability of these indoor air mitigation systems was not completely evaluated in the preparation of the FS and ROD for OU 12.Indoor air was not evaluated as part of the FS, because it is being addressed under the Basewide indoor air sampling program. In an effort to identify and subsequently mitigate potential risks to off-Base residents by this exposure pathway, Hill AFB established the BASAP in 2003 (**Hill AFB, 2003**). As of September 2007, a total of 92 mitigation systems were installed in homes at seven OUs to address indoor air exposures (see **Table IAP-1a**). The most common type of mitigation system installed was the sub-slab depressurization system. Other types of mitigation systems have been installed and are discussed in the Remedy Implementation section. (**MWH, 2005**).

A list of the documents reviewed for the IAP as part of the 2008 five-year review is provided in **Appendix C**.

**Table IAP-1a**

| Operable Unit (OU) | Number of Analytical Areas Identified per OU | Mitigation Systems Installed |
|---|---|---|
| OU 1 | 1 | 1 |
| OU 2 | 1 | 1 |
| OU 3 | None | None |
| OU 4 | 1 | None |
| OU 5 | 5 | 13 |

| | Operable Unit (OU) | Number of Analytical Areas Identified per OU | Mitigation Systems Installed |
|---|---|---|---|
| | OU 6 | 1 | 5 |
| | OU 7 | None | None |
| | OU 8 | 3 | 52 |
| | OU 9 | 1 | None |
| | OU 10 | 1 | 1 |
| | OU 11 | None | None |
| | OU 12 | 3 | 19 |
| **Site Chronology** | Provided separately. See **Table IAP-2** | | |
| **Background** | **Physical Characteristics.** Hill AFB is located in northern Utah, approximately 25 miles north of Salt Lake City and 5 miles south of Ogden. The Base occupies approximately 6,700 acres in Davis and Weber counties. The Base is bounded on the north by the Davis-Weber Canal, a privately owned irrigation canal, and on the east by private property. Interstate 15 and State Route 193 form the western and southern boundaries of the Base, respectively (**Hill AFB, 2003**). The cities adjacent to Hill AFB are Roy, Riverdale, South Weber, Layton, Clearfield, Sunset, and Clinton. The plateau-like bench, or terrace, on which Hill AFB is located is a remnant of the Weber River Delta that formed as the river entered ancient Lake Bonneville and Pre-Bonneville lakes. Fluctuations of the lake level, variations in the entry point of the Weber River into ancient Lake Bonneville, and the depositional environments of these formations combined to produce a complex stratigraphy beneath Hill AFB characterized by interlayering of lenticular, laterally discontinuous gravel, sand, and clay beds. Areas of groundwater contamination identified by the Installation Restoration Program (IRP) at Hill AFB have been organized into 12 OUs. Volatile organic compounds have been detected in the shallow groundwater below the Base and surrounding communities. Several of the Hill AFB OUs have portions of contaminated groundwater plumes less than 25 feet bgs that underlie residential communities. Previous indoor air quality sampling in areas of shallow groundwater indicates that there is a potential for vapor intrusion into residential indoor air due to the types of contaminants present in the shallow groundwater overlaying residential areas (**MWH, 2004**). | | |

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| | **Land and Resource Use.** Cities adjacent to Hill AFB are Roy, Riverdale, South Weber, Layton, Clearfield, Sunset, and Clinton. Land use within the cities surrounding Hill AFB is primarily residential, light industrial, commercial, and agricultural (**Hill AFB, 2003**). Hill AFB is included in the Weber Delta Subdistrict of the East Shore hydrologic region. The Sunset and Delta Aquifers are considered the principal aquifers of the East Shore area. They occur at depths of approximately 250 to 400 feet and 500 to 700 feet bgs, respectively (**Hill AFB, 1998**). Both aquifers are used by Hill AFB and surrounding communities as domestic water supplies. The Sunset and Delta Aquifers are classified as Class I – Irreplaceable Source of Drinking Water or Class IIA – Current Source of Drinking Water (**Hill AFB, 1995**). Shallow groundwater also occurs in floodplain deposits and regionally in the valley lowlands within a few feet of the ground surface. Many seeps and springs exist at various locations within the communities surrounding the base (**Hill AFB, 1998**). The Weber River and the Davis-Weber Canal are located east to the Base boundary and are the primary surface water bodies. The Davis-Weber Canal, a privately owned irrigation canal, is used each year from April to October (**Hill AFB, 2003**). |
| | **History of Contamination.** Potential indoor air contamination in residences overlying Hill AFB VOC plumes is a result of VOCs migrating from groundwater to indoor air. The principal route of contaminant migration in groundwater from on-Base source areas to off-Base areas is by flow through the shallow groundwater system. In general, contaminants migrate both vertically and horizontally within the groundwater. However, low-permeability stratigraphic units beneath Hill AFB impede vertical contaminant migration to the deeper confined aquifers used for the drinking water supply. VOCs are the primary contaminants in groundwater at Hill AFB, the most prevalent of which is TCE. Other VOCs detected above their MCLs at Hill AFB include carbon tetrachloride, chloroform, 1,1- DCA, 1,2-DCA, 1,1-DCE, cis-1,2-DCE, trans-i ,2-DCE, PCE, 1,1,1 - TCA), and vinyl chloride. The OUs 2, 4, 5, 6, 8, 9, 10, and 12 plumes are defined by TCE contamination detected above the MCL of 5 µg/L. The OU 1 plume is defined by cis-1,2-DCE contamination detected above the MCL of 70 µg/L, while the on-Base OU 11 plume is defined by methyl tertiary butyl ether (MTBE) detected above a concentration of 5 µg/L. Also depicted on Figure 2 is the approximate depth to groundwater at Hill AFB and the surrounding areas (**Hill AFB, 2003**). |
| | **Initial Response.** Through August 2003, indoor air mitigation systems had been installed at nine residences overlying the OU 12 VOC plume. These systems were implemented to reduce indoor air concentrations of TCE and mitigate indoor air quality issues associated with groundwater contamination at OU 12. No indoor air mitigation systems were installed at other operable units at Hill AFB at that time. Performance monitoring of installed mitigation systems was planned to be conducted quarterly for the first year, semi-annually for the second year, and then annually for two additional years, and then on a five-year review cycle, on the condition that sample results remain below MALs established in the Basewide Air Sampling and Analysis Plan Indoor Residential Air Sampling (**Hill AFB, 2003**). Hill AFB has continued annual sampling in all cases as a matter of practice with no specified timeframe for further reduction in frequency. |
| | **Basis for Taking Action.** Contaminant concentrations in the indoor air of some residences exceed MALs, which are derived from generic screening levels from the EPA Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soil or from background concentrations. The owners or occupants of residences where indoor air concentrations exceed the MALs have the option to have an indoor air mitigation system installed in their homes. The Action Memorandum stated that there were no known threats to the environment from air exposure pathways that were not being already addressed under individual operable unit investigations (**Hill AFB, 2003**). |
| **Remedial Actions** | **Remedy Selection (i.e., ROD/ESDs)**. Currently a ROD has not been signed to address residential indoor air quality issues due to vapor intrusion of VOCs from groundwater at off-Base locations. However, in 2003, Hill AFB established the Basewide Residential Sampling Program in an effort to identify and subsequently mitigate any potential risks to off-Base residents by this exposure pathway in all OUs, including residences within a specified radius of the groundwater |

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| | contamination plume footprint. Hill AFB has performed time-critical removal actions at off-Base residences which include installation of indoor air mitigation systems based on active soil depressurization systems to address indoor air quality issues. Mitigation systems installed will not interfere with existing or potential future remedial alternatives to address groundwater contamination that may be considered in the FS or ROD or any remedies implemented under existing OU RODs (**Hill AFB, 2003**). Hill AFB is currently considering addressing residential indoor air as a separate OU. |
| | **Remedy Implementation.** As of September 2007, a total of 92 mitigation systems were installed in homes at seven OUs Basewide. No systems have been installed at OUs 4 and 9 because no plume-related VOCs have been detected in indoor air. Sub-slab depressurization systems, designed to draw soil gas from beneath the slab of the home for discharge at or above the roofline, were the most common mitigation systems installed in homes. Additional types of mitigation systems installed include crawl space sub-membrane depressurization systems, systems comprised of a combination of typical sub-slab depressurization and crawl space sub-membrane depressurization components, and a heat-recovery ventilation system (**MWH, 2005**).<br><br>Every year as part of the BASAP, residences overlying or near contaminated groundwater are contacted and solicited for air sampling. Potential indoor air sampling areas are identified based on groundwater sampling at individual OUs and subsequent plume boundary mapping. Every year as part of this ongoing program, residences overlying or near contaminated groundwater are contacted and solicited for air sampling in their residences. Between 1 July 2005 and 31 March 2006, Hill AFB contacted approximately 2,600 off-Base residences for sampling, with a positive response rate of approximately 21 percent (**MWH, 2006**).<br><br>Two database interfaces are in place to track resident communications and sample information. The Residential Tracking interface is used to track, among other things, sampling appointments, contacts, and communications with residents. This interface has been in use since the beginning of the BASAP. The Inventory Entry interface replaces the Indoor Air Sampling Inventory Form and is used to record home construction, household product, weather, and sample placement information. This interface was initially used for database entry of information on the Indoor Air Sampling Inventory Forms after the sampling events; however since October 2005, air sampling technicians have been entering information directly into the database while in the field through the use of notebook computers (**MWH, 2006**).<br><br>There are seven basic types of sample collection: initial, follow-up, verification, quarterly, semi-annual, annual, and performance. The first indoor air sample collected at a residence as part of the BASAP is considered the initial sample. Residences with no detections of target compounds in the initial sample are offered follow-up sampling on an annual basis to confirm that conditions have not changed. Verification samples are collected at some residences to verify previous questionable or anomalous sample results. Residences in which target VOCs have been detected are encouraged to participate in sample frequency cycles such as quarterly, semi-annual, or annual cycles. Residences in which vapor removal systems have been installed typically participate in quarterly, semi-annual, or annual performance sample cycles (**MWH, 2006**). |

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| | **Operations and Maintenance.** After the sub-slab depressurization system is complete and the system has been handed over to the homeowner, the property resident(s) becomes responsible for monitoring proper system operation and requesting maintenance when necessary. The resident(s) are to be familiar with recognizing system failure and faulty operation and is responsible for prompt notification of the installation or maintenance subcontractor. The resident(s) is also responsible for keeping the system continuously supplied with sufficient power to operate the system and for monitoring the condition of the carbon monoxide detector. However, Hill AFB has tasked their O&M contractor to perform annual inspections of the vapor removal systems to ensure they are operating properly and to complete any maintenance needs that have not been identified previously. Hill AFB is also responsible for maintaining Access Agreements, conducting Performance Sampling at the residence, and responding to resident questions and concerns. Hill AFB is also responsible for post-warranty system and carbon monoxide detector upgrades and component replacement. The responsibility of the homeowner/resident(s) is to be passed along every time the property is sold or new residents occupy the property. Homeowners are to notify Hill AFB when they sell their property, so that Hill AFB can continue communication and Access Agreements with the new homeowners/resident(s) (**MWH, 2004**). |
| **Progress Since Last FYR** | As of September 2007, Hill AFB has indicated that a total of 92 indoor air mitigation systems have been installed at off-Base residences at OUs 1, 2, 5, 6, 8, 10, and 12. No systems have been installed in OUs 4 and 9 because no plume-related VOCs have been detected in indoor air. Sub-slab depressurization systems were the most common mitigation systems installed in homes. Additional types of mitigation systems installed include crawl space sub-membrane depressurization systems, systems comprised of a combination of typical sub-slab depressurization and crawl space sub-membrane depressurization components, and a heat-recovery ventilation system. Sump covers were also installed at residences, typically in conjunction with sub-slab depressurization systems (**MWH, 2005**).The BASAP is ongoing and the collection of additional indoor air and water samples at residential locations is planned (**MWH, 2006**). |

Table IAP-2
Chronology of Site Events
Basewide Indoor Air Program
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Event Month | Event Year | Event | Event_Comments | Reference_Name |
|---|---|---|---|---|---|
| Basewide | 9 | 2003 | Action Memorandum | Action Memorandum for Time-Critical Removal Actions for Indoor Air signed. The purpose of this Action Memorandum was to request and document approval of time-critical removal actions at Hill Air Force Base (AFB), Utah. The time-critical removal actions involved the Basewide installation of indoor air mitigation systems in residences overlying VOC plumes originating from Hill AFB. Due to direct impacts to off-Base residences, Hill AFB considered the installation of these indoor air mitigation systems to be "Time Critical" under the Superfund Removal Procedures Action Memorandum Guidance (EPA/540/P-90/004, 1990). | Final Action Memorandum for Time-Critical Removal Actions for Indoor Air, Hill Air Force Base, Utah, September 2003 |
| Basewide | 1 | 2004 | Indoor Residential Air Sampling | A Basewide Air Sampling and Analysis Plan for Indoor Residential Air Sampling (BASAP) was prepared to standardize sample collection and analysis procedures for all Hill Air Force Base (Hill AFB), Utah indoor air sampling projects. The BASAP incorporated lessons learned and method development from air sampling programs that were currently being conducted at OUs 5 and 12 and from recommendations from industry experts. | Final Basewide Air Sampling and Analysis Plan Indoor Residential Air Sampling, Hill Air Force Base, Utah, January 2004. |
| OU 1 | | 1994-1995 | Indoor Residential Air Sampling | Indoor residential air sampling was conducted at 2 residences for four to five rounds in 1994 and 1995. cis-1,2-DCE was detected in both residences. | Final Basewide Air Sampling and Analysis Plan Indoor Residential Air Sampling, Hill Air Force Base, Utah, January 2004. |
| OU 4 | | | Indoor Residential Air Sampling | Indoor residential air sampling conducted at one home. The off-Base area impacted by groundwater contamination at OU4 is predominantly agricultural. | Final Basewide Air Sampling and Analysis Plan Indoor Residential Air Sampling, Hill Air Force Base, Utah, January 2004. |
| OU 5 | | 1993-1994 | Indoor Residential Air Sampling | Indoor residential air sampling was conducted in 1993 and 1994 at 12 residences and one school. | Final Basewide Air Sampling and Analysis Plan Indoor Residential Air Sampling, Hill Air Force Base, Utah, January 2004. |
| OU 5 | | 2000 - 2002 | Indoor Residential Air Sampling | From 2000 to 2002, 35 residential locations were sampled (included 4 locations sampled in 1993 and 1994). PCE and chloroform were both detected at two locations, and 1,1,1-TCA was detected at five locations sampled between 2000 and 2002. | Final Basewide Air Sampling and Analysis Plan Indoor Residential Air Sampling, Hill Air Force Base, Utah, January 2004. |
| OU 6 | | 1992-1994 | Indoor Residential Air Sampling | Indoor residential air sampling was conducted at 13 residences (10 within and 3 outside the groundwater plume) between 1992 and 1994. Chloroform was detected in seven residences, 1,1,1-TCA was detected in 10 residences, and TCE was detected in seven residences. | Final Basewide Air Sampling and Analysis Plan Indoor Residential Air Sampling, Hill Air Force Base, Utah, January 2004. |
| OU 8 | | 1997 | Indoor Residential Air Sampling | Indoor residential air sampling was conducted in 1997 at two residences. TCE was detected in one of the residences. | Final Basewide Air Sampling and Analysis Plan Indoor Residential Air Sampling, Hill Air Force Base, Utah, January 2004. |
| OU 8 | | 2000 | Indoor Residential Air Sampling | TCE was detected in a residence with a previously flooded basement. | Final Basewide Air Sampling and Analysis Plan Indoor Residential Air Sampling, Hill Air Force Base, Utah, January 2004. |
| OU 8 | | 2001 | Indoor Residential Air Sampling | Eight residences were sampled as part of the 2450 North Street Area Investigation and at 12 other residences as part of a Baseline Risk Assessment. TCE was detected in nine residences, 1,2-DCA was detected in two residences, and vinyl chloride was detected in one residence. | Final Basewide Air Sampling and Analysis Plan Indoor Residential Air Sampling, Hill Air Force Base, Utah, January 2004. |

Table IAP-2
Chronology of Site Events
Basewide Indoor Air Program
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Event Month | Event Year | Event | Event_Comments | Reference_Name |
|---|---|---|---|---|---|
| OU 8 | 3 | 2006 | Post-ROD Study | Investigations were performed at OU 8 involving CPT and direct-push groundwater sampling at on- and off-Base locations of OU 8 at Hill AFB. The primary objective of the investigations was to delineate the current extent (both horizontal and vertical) of TCE and 1,2-DCA contamination in groundwater in specific areas where current data were not adequate (e.g., sparse data, old data, insufficient vertical sampling). TCE and 1,2-DCA were detected in indoor air in several residences that were not located above the OU 8 TCE and 1,2-DCA groundwater plumes as they were previously defined based on data from 2003 and earlier . Results of samples collected at U8-9226 and U8-9227, located between U8-207 and U8-208, indicated that contaminants were not present above MCLs at these depths, as previous investigations had indicated. However, a sample collected at 111 ft bgs at U8-9228, located between U8-201 and U8-207, resulted in a TCE detection of 33 µg/l. 1,2-DCA was detected at a concentration of 14 µg/l in this sample as well. | Operable Unit 8 CPT and Groundwater Detailed Investigations Summary, Hill Air Force Base, Utah, March, 2006. |
| OU 8 | 5 | 2007 | Post-ROD Study | OU 8 CPT and Groundwater Investigation in support of the Indoor Air Program completed. The primary objective of the investigations described in this summary was to delineate the current extent (both horizontal and vertical) of VOC contamination in groundwater in support of the Basewide Residential Indoor Air Sampling Program. These investigations were performed under Task Orders 139 and 167 in the winter of 2006 (10 January through 7 February) and in the fall of 2006 (11 through 20 October), respectively. TCE was detected above the MCL of 5 µg/l in the shallow samples collected at U8-9244 and U8-9245, which are located along 700 and 800 West, north of Antelope Drive. TCE was detected below the MCL in shallow samples collected from other locations on 700 and 800 West both north and south of Antelope Drive. TCE was also detected at concentrations below the MCL at U8-9252 and U8-9255 in the northwest portion of Robins Park. TCE was detected in only the shallowest samples collected during the TO 167 investigation, which were generally less than 20 ft bgs. At U8-9251, TCE was detected in the sample collected at 55 ft | Final Operable Unit 8 CPT and Groundwater Investigation in Support of the Indoor Air Program, Hill Air Force Base, Utah, May 2007. |
| OU 12 | | 2002 | Indoor Air Mitigation | Indoor air mitigation systems were installed at off-Base residences overlying the OU 12 VOC plume at Hill AFB in late 2002. Through August 2003, indoor air mitigation systems were installed at nine residences overlying the OU 12 VOC plume. | Final Basewide Air Sampling and Analysis Plan Indoor Residential Air Sampling, Hill Air Force Base, Utah, January 2004. |
| OU 12 | 9 | 2003 | Indoor Residential Air Sampling | Indoor residential air sampling was conducted at OU 12 since 2002. As of August 2003, 151 locations had been sampled, and TCE has been detected in twelve residences. | Final Action Memorandum for Time-Critical Removal Actions for Indoor Air, Hill Air Force Base, Utah, September 2003 |
| OUs 1, 2, 4, 5, 6, 8, 9, 10, and 12 | 11 | 2005 | Indoor Residential Air Sampling | Final Basewide Residential Sampling Data Summary Report 1 October 2003 through 30 June 2005 issued. The report presents a summary of analytical data collected as part of the Basewide Residential Sampling Program at Hill AFB from 1 October 2003 to 30 June 2005. Sampling of ambient air, soil gas, surface water, groundwater, and soil was performed at off-Base locations in the cities of Layton, Clearfield, Sunset, Clinton, Roy, Riverdale, and South Weber; and ambient air sampling was performed at the on-Base Patriot Hills housing area. The objectives of the residential field investigations were to identify residential locations where indoor air VOC concentrations exceed Hill AFB mitigation action levels (MALs) so that measures could be taken to reduce these concentrations in indoor air; to monitor the performance of the mitigative measures taken at residences; to characterize groundwater contamination with current residential exposure pathways; and to provide residents with the results of samples taken on their properties. | Final Basewide Residential Sampling Data Summary Report 1 October 2003 through 30 June 2005 Volume 1 of 3–Report and Appendices A, B, and C, Hill Air Force Base, Utah, November 2005. |

Table IAP-2
Chronology of Site Events
Basewide Indoor Air Program
*2008 Five-Year Review*
*Hill Air Force Base, Utah*

| Operable Unit | Event Month | Event Year | Event | Event_Comments | Reference_Name |
|---|---|---|---|---|---|
| | | | | Approximately 1,860 ambient air and soil gas samples were collected, the results of which are included in this report. VOCs were detected in the indoor air of approximately 49 percent of the homes, however it is unknown if all detected VOC concentrations were related to groundwater contamination from Hill AFB. Additional groundwater, surface water, and soil samples were collected from residential locations primarily upon request. | |
| OUs 1, 2, 4, 5, 6, 8, 9, 10, and 12 | 8 | 2006 | Indoor Residential Air Sampling | Final Basewide Residential Sampling Data Summary Report 1 July 2005 through 31 March 2006 issued. The report presents a summary of analytical data collected as part of the Basewide Residential Air Sampling Program at Hill Air Force Base (AFB) from 1 July 2005 to 31 March 2006. Sampling of residential ambient air, soil gas, water, and soil was performed at off-Base locations in the cities of Layton, Clearfield, Sunset, Clinton, Roy, Riverdale, and South Weber. Approximately 1,030 ambient air and soil gas samples were collected during the reporting period. In addition, surface water and soil samples were collected upon request from residential locations. VOCs were detected in the indoor air of approximately 33 percent of the homes sampled, however it is unknown if all detected VOC concentrations were related to groundwater contamination from Hill AFB. | Final Basewide Residential Sampling Data Summary Report 1 July 2005 through 31 March 2006 Report and Appendices A–D, Hill Air Force Base, Utah, August 2006. |

**Notes**
bgs: below ground surface
CPT: cone penetration testing
1,2-DCA: 1,2-Dichloroethane
1,1-DCE: 1,1-Dichloroethene
cis-1,2-DCE: cis-1,2-Dichloroethene
ft: feet
MCL: maximum contaminant levels
OU: Operable Unit
PCE: Tetrachloroethene
1,1,1-TCA: 1,1,1-Trichloroetane
TCE: Trichloroethylene
VOC: volatile organic compound
µg/l: microgram per liter

Table IAP-3
# Indoor Air Sampling and Mitigation Program
# Five-Year Review Process

Reviewer: Victor Martinez

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| **Introduction** | The 2008 five-year review for Hill AFB has been conducted in accordance with the EPA's Comprehensive Five-Year Review Guidance dated June 2001 (**EPA, 2001**). Administrative and community involvement components of the five-year review are described in **Section 2.0** of this report. In addition, interviews were conducted with relevant parties. Relevant site documents and applicable data covering the period of the five-year review were evaluated. Documents reviewed for the IAP as part of the 2008 five-year review are provided in **Appendix C**. The site interviews, site inspection, and data review are further discussed in the following sections. |
| **Interviews** | An interview for the IAP was conducted with CEVR program manager Jarrod Case. Mr. Case provided responses via electronic mail on December 17, 2007. A copy of the Interview Record Form is provided in **Appendix D**.<br><br>Mr. Case indicated in the interview that actions performed under the IAP have been significant since the 2003 five-year review. The Basewide IAP was instituted in October 2002 for off-Base communities impacted by shallow groundwater contamination. The sampling methods and guidelines for investigating vapor intrusion in off-base residences were established in the Basewide Air Sampling and Analysis Plan – Indoor Residential Air Sampling (**MWH, 2004**). Multiple residences impacted by vapor intrusion in the off-base communities surrounding Hill AFB have been identified through the indoor air sampling program, and the affected residences have had mitigation systems installed and unacceptable exposures eliminated.<br><br>In his interview, Mr. Case stated that there is no current or planned document that evaluates the effectiveness of the program. Vapor removal system effectiveness is determined on a case-by-case basis as systems are installed and performance indoor air samples collected. The nature of the residential mitigation systems differs from typical groundwater treatment/remediation systems in that the systems are either effective or not, there isn't a decrease in contaminant levels over time in a residence. Once the system is turned on, the exposure is removed. Mitigation systems will not be closed until groundwater contamination is remediated. |
| **Site Inspection** | A separate site inspection was not performed for the IAP. Site inspections were performed for each OU that included off-Base groundwater plumes. |

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| **Data Review** | Every year as part of the Basewide Air Sampling and Analysis Plan for Indoor Residential Air Sampling (BASAP), residences overlying or near contaminated groundwater are contacted to offer air sampling in their residences. As of September 2007, Hill AFB has indicated a total of 92 indoor air mitigation systems have been installed at off-Base residences at OUs 1, 2, 5, 6, 8, 10, and 12. No systems have been installed in OUs 4 and 9 because no plume-related VOCs have been detected in indoor air. Sub-slab depressurization systems were the most common mitigation systems installed in homes. Additional types of mitigation systems installed include crawl space sub-membrane depressurization systems, systems comprised of a combination of typical sub-slab depressurization and crawl space sub-membrane depressurization components, and a heat-recovery ventilation system. Sump covers were also installed at residences, typically in conjunction with sub-slab depressurization systems (**MWH, 2005**).<br><br>Between July 1, 2005 and March 31, 2006, Hill AFB contacted approximately 2,600 off-Base residences for sampling, with a positive response rate of approximately 21 percent. In addition to the residents who responded to the sampling request, residents already involved in the IAP from previous years who are participating in specified air sample frequency cycles were also sampled. The results of the sampling activities are presented below (**MWH, 2006**).<br><br>All of the residential air samples collected during the sampling period were analyzed for TCE, with detectable concentrations found in 68 (approximately 9 percent) of the residences sampled. Of the 68 residences, 24 had concentrations above the 0.43 parts per billion by volume (ppbv) MAL. Trichloroethene was most often detected in OUs 6 and 8, occurring in 11 of the 31 residences tested in OU 6 (35 percent) and 29 of the 226 residences tested in OU 8 (13 percent). Trichloroethene was not detected in samples collected in OUs 4 and 9; however only a total of four samples were collected in these OUs, and only one of those residences was located above a known groundwater plume (**MWH, 2006**).<br><br>Indoor air samples collected from 313 residences were tested for chloroform in OUs 5, 6, and 12 with detectable concentrations found in 176 (approximately 56 percent) of the home sampled. Only three of the residences sampled had concentrations above the proposed screening level of 1.7 ppbv. The frequency of chloroform detections ranged from 35 percent in OU 6 to 71 percent in OU 5 Area 1 (**MWH, 2006**).<br><br>Air samples from 283 residences in OUs 2, 5, 9, and 10 were tested for tetrachloroethene (PCE), with detectable concentrations found in 60 (approximately 21 percent) of the residences sampled. Six of the residences sampled had concentrations above the 1.2 ppbv MAL. PCE was detected in three of the nine residences sampled in OU 2 (33 percent), 37 of the 185 residences tested for this compound in OU 5 (20 percent), and in 20 of the 87 residences sampled in OU 10 (23 percent). PCE was not detected in OU 9, however only two residences were sampled in OU 9, neither of which is located above the known groundwater plume (**MWH, 2006**).<br><br>1,2-Dichloroethaneis present in the groundwater at OU 8 only. A total of 226 residences in OU 8 were tested for 1,2-DCA, with detectable concentrations found in 23 (approximately 10 percent) of the residences sampled. Of the 23 residences with detections, 16 were found to have concentrations above the MAL of 0.23 ppbv (**MWH, 2006**).<br><br>Air samples collected from 640 residences were tested for cis-1,2-DCE. Residences in OU 5 Areas 1 and 3, and residences in OU 12 Area 1 were not sampled for this compound because it is not present in the groundwater in these Areas. Cis-1,2-DCE was detected in four of the 15 residences tested in OU 1 (27 percent) and in three of the 226 residences tested in OU 8 (1 percent). None of the residences tested for this compound had concentrations exceeding the 8.8 ppbv MAL. Cis-1,2-DCE is the principal contaminant of concern in OU 1 groundwater and was detected in the indoor air of residences sampled in OU 1 at concentrations ranging from 0.2 to 0.72 ppbv, well below the 8.8 ppbv MAL. The four residences with detections of cis-1,2-DCE are located above the OU 1 groundwater plume (**MWH, 2006**). |

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| | Indoor air samples collected in OU 5 Areas 1 and 2 and in OU 12 Area 3 were analyzed for carbon tetrachloride (CTCL) because it is present in the groundwater. Of the 120 residences sampled, 17 (approximately 14 percent) had detectable concentrations of CTCL. One of the 17 residences tested for CTCL in OU 12 had a concentration exceeding the 0.26 ppbv MAL (**MWH, 2006**).<br><br>Indoor air samples collected from 341 residences during the sampling period were analyzed for trans-1,2-dichloroethene (trans-1,2-DCE) in OUs 1, 2, 4, 8, 9, and 10. There were no detectable concentrations of this compound in any of the residences sampled (**MWH, 2006**).<br><br>Indoor air samples collected from 388 residences were analyzed for 1,1-DCE during the sampling period in OUs 2, 5, 6, 8, 9, and, 10. This compound was detected in ten of the residences sampled at concentrations below the MAL of 50 ppbv (**MWH, 2006**).<br><br>A total of 339 residences were tested for vinyl chloride in OUs 1, 2, 8, 9, and 10. This compound was detected in one of the residences in OU 8 at a concentration exceeding the MAL of 1.1 ppbv (**MWH, 2006**).<br><br>The IAP is ongoing and the collection of additional indoor air and water samples at residential locations is planned (**MWH, 2006**). |

Table IAP-4
# Indoor Air Sampling and Mitigation Program
# Five-Year Review Technical Assessment

Reviewer: John Lowe

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| **Introduction** | The five-year review must determine whether the remedy at a site is protective of human health and the environment. The EPA guidance describes three questions used to provide a framework for organizing and evaluating data and information and to ensure all relevant issues are considered when determining the protectiveness of a remedy (**EPA, 2001**). These questions are assessed for the IAP in the following sections. The implementation of ICs is also described. At the end of this table is a summary of the technical assessment. |
| **Question A.** | **Is the remedy functioning as intended by the decision documents?**<br><br>Yes. The Action Memorandum for the Time-Critical Removal Action for Indoor Air documents the rationale for taking actions to reduce potential indoor air risks at off-base residences (**Hill AFB, 2003**). The time-critical removal action identified by Hill AFB consists of installing indoor air mitigation systems in residences identified or that will be identified in the future as having elevated concentrations of VOCs in indoor air. The Basewide Air Sampling and Analysis Plan, Residential Air Sampling (BASAP) (**MWH, 2004**) provides the method for identifying the residences that require installation of mitigation systems.<br><br>Every year, as part of the ongoing residential air sampling program, residents overlying or near contaminated groundwater plumes are contacted to solicit their participation in the air sampling program. According to an interview with base staff conducted in December 2007, residents near or overlying plumes with contaminant concentrations higher than MCLs are contacted. This approach assures that the residences potentially requiring mitigation systems are identified in a protective manner.<br><br>As described in the BASAP, the decision to install a mitigation system in a residence is based on the result of the initial air sampling event. Experience with air sampling in OUs 5 and 12 has shown that follow up air sampling generally confirms the results of initial testing. The air sampling results are compared to Mitigation Action Levels (MAL). The MALs are risk-based values, except in the cases where the risk-based values are lower than ambient background concentrations. The risk-based values were obtained from EPA's draft vapor intrusion guidance (**EPA, 2002**). Risk-based values for carcinogenic VOCs correspond to a $1 \times 10^{-5}$ target cancer risk level; risk-based values for non-carcinogens correspond to a non-cancer hazard quotient of one.<br><br>Once a mitigation system has been installed, Hill AFB conducts performance monitoring to verify that the system is reducing indoor concentrations to below MALs. Modifications to the mitigation system are made if indoor concentrations do not decrease. Hill AFB then conducts quarterly monitoring for at least one year to verify that the system is effective under a range of weather conditions. If the system continues to operate satisfactorily, the monitoring frequency decreases to semi-annual, then annual sampling.<br><br><u>Opportunities for Optimization:</u><br><br>The indoor air sampling and mitigation program operates effectively, providing limited opportunities for optimization. Resident participation in the program is voluntary. For example, between 1 July 2005 and 31 March 2006, Hill AFB contacted approximately 2,600 off-Base residences for sampling, with a positive response rate of approximately 21 percent (**MWH 2006**). Residents who are contacted are maintained in a database, and receive an annual mailing requesting participation in the sampling program. While the possibility exists that more extensive public outreach efforts might increase the response rate, given the high awareness of the program, it is uncertain that additional outreach would significantly increase public participation. |

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| | As investigation and remedial action proceeds in the individual OUs, it may be useful to begin integrating the indoor air sampling data with the other investigations. The purpose for this integration is to refine the conceptual site model of the vapor intrusion pathway offsite, and begin observing how remedial actions for offsite groundwater plumes might be affecting indoor air concentrations. During the December 2007 interview, Hill AFB staff described how shallow groundwater sampling offsite at OU 8 was useful in identify groundwater sources that might be related to vapor intrusion pathways. Developing an integrated conceptual model for vapor intrusion may identify data needs (such as soil gas or sub slab sampling), for use in demonstrating overall remedy effectiveness. In general, regulatory agencies view building mitigation as an interim measure and not a final remedy (**ITRC, 2007**). In an interview in December 2007, Hill AFB staff stated they are proposing to make the offsite air sampling program its own OU. This administrative measure may be helpful in increasing the integration with the activities of the other groundwater OUs.<br><br>Early Indicators of Potential Remedy Problems:<br><br>Potential problems generally are minor in nature. During the December 2007 interview, Hill AFB staff relayed they were encountering some problems with potential indoor sources in OU 8; the constituent of interest was 1,2-dichloroethane. Hill AFB is currently conducting a study to address this issue. |
| **Question B.** | **Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?**<br><br>Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics:<br><br>There have been no changes in the MAL developed for the Hill AFB Basewide Residential Air Sampling Program. No new contaminants have been identified for the IAP as part of this five-year review<br><br>Changes in Applicable or Relevant and Appropriate Requirements:<br><br>The indoor air program is managed separate from the individual OUs at Hill AFB, and is not included in a separate OU. A ROD has not been signed for the indoor air program, and no ARARs were therefore evaluated. |
| **Question C.** | **Has any other information come to light that could call into question the protectiveness of the remedy?**<br><br>Examples of other information that might call into question the protectiveness of the remedy include potential future land use changes in the vicinity of the site or other expected changes in site conditions or exposure pathways.<br><br>No. As described previously, the available information indicates that the Basewide air sampling and mitigation program is operating effectively. |

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| **Institutional Controls** | Institutional controls are generally defined as non-engineered instruments such as administrative and legal tools that do not involve construction or physically changing the site, and that help minimize the potential for human exposure to contamination and/or protect the integrity of a remedy by limiting land and/or resource use (**EPA, 2005**). Institutional controls can be used for many reasons including restriction of site use, modifying behavior, and providing information to people (**EPA, 2000**). Institutional controls may include deed notices, easements, covenants, restrictions, or other conditions on deeds, and/or groundwater and/or land use restriction documents (**EPA, 2001**). The following paragraphs address ICs implemented for the IAP, the potential affect of future land use plans on ICs, and any plans for changes to site contamination status.<br>Types of ICs in Place at the Site:<br>There are no ICs in place specific to indoor air issues in off-site areas.<br>Effects of Future Land Use Plans on ICs:<br>Not Applicable.<br>Plans for Changes to Site Contamination Status:<br>No changes to site contaminant status are anticipated in the near future. |
| **Summary of the Technical Assessment** | The technical assessment, based on the data review, site inspection, technical evaluation, and interviews indicates that the remedial actions selected for the offsite air sampling and mitigation program generally appear to have been implemented and are functioning as intended by the Action Memorandum.<br>Integrating the offsite program with the data and activities of the groundwater portions of the OUs will be useful in verifying the overall remedy effectiveness in addressing potential indoor air exposures. In this regard, Hill AFB should continue to move forward with its plans to make the off-Base program a separate OU. |

Table IAP-5
# Indoor Air Sampling and Mitigation Program
# Technical Assessment Summary

Reviewer: John Lowe

| Site ID | Remedy Description | Technical Assessment | | | Protectiveness | Next Five-Year Review |
|---|---|---|---|---|---|---|
| | | Question A* | Question B* | Question C* | | |
| OUs 1, 2, 5, 6, 8, 10, and 12 | Indoor air mitigation systems | Yes | Yes | No | Protective in the short term | 2013 |

*Question A: Is the remedy functioning as intended by the decision documents?
*Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objective (RAOs) used at the time of the remedy still valid?
*Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
NA = Not Applicable

Table IAP-6
# Indoor Air Sampling and Mitigation Program
# Five-Year Review Issues, Recommendations and Follow-Up Actions, and Protectiveness Statement

Reviewer: John Lowe

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| **Issues** | Based on the document review, interviews, and the technical assessment, it appears the time-critical removal action has been implemented as planned and is functioning as intended by the decision documents in the short term. To ensure continued protectiveness, three issues are identified, as described below. These issues do not affect the current protectiveness of the removal action. However, addressing these issues is important for Hill AFB to provide the demonstration that remedial actions for offsite groundwater are reducing indoor air risks from vapor intrusion. These issues are as follows:<br><br>1) Hill AFB is currently considering creating a separate OU for the IAP. Managing the indoor air program as a separate OU would facilitate management of offsite issues, and define action levels, O&M, LTM activities under a single decision document.<br><br>2) Currently, the basewide air sampling program collects ambient air samples to identify structures that may need mitigation systems, and to evaluate mitigation system performance in reducing indoor air concentrations. As groundwater remedial actions progress, there will be an increasing need to integrate the data collected from the groundwater OUs with the offsite air sampling program. This integration will be necessary to develop a conceptual model of the vapor intrusion pathways that can be used to evaluate the effectiveness of groundwater remedial actions in reducing indoor air concentrations; this evaluation will be useful in verifying overall remedy performance. This conceptual model can also be used to identify additional data collection (such as shallow groundwater, soil gas, subslab or indoor air sampling) that may help in verifying remedy performance.<br><br>3) Hill AFB has taken the conservative approach of proactively sampling residential indoor air to assess vapor intrusion. The Basewide air sampling program is currently configured as an ongoing activity with no timeline for completion. This represents an ongoing commitment made by Hill AFB for the residents to continue to monitor indoor air concentrations in the long-term. As the IAP progresses through the CERCLA process, however, it is appropriate to consider what will define remedy completion. Development of decision rules early in the process will help in the understanding of the relationship between the presence of VOCs in the subsurface (i.e. groundwater or soil gas) and VOC concentrations in indoor air, along with an understanding of the trends observed with indoor air concentrations. Collection of some additional data over time as detailed in issue 2, may be appropriate to help develop future decision rules. |

| | |
|---|---|
| **Recommendations and Follow-Up Actions** | As described in the previous section, three issues were identified in the 2008 five-year review for the IAP. To address these issues, the following recommendation/follow-up action has been defined.<br><br>1) Hill AFB should move forward with creating a separate OU for the IAP with concurrence from the regulatory agencies. A separate OU will facilitate management of offsite residential indoor air issues on an integrated basis. The IAP should proceed through the RI/FS process, and a ROD should be signed documenting the remedies, O&M, and LTM activities performed under the IAP.<br><br>2) Hill AFB should begin integration of the data collected from the groundwater OUs with the data collected during the residential air sampling program, in order to develop a more refined conceptual model of the vapor intrusion pathway. Due to the potential for vapor intrusion, it is important to understand groundwater contamination at or near the top of the water table, in at least general terms, across a site. The relationship between groundwater concentrations and indoor air concentrations should be further defined, so that reductions in groundwater concentrations through remedial action can be linked with reductions in indoor air concentrations. Additional data collection (monitoring of groundwater concentrations, including at or near the top of the water table) that may help to define the groundwater and indoor air relationships also should be identified.<br><br>3) As the IAP progresses through the CERCLA process, the development of decision rules for the continued sampling of indoor air will eventually become important to address site closure. The site conceptual model of the vapor intrusion pathway (described previously) should be evaluated to establish these decision rules so that progress can be appropriately tracked and additional data can be collected if needed in the interim. |
| **Remedial Timeframe** | Not specifically applicable to the IAP. Refer to the remedial timeframes for each individual OU. |
| **Protectiveness Statement** | **The remedial actions implemented through the IAP are considered protective of human health and the environment in the short-term.** Indoor air exposures are identified and mitigated through implementation of the program. Institutional controls to restrict groundwater use are currently in place. ICs and land-use controls are assessed annually. The selected remedy will continue to be protective if the recommendations and follow-up items identified in this five-year review are addressed. |
| **Next Five-Year Review** | Remedial actions implemented at off-Base residence will be reviewed in the next five-year review for Hill AFB to be completed during or before September 2013. |

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Section 8

# Deferred Sites (IRP Site OT106)

Hill AFB defines deferred sites as those facilities or areas that are considered to pose little risk to human health based on existing land use and the lack of a completed exposure route. Complete site characterization of these sites was deferred because either sampling could not be performed without disturbing facility operations or preliminary sampling indicated that detected contaminant concentrations were below risk-based screening levels for the current land use. Action at these sites was deferred until the facility could be completely investigated or use at a facility changed from industrial to residential (**SES, 2006**). The deferred sites were originally identified during the OU 9 South Area and North Area Site Inspections (**CH2M HILL, 2003**), and until recently, were considered as part of OU 9. There are currently 108 sites included on the deferred sites list (**SES, 2006**).

The 2003 five-year review recommended a continuation of the annual inventory of deferred sites to determine when sites could be characterized and investigated. The annual inventory of the deferred sites is currently performed as required by the site management plan for the OU 9 deferred sites (**CH2M HILL, 2002**). The most recent inventory was completed in November 2006. **Table 8-1** provides a list of the deferred sites at Hill AFB. This inventory is completed to evaluate the existing status of each site on the deferred sites list.

As part of the inventory, each site is assessed to determine if the facility is still intact, if use at a facility has changed, if there has been recent construction, and if a facility is scheduled for demolition. The inventory also includes a review of Air Force Form 332 submittals for each site to determine if construction activities has or will occur at a facility. The annual inventory includes recommendations in changes of status for deferred sites and recommends sites for further investigation when warranted. The Hill AFB Restricted Use Access Map (provided as **Figure 8-1**), which is used to identify areas of potential contamination at the Base during the Air Force Form 332 submittal process, is also updated (**SES, 2006**).

The draft ROD for OU 9 proposed to continue to defer action on these sites. The EPA requested that the OU 9 ROD address only those sites for which an action has been defined. As a result, the deferred sites were removed from OU 9 in August 2007 and returned to Site Inspection status. These sites remain under the FFA and will be addressed under CERCLA, but they are not currently assigned to an OU. The annual inventory of deferred sites is still performed. Hill AFB is beginning the process to address the deferred sites (**Smith, 2008**).

For the next five-year review, any deferred sites that have progressed sufficiently through the CERCLA process to be considered as individual OUs or part of an existing OU should be reviewed.

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Table 8-1
OU 9 Deferred Site Inventory Summary for 2006
2008 Five-Year Review
Hill Air Force Base, Utah
(reproduced from SES, 2006)

| Building Number | Facility Use | Area | OU9 Site Inspection Results and Findings | Changes to Building | Recommended Actions |
|---|---|---|---|---|---|
| 1 | Maintenance Hangar | South Area | Facility connected to the Industrial Waste Collection System (IWCS). | | |
| 1A | Annex to Maintenance Hangar 1 | South Area | Facility connected to the Industrial Waste Collection System (IWCS). | | |
| 5 | Office and Shop Area | South Area | Facility connected to IWCS. | | |
| 25 | Maintenance Hangar | South Area | Single exceedance of industrial RBSLs for chloroform, exceedance could not be confirmed. | | |
| 30 | Shop Facility | South Area | Facility connected to IWCS. | | |
| 37 | Maintenance Hangar | South Area | Facility connected to IWCS. | | |
| 39 | Maintenance Hangar and Warehouse | South Area | Facility connected to IWCS. | | |
| 40 | Maintenance Hangar | South Area | Facility connected to IWCS. | | |
| 42 | Maintenance Hangar | South Area | Facility connected to IWCS. | | |
| 43 | Maintenance Hangar | South Area | Facility connected to IWCS. | | |
| 45 | Maintenance Hangar | South Area | Facility connected to IWCS. | | |
| 46 | Maintenance Hangar | South Area | Single exceedance of industrial RBSLs for cadmium, exceedance could not be confirmed. | | |
| 48 | Maintenance Facility | South Area | Facility connected to IWCS. | | |
| 10049/49 | Maintenance Facility | South Area | Facility connected to IWCS. | Formerly Building 49. Building renumbered to 10049 in 2003. | |
| 50 | Repair Facility | South Area | Soil sampling was performed during the demolition of Facility 52 under the OWS at the NE corner of the facility | | Since building 50 is currently in the location of building 52, building 50 will be inventoried until a complete site investigation can be conducted at the site. |
| 55 | Storage Building | South Area | Exceedances of industrial RBSLs for N-Nitrodimethylamine. The exceedance could not be confirmed by other sampling. | | |
| 100 | Administrative Building | South Area | Single exceedance of residential RBSLs for benzo(a)pyrene, exceedance could not be confirmed. | | |
| 202 | Maintenance Facility | South Area | Facility connected to IWCS. | | |
| 205 | Repair Facility | South Area | Industrial RBSLs for beryllium, cadmium, and chromium were exceeded in single samples. Exceedances could not be confirmed. | | |
| 206 | Wash Rack | South Area | Facility connected to IWCS. | | |
| 214 | Repair Facility | South Area | Soils contaminated with Stoddard solvent to a depth of 45 ft from a UST removed from the north of the facility in 1989. The contamination was remediated with bioventing. Other potential areas of concern include the floor drains and the floors, walls, and pipes in room 201 where there is potential radium contamination. | | |
| 220 | Maintenance Hangar | South Area | Single exceedance of industrial RBSLs for benzo(a)pyrene, exceedance could not be confirmed. | | |
| 225 | Maintenance Hangar | South Area | Facility connected to IWCS. | | |
| 227 | Maintenance Hangar | South Area | Facility connected to IWCS. | | |
| 228 | Maintenance Hangar | South Area | Facility connected to IWCS. | | |

Table 8-1
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2008 Five-Year Review
Hill Air Force Base, Utah
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| Building Number | Facility Use | Area | OU9 Site Inspection Results and Findings | Changes to Building | Recommended Actions |
|---|---|---|---|---|---|
| 233 | Maintenance Hangar | South Area | Petroleum hydrocarbons as diesel were observed above industrial RBSLs in two samples. Volatile Organic Compound (VOC) analysis of these samples did not show any significant contamination. | | |
| 236 | Maintenance Hangar | South Area | Petroleum hydrocarbons as diesel, total petroleum hydrocarbons, and chloroform were observed above industrial RBSLs in two samples. VOC analysis of these samples did not show any significant contamination. Exceedance of industrial RBSLs for cadmium and residential exceedances for benzo(a)pyrene and benzo(g,h,I)perylene. The exceedance could not be confirmed by other sampling. | | |
| 238 | Repair Facility | South Area | Facility connected to IWCS. | | |
| 256 | Storage Area | South Area | Minor exceedance of an industrial RBSL for arsenic. | | |
| 257 | Repair Facility | South Area | Facility connected to IWCS. | | |
| 260 | Utilities Facility | South Area | Facility connected to IWCS. | | |
| 265 | Shop Facility | South Area | Exceedance of industrial RBSLs for cadmium and residential exceedances for benzo(a)pyrene and benzo(g,h,I)perylene. The exceedance could not be confirmed by other sampling. | | |
| 270 | Maintenance Hangar | South Area | Minor exceedance of an industrial RBSL for arsenic. | | |
| 279 | Storage Area | South Area | Facility connected to IWCS. | | |
| 287 | Maintenance Facility | South Area | Total petroleum hydrocarbons and benzo(a)pyrene were observed above industrial and residential RBSLs, respectively, in two samples. VOC analysis of these samples did not show any significant contamination. | | |
| 295 | Storage Area and Office Space | South Area | Facility connected to IWCS. | | |
| 505 | Shop Facility | South Area | Minor exceedances of industrial RBSLs for arsenic and cadmium. | | |
| 507 | Repair Facility | South Area | Minor exceedances of industrial RBSLs for cadmium in four samples. | | |
| 509 | Repair Facility | South Area | Facility connected to IWCS. | | |
| 510 | Shop Facility | South Area | Facility connected to IWCS. | | |
| 511 | IWCS Line | South Area | Minor exceedance of an industrial RBSL for arsenic. | | |
| 515 | Maintenance Facility | South Area | Facility connected to IWCS. | | |
| 575 | Utilities Facility | South Area | Exceedances of industrial RBSLs for cadmium along the IWCS line. | | |
| 576 | Repair Facility | South Area | Facility connected to IWCS. | | |
| 589 | Maintenance Facility | South Area | Minor exceedance of an industrial RBSL for arsenic. | | |
| 590 | Repair and Maintenance Facility | South Area | Facility connected to IWCS. | | |
| 592 | Maintenance Facility | South Area | Facility connected to IWCS. | | |

Table 8-1
OU 9 Deferred Site Inventory Summary for 2006
2008 Five-Year Review
Hill Air Force Base, Utah
(reproduced from SES, 2006)

| Building Number | Facility Use | Area | OU9 Site Inspection Results and Findings | Changes to Building | Recommended Actions |
|---|---|---|---|---|---|
| 597 | Repair Facility | South Area | Residential RBSLs for benzo(b)fluoranthene were exceeded in a single sample. | | |
| 732 | Training Facility | North Area | The past chemical practices in the area are unknown. | | |
| 741 | Training Facility | North Area | Lead was observed above industrial RBSLs. | | |
| 752 | Shop Facility | North Area | Unable to gain access; however, chemical release from building is unlikely. | Planned for demolition in FY07 | |
| 776 | Storage Shed | North Area | The facility is located in the middle of the flight line. The site has not been visited. | | |
| 800 | Warehouse and Office Space | South Area | Facility connected to IWCS. | Building demolished in CY06 | Investigation is recommended during CY07. |
| 841 | Abandoned UST | South Area | Facility was not investigated as part of OU9. An unknown tank was discovered in the parking lot of the current facility. Likely it was associated with a previous facility located in the area. | | Additional investigation is recommended if the UST is removed in the future. |
| 847 | Maintenance Facility | South Area | Facility connected to IWCS. | | |
| 893 | Storage Area | South Area | Minor exceedance of an industrial RBSL for cadmium. | | |
| 896 | Storage Area | South Area | Minor exceedance of an industrial RBSL for cadmium. | | |
| 897 | Storage Area | South Area | Minor exceedance of an industrial RBSL for cadmium. | | |
| 911 | Maintenance Facility and Storage Area | South Area | Residential RBSL for benzo(a)pyrene exceeded in a single sample. | | |
| 924 | IWCS Lift Station 1 | South Area | Residential RBSL for benzo(a)pyrene exceeded in a single sample. | | |
| 935 | Maintenance / Inspection Building | North Area | Drains discharge to the sanitary sewer. Small quantities of chemicals used at the building. | | |
| 940 | Repair Facility | North Area | Drains discharge to the sanitary sewer. Small quantities of chemicals used at the building. | | |
| 960 | Maintenance Facility | North Area | Drains discharge to the sanitary sewer. Small quantities of chemicals used at the building. | | |
| 965 | Process Facility | North Area | Drains discharge to the sanitary sewer. Small quantities of chemicals used at the building. | | |
| 970 | Process Facility | North Area | Drains discharge to the sanitary sewer. Small quantities of chemicals used at the building. | | |
| 975 | Process Facility | North Area | Drains discharge to the sanitary sewer. Small quantities of chemicals used at the building. | | |
| 980 | Process Facility | North Area | Drains discharge to the sanitary sewer. Small quantities of chemicals used at the building. | | |
| 983 | Storage Area | North Area | Sump located in bottom of pit in the mechanical room, discharges to an unknown location (installed in 1974). The sump outlet was not verified during site visit. | | |
| 1132 | Storage Area | North Area | No VOCs detected in soil samples. Arsenic exceeded residential RBSLs, beryllium exceeded industrial RBSLs but both arsenic and beryllium are below calculated background levels. | | |
| 1133 | Maintenance Facility | North Area | No VOCs or BNAEs in two soil borings exceeded residential RBSLs. Arsenic and beryllium exceeded residential RBSLs. As in U9-11-903 exceeded calculated background concentrations. | | |

Table 8-1
OU 9 Deferred Site Inventory Summary for 2006
2008 Five-Year Review
Hill Air Force Base, Utah
(reproduced from SES, 2006)

| Building Number | Facility Use | Area | OU9 Site Inspection Results and Findings | Changes to Building | Recommended Actions |
|---|---|---|---|---|---|
| 1135 | Shop Facility | North Area | No VOCs detected in a soil boring drilled near the drain located outside the southeast corner of the building. | | |
| 1202 | Administrative Building | North Area | No potential sources were noted during the site visit. | | |
| 1203 | Test Facility | North Area | Building renovated to office space. No current sources noted during site visit. | | |
| 1243 | Maintenance Facility | North Area | No VOCs in one soil boring drilled next to the oil-water separator exceeded residential RBSLs. No TPH detected. | Planned for demolition in FY10 | |
| 1248 | Process Facility | North Area | Investigation warranted based on NAPA. | | |
| 1253 | Maintenance Facility | North Area | No VOCs or TPH detected in one soil boring drilled near the oil-water separator. | Planned for demolition in FY10 | |
| 1258 | Administrative Building | North Area | Investigation warranted based on NAPA. | | |
| 1264 | Administrative Building | North Area | Maintenance areas unconfirmed during site visit. | | |
| 1267 | Process Facility | North Area | The building drainage system currently discharges to the sanitary sewer. | | |
| 1289 | Administrative Building | North Area | Building renovated to office space. No potential sources noted. | | |
| 1377 | Process Facility | North Area | Investigation warranted based on NAPA. | | |
| 1422 | Process Facility | North Area | Investigation warranted based on NAPA. | | |
| 1424 | Process Facility | North Area | Investigation warranted based on NAPA. No VOCs or TPH detected in one soil boring drilled next to the spill sump. | | |
| 1566 | Maintenance Facility | North Area | No VOCs or explosives detected in two surface soil samples collected near the loading areas. Arsenic exceeded calculated background. | | |
| 1590 | Utilities Facility | North Area | No TPH, VOCs, or explosives detected. Arsenic exceeded residential RBSLs, but was below calculated background. | | |
| 1606 | Utility Vault | North Area | Former underground transformer vault with potential release of PCBs. Two soil boring attempts were refused. Recommended for investigation when demolished. | | |
| 1607 | Storage Building | North Area | No contamination above RBSL's in soil borings was identified. 10 Hydropunch samples of shallow groundwater near building 1607 contained TCE above the groundwater MCL | | |
| 1643 | Storage Building | North Area | The building has been located. No evidence of release noted during site visit. | | |
| 1649 | Test Facility | North Area | Investigation warranted based on NAPA. Evaluate whether explosive residues have been released from the building. | | |
| 1833 | Support Facility | North Area | Concrete-lined 14,000-gallon evaporation pond with a vapor barrier to collect wash down and runoff. No VOCs in one surface water sample exceeded residential RBSLs. | | |
| 1913 | Shop Facility | North Area | No VOCs in one soil boring drilled near the loading area exceeded residential RBSLs. No TPH detected. | | |
| 1917 | Process Facility | North Area | No VOCs detected in one soil boring drilled near the loading area. | Planned for demolition in FY07 | |
| 1919 | Repair Facility | North Area | Limited chemical use. No potential sources noted in NAPA. | | |

Table 8-1
OU 9 Deferred Site Inventory Summary for 2006
2008 Five-Year Review
Hill Air Force Base, Utah
(reproduced from SES, 2006)

| Building Number | Facility Use | Area | OU9 Site Inspection Results and Findings | Changes to Building | Recommended Actions |
|---|---|---|---|---|---|
| 1931 | Repair Facility | North Area | Small building with no water or sewer hookups. No potential sources noted during site visit. | | |
| 1936 | Wash Rack | North Area | Appears to be used only occasionally. | | |
| 2016 | Repair Facility | North Area | Investigation warranted based on NAPA. | | |
| 2114 | Maintenance Facility | North Area | Not sampled due to asphalt cover. | Originally planned for demolition in FY03. Building is now being preserved. | |
| 2201 | Storage Building | North Area | No PCBs detected in two surface soil samples collected from around the perimeter of the building. | Planned for demolition in FY07 | |
| 2214 | Shop Facility | North Area | Lead in seven soil samples collected at the loading dock exceeded residential RBSLs. No explosives detected. | | |
| 2401 | Process Facility | North Area | PCBs exceeded residential RBSLs, but were below industrial RBSLs. Arsenic exceeded residential RBSLs but was below calculated background concentrations. No VOCs or TPH detected. | | |
| 2405 | Process Facility | North Area | PCBs exceeded residential RBSLs in eight additional soil samples collected from the transformer pad area. | | |
| 2406 | Process Facility | North Area | PCBs exceeded residential RBSLs in two surface soil samples collected near the transformer pad. | | |
| 2407 | Process Facility | North Area | PCBs exceeded residential RBSLs in two surface soil samples collected near the transformer pad. | | |
| 2408 | Process Facility | North Area | PCBs exceeded residential RBSLs in two surface soil samples collected near the transformer pad. | | |
| 11420 | Transformer Vault | North Area | No PCBs detected in three additional soil borings drilled near the transformer vault. | | |
| 11647 | Test Facility | North Area | Investigation warranted based on NAPA. Evaluate whether explosive residues have been released from the building. | | |
| 15090 | Maintenance Area | South Area | Total petroleum hydrocarbons and benzo(a)pyrene were observed above industrial and residential RBSLs, respectively, in two samples. VOC analysis of these samples did not show any significant contamination. | | |
| OB/OD Range | Open Burn / Open Detonation | North Area | TNT exceeded residential RBSLs. Arsenic exceeded residential RBSLs, but was below calculated background concentrations. | | |

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## Explanation

Restricted Area: Area of significant soil contamination. No construction or other activity that will disturb the soil or groundwater within these areas shall occur without the concurrence of 75 CEG/CEV and OO-ALC/JA. Please contact 75 CEG/CEVR at 777-6916.

Potential to Encounter Contamination: If construction activities are planned in this area, please contact 75 CEG/CEVR at 777-6916 for further information during excavation activities.

Operable Unit Area

Hill Air Force Base Property Boundary

Low-Permeability Cap

Area of Restricted Water Well Drilling and Use of Shallow Groundwater by the Utah Division of Water Rights

### Authority for construction restrictions found in AFI 32-7020/OO-ALC Hill AFB Supplement 1

Note: Data contained on this map are based on existing investigations performed at Hill Air Force Base. Other areas of contamination may exist at Hill Air Force Base that are not shown on this map. Due to the nature of past activities, contaminated soils may be found throughout the base and may be encountered in any investigation. Proper precautions should be taken for all excavation work.

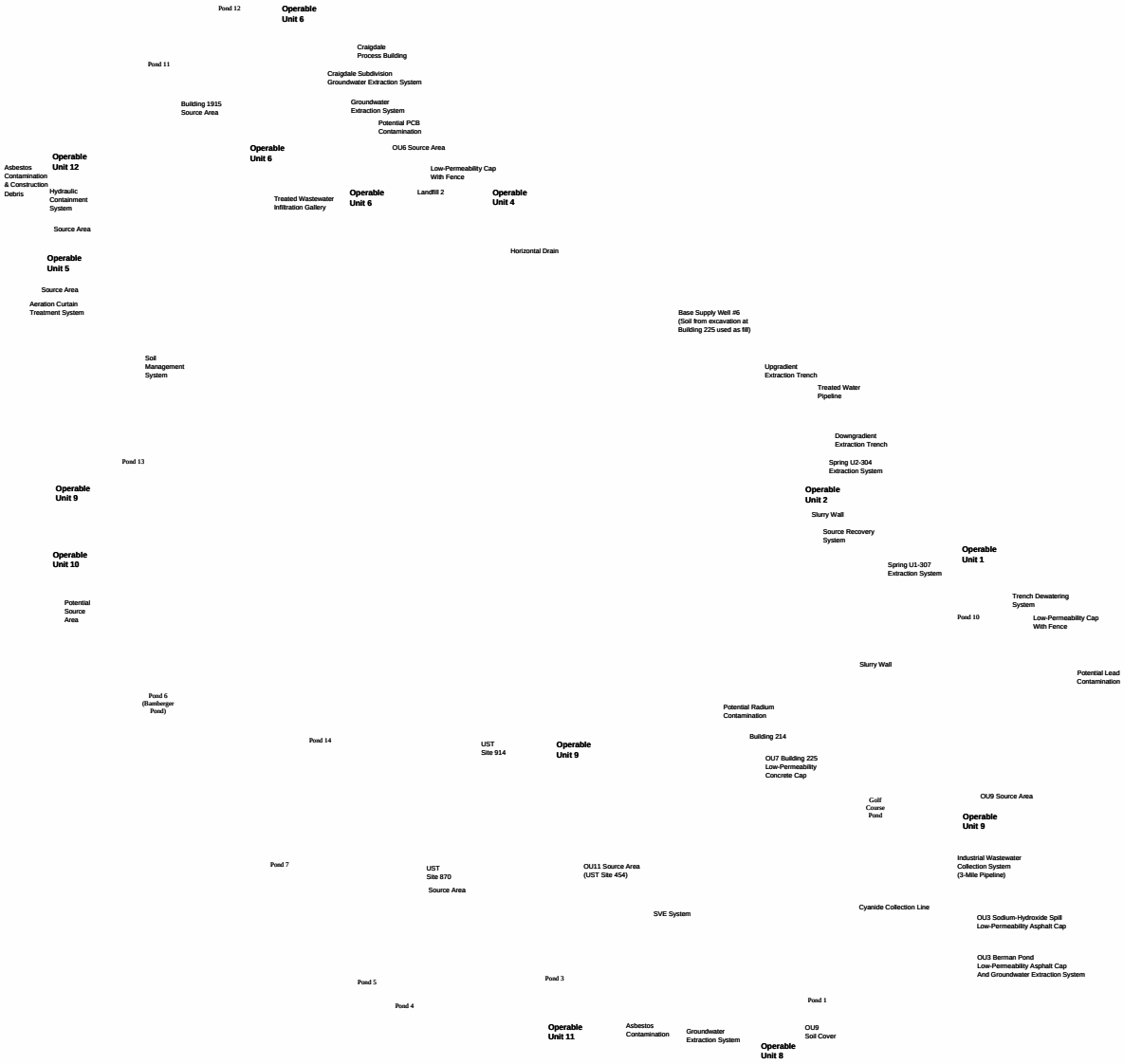


FIGURE 8 - 1
**CONTAMINATION SUMMARY MAP**
2008 FIVE-YEAR REVIEW
HILL AIR FORCE BASE, UTAH