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EPA Superfund Record of Decision:

Hill Air Force Base, Operable Unit 2, Ogden, UT 9/30/1996

P:/108602/E1/DRAWINGS/COVER.FH3

Hill Air Force Base, Utah

Final

Record of Decision and Responsiveness Summary for Operable Unit 2

Contract F42650-92-D-0006,
Delivery Order 5008

September 1996

FINAL RECORD OF DECISION
FOR OPERABLE UNIT 2
HILL AIR FORCE BASE, UTAH

This is a primary document for Operable Unit 2 at Hill Air Force Base. It will be available in the Administrative Record, which will be maintained at the following locations:

Davis County Library
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Environmental Management Directorate
OO-ALC/EMR
Building 5
7274 Wardleigh Road
Hill AFB, Utah 84056-5137

Contact: Ms. Gwen Brewer (801) 777-0359

Submittal Date:

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Glossary of Acronyms

ARAR	applicable or relevant and appropriate requirements
BACT	Best Available Control Technology
bgs	below ground surface
BRA	Baseline Risk Assessment
CAMU	Corrective Action Management Unit
CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Chemical of Concern
COPC	Chemical of Potential Concern
CPT	cone penetrometer testing
DCE	1,2-Dichloroethene
DNAPL	dense, non-aqueous phase liquid
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
HAFB	Hill Air Force Base
HI	hazard index
HQ	hazard quotient
IRM	intermediate remedial measures
IRP	Installation Restoration Program
IWTP	Industrial Water Treatment Plant
LDR	Land Disposal Restriction
MCL	maximum contaminant level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NPL	National Priorities List
OU	Operable Unit
PA	Preliminary Assessment
PCE	Tetrachloroethylene
POTW	Publicly Owned Treatment Works
PRG	proposed remediation goal
RAB	Restoration Advisory Board
RCRA	Resource Conservation and Recovery Act of 1976
RD	remedial design
Rfd	reference dose
RI	remedial investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act of 1986
SF	slope factor
SRS	Source Recovery System
SVE	soil vapor extraction
SVOC	semi-volatile organic compound
TAG	technical assistance grant
TCA	trichloroethane
TCE	trichloroethylene
TDS	total dissolved solids
TRC	Technical Review Committee
UAC	Utah Administrative Code
UCL	upper confidence limit
UDEQ	Utah Department of Environmental Quality
UST	Underground Storage Tanks
VOC	volatile organic compound

DECLARATION FOR THE RECORD OF DECISION

Site Name and Location

Operable Unit 2
Hill Air Force Base, Utah
Davis County, Utah

Statement of Basis and Purpose

This decision document presents the selected remedy for Operable Unit 2 (OU2) at Hill Air Force Base (HAFB), Utah. It was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for this site.

The State of Utah and the U.S. Environmental Protection Agency (EPA) concur with the selected remedy.

Assessment of the Site

Actual or threatened releases of hazardous substances from the site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

OU2 (IRP Site WP007) is addressed in two components, the source area and the non-source area. The source area is on-Base and is the immediate area around the former Chemical Disposal Pit 3 that is underlain by a dense, non-aqueous phase liquid and affected areas west of Perimeter Road. This area has the highest concentrations of contaminants, and occupies approximately 6 acres. The non-source area is north and east of the source area and Perimeter Road. The non-source area includes shallow groundwater and seep and spring contamination off-Base. This area generally has lower contaminant concentrations and occupies approximately 25 acres.

The remedy selected for OU2 addresses contaminated groundwater, contaminated soil, and contaminated surface water at OU2. This ROD also addresses a dense, non-aqueous phase liquid (DNAPL) composed mainly of chlorinated solvents which contributes to contamination of groundwater. The selected remedy for OU2 addresses the principal threats posed by the site by minimizing or preventing direct contact with contaminated soils; preventing ingestion of and direct contact with contaminated groundwater and surface water; and preventing further offsite transport of contaminants.

The selected remedy for the OU2 source area includes:

- an encircling vertical barrier

- shallow groundwater extraction and treatment, and discharge
- soil vapor extraction (SVE) to remove volatile organic compounds (VOCs) from subsurface soils
- continued operation of the source recovery system (SRS) to remove dense, non-aqueous phase liquid (DNAPL) to the maximum extent practicable and for the treatment of shallow groundwater
- a surface cap to prevent further degradation of groundwater
- treatability studies planned to address DNAPL contamination include the use of surfactants and steam injection. If successful, these technologies may be implemented as part of this remedy. The surface cap will be installed once treatment is completed or it is established the innovative technologies cannot meet remedial action objectives.

The selected remedy for the OU2 non-source area includes:

- shallow groundwater extraction, treatment, and discharge
- continued collection, treatment, and discharge of contaminated water flowing from springs and seeps
- discharge for groundwater treatment systems for the source area and non-source area is currently planned for the SRS which in turn discharges to the Industrial Water Treatment Plant (IWTP) on Base. However, as concentrations decrease in time, it may become more cost-effective to use other on-Site discharge options. Other options, after necessary treatment, include discharge to the sanitary sewer where it will be treated further at the Central Weber Sewer Improvement District, or on-Site discharge to a surface drainage or storm sewer.

The selected remedy for both areas include:

- environmental monitoring to evaluate the effectiveness of the remedy
- implementing institutional controls to minimize exposure by limiting use and preventing access to contaminated water and soil

Perimeter Road (IRP Site SS021), investigated as part of OU2, has been 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 OU2.

Statutory Determinations

The selected remedy is protective of human health and the environment; complies with Federal and State of Utah requirements that are legally applicable or relevant and appropriate requirements (ARARs) to the remedial action; and is cost-effective. Once the remedy is complete, ARARs will be met or a waiver will be justified. An ARARs waiver may be invoked, accompanied by an Explanation of Significant Differences, if it is determined on the basis of criteria stated in this ROD that MCLs/MCLGs or other chemical-specific ARARs cannot be achieved within all portions of the area of attainment or where it is anticipated that it may be technically impracticable to reach such levels targeted in the ROD.

This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this site, and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Because this remedy will result in hazardous substances on site above health-based levels, a review will be conducted within 5 years after commencement of remedial actions to ensure that the remedy continues to provide adequate protection of human health and the environment.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Maxwell H. Dodson [signature] 9/30/96

Maxwell H. Dodson,
Assistant Regional Administrator
Office of Ecosystems Protection and Remediation
EPA Region VIII

DATE

STATE OF UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY

Dianne R. Nielson   9-30-96

Dianne R. Nielson, Ph.D.,   DATE
Executive Director

HILL AIR FORCE BASE, UTAH

Thomas W. L. McCall, Deputy Assistant Secretary of Air Force (Environment, Safety, and Occupational Health)	DATE

1. SITE NAME, LOCATION, AND DESCRIPTION

Hill Air Force Base (HAFB) is located in northern Utah, approximately 25 miles north of Salt Lake City and about 5 miles south of Ogden, Utah (Figure 1-1). HAFB occupies approximately 6,700 acres in Davis and Weber Counties. The base is bounded on the west by Interstate 15, on the south by State Route 193, and on the northeast by the Weber River Valley (Figure 1-2). The base is located on a prominent terrace known as the Weber Delta.

Operable Unit 2 (OU2), one of nine OUs at HAFB, is located along the northern boundary of the Base (Figure 1-2). Areas investigated as part of OU2 consist of Perimeter Road and two unlined trenches known together as Chemical Disposal Pit 3. The trenches are now obscured by facilities of the Source Recovery System (SRS). The SRS was installed as part of an interim remedial action to extract as much of a dense, non-aqueous phase liquid (DNAPL) as practicable. Except for the SRS and Perimeter Road, there are no other buildings or man-made structures in the on-Base portion of OU2. Traffic is sparse and the area is seldom used by HAFB for military activities.

Separating the on-Base portion of OU2 from the off-Base portion of OU2 is a steep, terraced, north-facing escarpment that is the south wall of the Weber River Valley. There is about 300 feet of relief between HAFB 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 groundwater table conditions and the season, the springs and seeps discharge water from the shallow groundwater system.

Along this hillside escarpment and just outside of the northeastern 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 extent of the base adjacent to the Weber River Valley. The canal provides water from the Weber River for irrigation in the surrounding areas.

At the bottom of the hillside, the land is generally level. Land use in the off-Base part of OU2 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). There are no hospitals, retirement or nursing homes, schools, nurseries, or day care centers, currently located in the vicinity of OU2.

Municipal water for South Weber is supplied by the Weber Basin Conservancy District. The district provides water from wells which tap deep aquifers believed to be unaffected by contaminants associated with OU2. 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.

The Bambrough irrigation canal is located adjacent to South Weber Drive. Approximately 4,000 feet northeast of South Weber Drive is the Weber River. Land within OU2 is not located within the 100-year floodplain. There are no jurisdictional wetlands, as regulated by the U.S. Army Corps of Engineers, within OU2. There are no uses or known occurrences of commercially valuable natural resources within OU2 area.

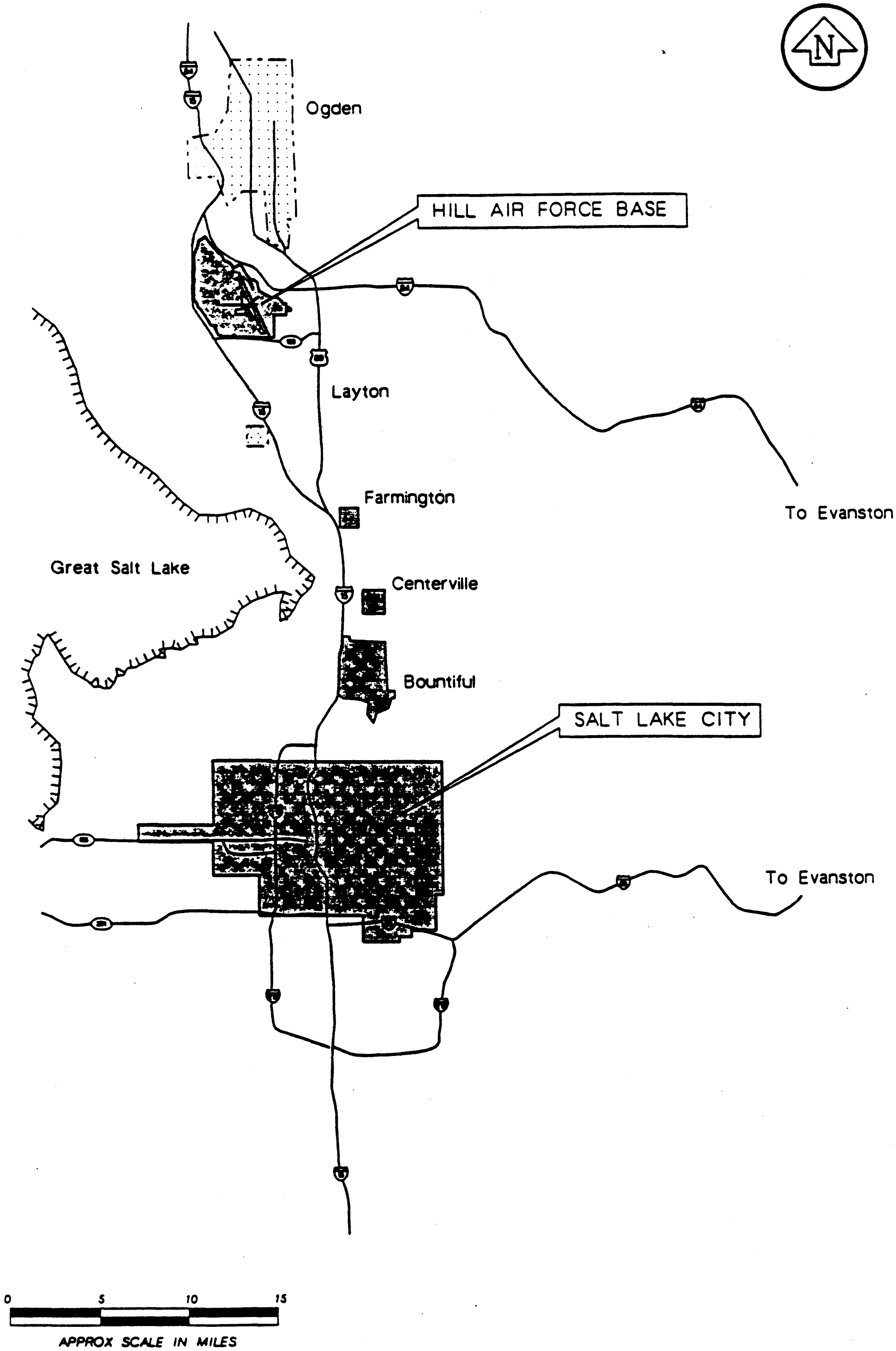

Figure 1-1
LOCATION MAP
Operable Unit 2, Hill Air Force Base, Utah

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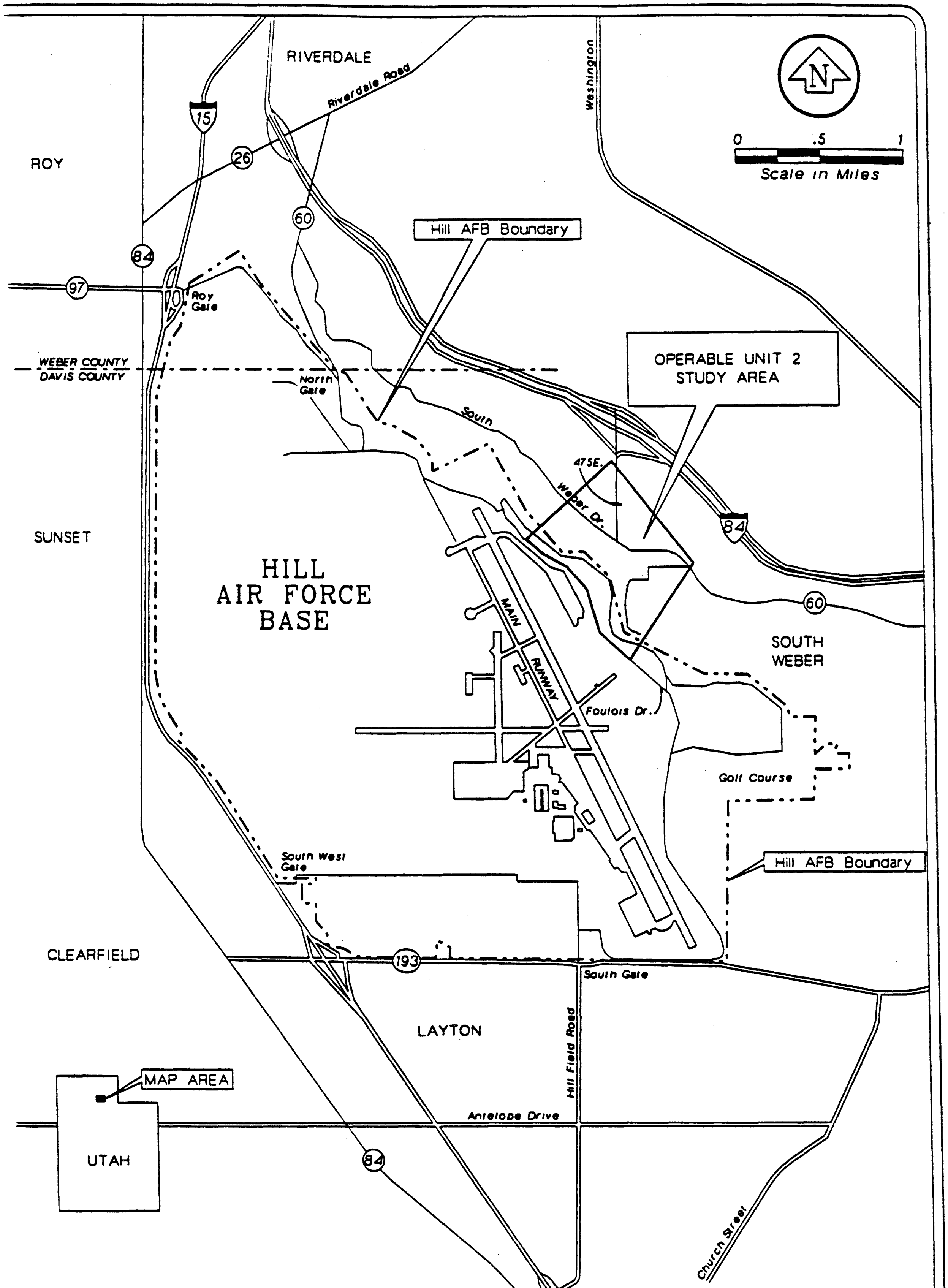

Figure 1-2
LOCATION OF OU2
Operable Unit 2, Hill Air Force Base, Utah

The hydrogeologic setting is complex. Based on the available information, there are three shallow, unconfined groundwater systems. The three groundwater systems are conceptually shown on Figure 1-3 and consist of: a shallow system extending from the source area to the elevated portion of the north-south trending knoll; a hillside groundwater flow system located east of the knoll; and the Weber River alluvium to the north and east. Figure 1-4 presents a topographic cross-section of OU2 and illustrates the location of the groundwater flow system.

The degree of hydrogeologic continuity between these systems is difficult to define because of the complex nature of the geology observed in the off-Base area. This is further complicated because the steep escarpment between HAFB and the Weber River valley is part of the Weber Delta Landslide Complex. However, the distribution of major ions in groundwater flowing through each system shows similarities between the three systems. The major ion data suggests that these systems may differ from the flow system in which the background test wells are screened.

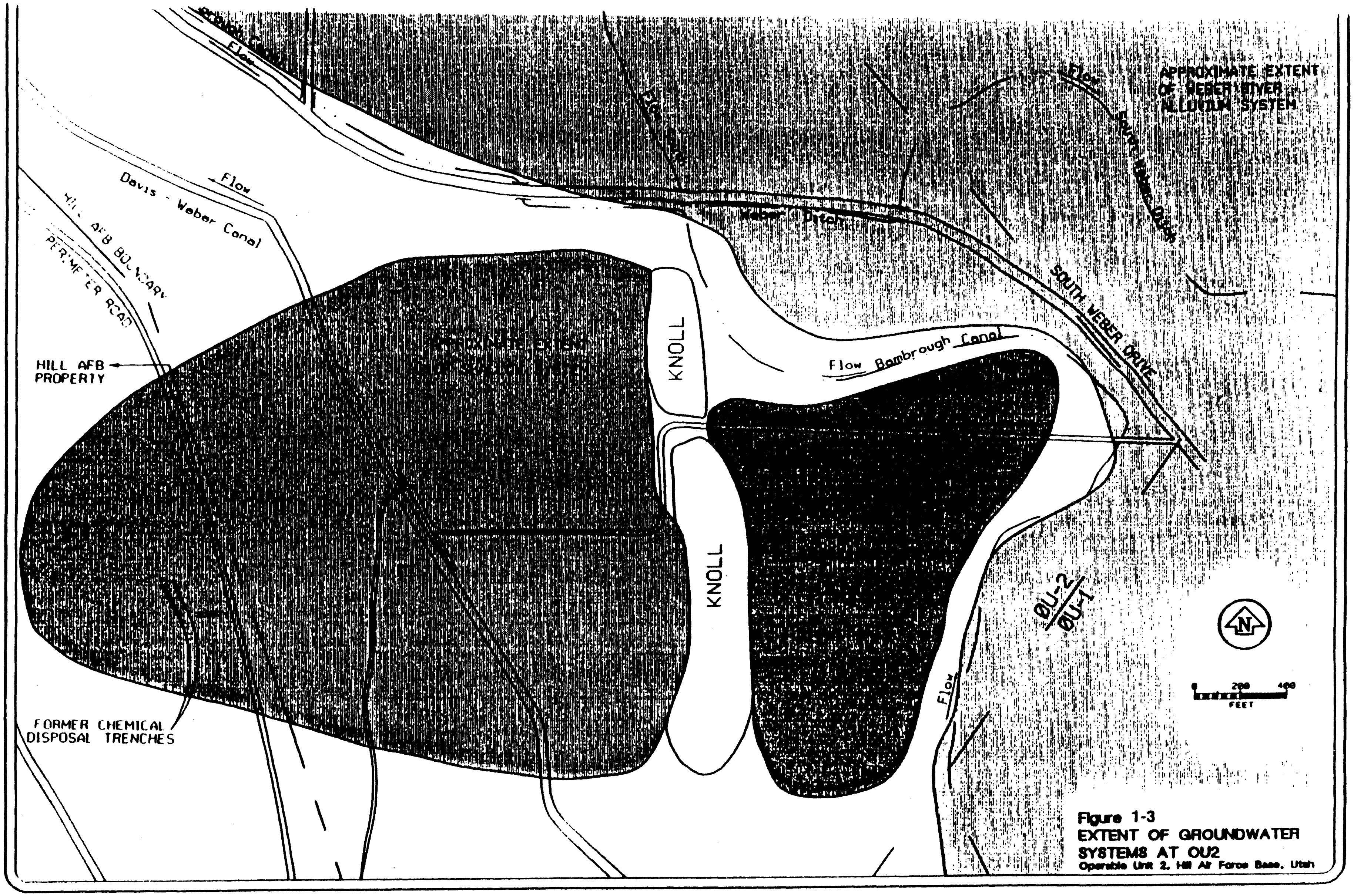

Figure 1-3
EXTENT OF GROUNDWATER SYSTEMS AT OU2
Operable Unit 2, Hill Air Force Base, Utah

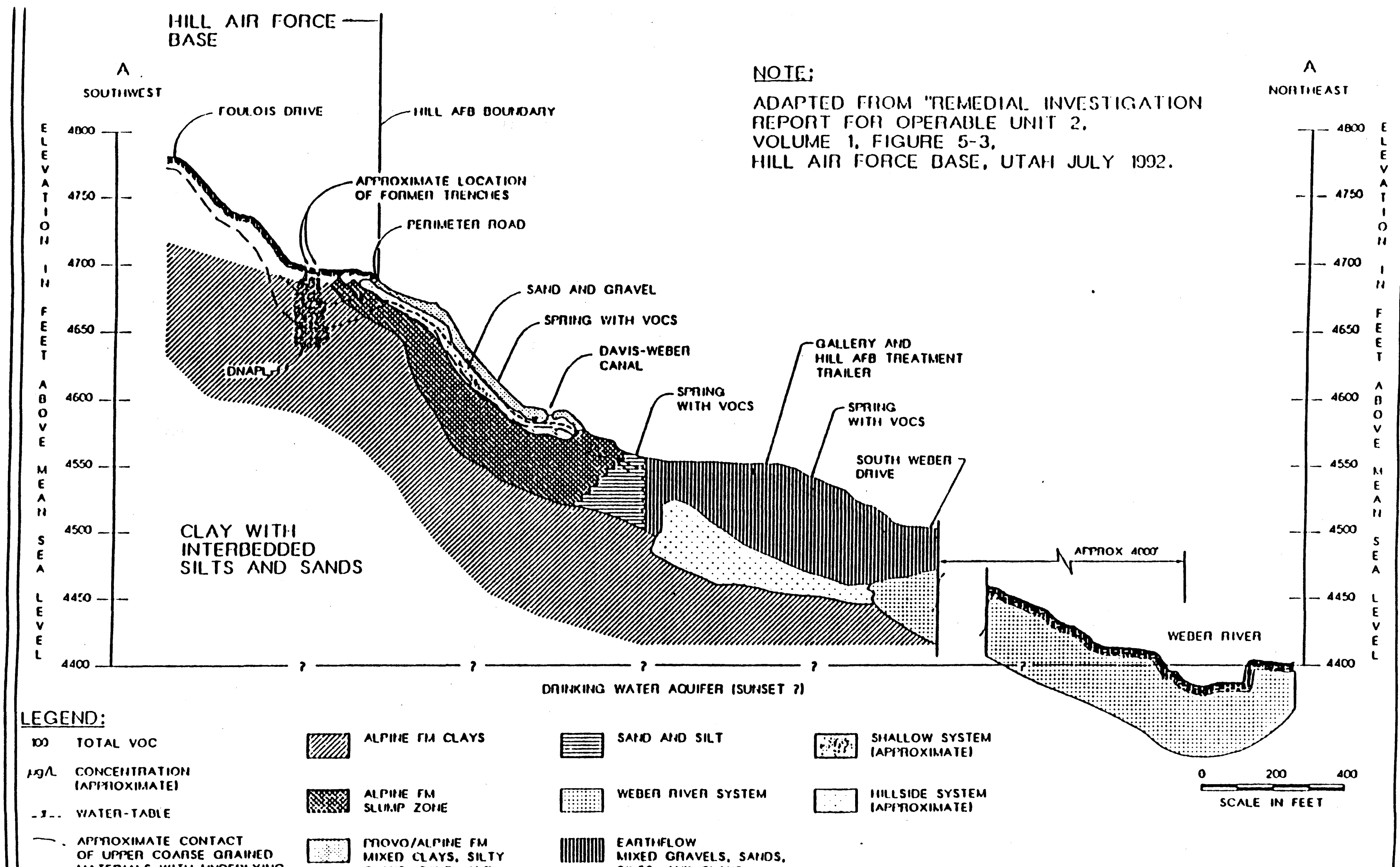

Figure 1-4
GENERALIZED CROSS SECTION
Operable Unit 2, Hill Air Force Base, Utah

2. SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 History of Site Activities

HAFB has been a major center for missile assembly and aircraft maintenance and repair. The associated industrial processes include metal plating, degreasing, paint stripping, and painting. These processes required use of various chemicals, metal plating solutions, chlorinated and non-chlorinated solvents, degreasers, petroleum hydrocarbons, acids, and bases. HAFB records indicate that from 1967 to 1975, former Chemical Disposal Pit 3 was used for disposing unknown quantities of trichloroethylene (TCE) bottoms from solvent recovery units and sludge from vapor degreasers. In the early 1940s, an unknown volume of plating tank bottoms were disposed of at this site.

Perimeter Road 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 Operable Units on HAFB.

2.2 Enforcement Activities

In 1987, HAFB was placed on the National Priorities List (NPL) under CERCLA by the U.S. Environmental Protection Agency (EPA). On April 10, 1991, HAFB entered into a Federal Facilities Agreement with the Utah Department of Environmental Quality (UDEQ) and the EPA to establish a procedural framework and schedule for developing, implementing, and monitoring appropriate response actions at the site in accordance with existing regulations.

Prior response actions taken by HAFB to prevent exposure to contamination include:

- Providing municipal water connections to five homes known to have been affected by contamination at OU2.
- Collecting and treating contaminated water flowing from springs and seeps. The treated water is discharged to the original spring drainage.
- Installing fences around springs and seeps with contaminated water to prevent livestock access.
- Constructing, as an interim remedial action (IRA), the Source Recovery System (SRS) to remove DNAPL from the area near the former Chemical Disposal Pit 3. The ROD for this action was signed September 30, 1991. Operation of the SRS has resulted in the recovery of about 30,000 gallons of DNAPL to date.

2.3 Investigation History

Investigative work was conducted in phases under the Installation Restoration Program (IRP). Phase I activities (Engineering Science, 1982) ranked sites according to their potential for offsite migration of contaminants. As a result, Chemical Disposal Pit 3 was included for further investigation in the IRP Phase II Field Survey in 1986, along with 12 other sites. Sampling activities in the Phase II Field Survey confirmed contamination of groundwater by TCE and other VOCs in the vicinity of Chemical Disposal Pit 3.

Initially, site characterization focused on the area of the pit in which the highest concentrations of contaminants were observed in groundwater and where the DNAPL was discovered. Remedial Investigation (RI) activities progressed to further characterize the extent of contamination in unsaturated and saturated soil zones, the seeps, springs and canals; and to evaluate potential down gradient receptors, aquifer properties, and transport pathways. The first phase of RI work is documented in a "Final RI" report completed in July 1992. Additional site characterization was conducted in a second phase of the remedial investigation to better define the extent of contamination in the off-Base area, possible inorganic contamination, statistical characterization of background conditions, and determining the presence or absence of contamination in the Bambrough Canal. This last phase of RI work also resulted in a better understanding of the hydrogeologic setting. The results of this additional site characterization field work have been reported in the "Final Addendum to the RI Report for OU2" (Radian, April 1994).

The Baseline Risk Assessment (BRA) for OU2 was released to the public in March 1992 and was based on the RI information available at the time. The final addendum to the RI was released to the public in April 1994. The FS for OU2 was released to the public in April 1993. The Final Addendum to the FS was released to the public in February 1994. The Proposed Plan, describing remedial alternatives, was released to the public on May 11, 1994, as discussed in Highlights of Community Participation.

2.4 Highlights of Community Participation

The public participation requirements of CERCLA Sections 113(k)(2)(B)(i-iv) and 117 were met for the remedy selection process. HAFB has a Community Relations Plan which was finalized in February of 1992. Because there is generally a high degree of interest within the adjacent communities, HAFB participates in a series of community involvement activities that pertain to all of HAFB or specifically to OU 2.

Ongoing community relations activities include: (1) a Restoration Advisory Board (RAB) which includes representatives of the community and city government, and meets at least quarterly and is open to the public; (2) mailings of announcements, fact sheets, and newsletters to interested parties in the community; (3) a bi-monthly newsletter called "EnviroNews;" (4) visits to nearby schools to discuss environmental issues; (5) semi-annual presentations at town council meetings; (6) opportunities for public comments on remedial actions; and (7) participation in technical assistance grant (TAG) program activities with the South Weber Landfill Coalition (SWLC). The RAB replaced the prior Technical Review Committee (TRC) in January 1995.

Specific to OU2, meetings were held with the public to discuss response actions such as the SRS, alternative water supplies for effected residents, and collection, treatment, and discharge of contaminated water flowing from springs and seeps. In addition, a public meeting was held on April 28, 1993, to explain and discuss risk assessment and risk management issues for the communities north of HAFB that are affected by OU1, OU2, and OU4.

The Proposed Plan, describing remedial alternatives, was released to the public on May 11, 1994, for public comment and was mailed to Federal, State, and local agencies; interested organizations and citizens; and to residents in the vicinity of OU2. All documents of the remedial investigation/feasibility study (RI/FS), as they were finalized, were placed in the Administrative Record located at the Directorate of Environmental Management at HAFB and at the Central Branch of the Davis County Library located in Layton, Utah.

The notice of availability of the Proposed Plan was announced in the *Ogden Standard-Examiner* on May 11, 1994. A public comment period was held from May 11 to June 10, 1994. A public availability session was held on May 19, 1994, at the South Weber City Hall. All interested parties on the HAFB mailing list, which includes affected residents, were notified in writing about the session. The purpose of the availability session was to answer questions about the remedial alternatives presented in the Proposed Plan and other topics relevant to OU2 in an informal setting.

A public meeting was held on May 25, 1994. At this meeting, representatives of HAFB, EPA, and the UDEQ answered questions and accepted comments about the site and on the remedial alternatives under consideration. Copies of the transcript and all written comments received during the comment period are appendices to this ROD. Responses to comments received during the public comment period are included in the Responsiveness Summary of this ROD.

2.5 Scope and Role of Operable Unit 2 within Site Strategy

Response actions at HAFB are structured into nine operable units. Most of the operable units, including Operable Unit 2, are geographically defined and address all contaminated media within each unit. Remedial actions are addressed separately for each operable unit and are at different stages of investigation or remediation.

The selected remedy for OU2 incorporates or develops upon prior response actions described in Section 2.2 that will continue as part of this remedy. The DNAPL and groundwater with high concentrations of contaminants in the source area originally addressed with the SRS are further addressed by containment. VOC contamination of soils in the source area will be reduced by soil vapor extraction (SVE). Extraction and treatment of groundwater will reduce concentrations of contaminants and prevent further expansion of the contaminant plume with hydraulic controls. Collection and treatment of contaminated seeps and springs will continue.

3. SUMMARY OF SITE CHARACTERISTICS

3.1 Topography and Hydrogeology

HAFB covers about 6,700 acres and is located on a terrace approximately 300 feet above the surrounding valley floors in Davis and Weber Counties. OU2 is located near the northern boundary of HAFB. The topography is relatively flat in the immediate vicinity of the disposal pits. The topography drops steeply to the north in the direction of the city of South Weber, forming a steep hillside. Parts of the hillside are unstable and are known as the Weber Delta Landslide complex.

Western portions of HAFB overlie two deeper confined aquifers. The Sunset and Delta Aquifers are generally located about 300 and 500 feet below the ground surface, respectively. Municipal groundwater supplies in the area are obtained from these aquifer systems. It is unclear if the Sunset and Delta are separate aquifer systems beneath OU2. Both aquifers would be either Class I - Irreplaceable Source of Drinking Water or Class IIA - Current Source of Drinking Water, under EPA's groundwater classifications. Natural regional flow directions for these aquifers is westward.

A silty clay unit separates shallow contaminated groundwater from the deeper confined units and is approximately 200 feet thick. This formation is of low permeability which impedes the downward migration of contaminants into the deeper aquifers.

Contaminants are found in the shallow unconfined groundwater systems at HAFB. Interpretation of the hydrogeologic conditions of the off-Base area suggests three shallow unconfined groundwater systems in the vicinity of OU2. The three groundwater systems are conceptually shown on Figure 1-3 and consist of: a shallow system extending from the source area to the elevated portion of the north-south trending knoll; a hillside groundwater flow system located east of the knoll; and another shallow system contained in the Weber River alluvium to the east. Figure 1-4 presents a topographic cross-section of OU2 and illustrates the location of the groundwater flow systems.

The degree of hydrogeologic continuity between these unconfined systems is difficult to define because of the complex nature of the geology observed in the off-Base area. This is further complicated because of landslides along the steep escarpment between HAFB and the Weber River Valley. However, the distribution of major ions in groundwater flowing through each system shows similarities between the three systems. The major ion data suggests that these systems may differ from the flow system in which the background test wells are screened.

Depth to groundwater in the shallow system is generally less than 10 feet below ground surface in the off-Base area and 20 feet below ground surface in the on-Base area. The depth to the hillside groundwater ranges from 35 to 70 feet below ground surface. The depth to groundwater in the Weber River alluvium ranges from 5 to 15 feet below ground surface. The saturated thickness of these shallow unconfined groundwater systems is generally less than 30 feet.

The highest levels of contamination are in the shallow groundwater flow system. Contamination has been found historically in the hillside system. However, flow patterns have changed since the Davis-Weber Canal was relined through the area of OU2. Monitoring since May 1993 has detected no contaminants in the hillside system. Low level contamination has been found in the Weber River alluvium groundwater flow system as of 1986.

Based on the State of Utah Groundwater Quality Classifications, the shallow groundwater, hillside, and Weber River alluvium systems would likely be Class II Drinking Water Quality Groundwater. The classification is based on ambient total dissolved solids (TDS) concentrations ranging between 500 and 3,000 milligrams per liter (mg/l). Figure 3-1 presents the potentiometric surface and flow direction of the shallow groundwater monitoring wells. Groundwater flow in the shallow system is to north and northeast.

Seeps and springs occur along the hillside and are fed by groundwater from the shallow and hillside systems where the groundwater surface intersects the land surface. Discharge rates vary seasonally with groundwater levels, some are dry in summer and fall.

3.2 Nature and Extent of Contamination

Environmental samples were taken from soil, sediment, groundwater, surface water, and air at the site. Table 3-1 lists the chemicals detected in soil, surface water, and groundwater at OU2. Inorganic chemicals on Table 3-1 include only those that appeared elevated above background based on statistical comparisons. Based on investigative efforts, the source of contamination at OU2 is the former disposal trenches (Chemical Disposal Pit 3). Perimeter Road along the northeastern part of HAFB has been investigated and found to be free of contamination except in those areas currently being addressed as part of other OUs.

Accumulations of a dense, non-aqueous phase liquid (DNAPL) occur on-Base and in the shallow groundwater flow system in the vicinity of the former disposal pits. The DNAPL layer is composed primarily of a mixture of several chlorinated and non-chlorinated solvents and a lesser amount of co-solved oil and grease. The solvent fraction is approximately 75 percent TCE with smaller percentages of TCA, PCE, methylene chloride, toluene, and Freon TF. Two separate accumulations of DNAPL have been identified and are depicted in Figure 3-2. The accumulations occur within depressions in the surface of a relatively low permeability clay layer. It is estimated that there are approximately 5,685 gallons of DNAPL as residual in the vadose zone and 110,000 gallons of free-phase DNAPL saturating sands and clays at the site.

Volatile Organic Compounds (VOCs) predominate among the contaminants found in all of the media. The principal VOCs include trichloroethylene (TCE), tetrachloroethylene (PCE), and 1,1,1-trichloroethane (TCA). Less common and widespread VOCs include 1,2 dichloroethene, methylene chloride, and toluene. VOCs are in the highest concentrations in the vicinity of the former disposal pits and decrease with distance laterally from the pit area. Soil samples in the immediate vicinity of the pit have concentrations of VOCs in the parts per million range. Groundwater samples in the source area near the DNAPL exhibit concentrations in the parts per million range, approaching the solubility limits of the principal VOCs. Concentrations drop rapidly to the parts per billion range toward the South Weber Valley.

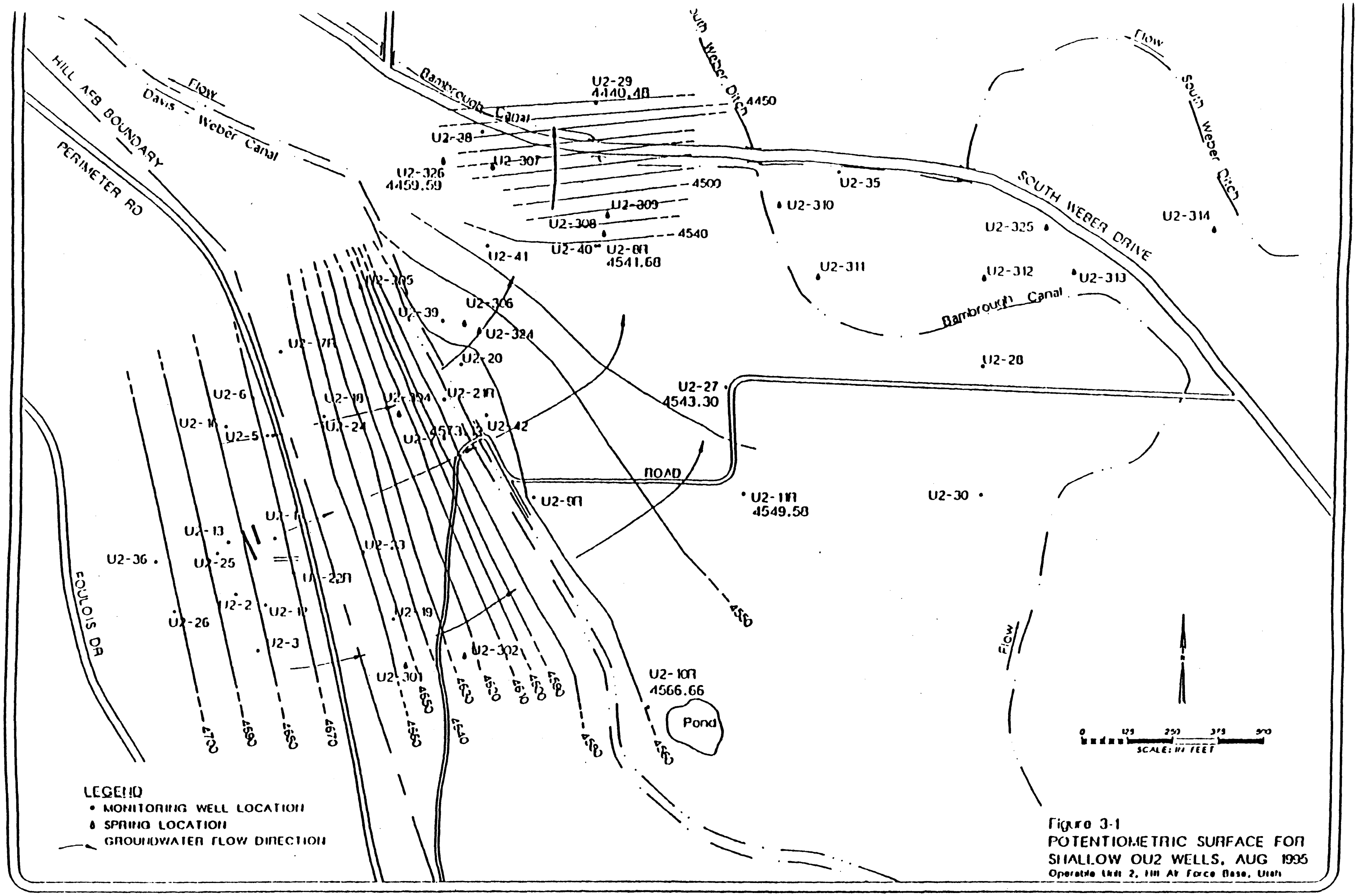

Figure 3-1
POTENTIOMETRIC SURFACE FOR SHALLOW OU2 WELLS, AUG 1995
Operable Unit 2, Hill Air Force Base, Utah

Table 3-1
Chemical Contaminants Detected in Soil, Surface Water, and Groundwater

Volatile Organic Compounds (SW8240 and SW8010)	
Acetone	Carbon disulfide
2-Butanone (MEK)	1,2-Dichloroethene
Carbon tetrachloride	1,1-Dichloroethene
Chloroform	1,2-Dichloroethane
Chlorobenzene	1,1-Dichlorethane
Ethylbenzene	1,1,2-Trichlorotrifluoroethane
2-Hexanone	Trichloroethylene
Methylene Chloride	Trichlorofluoromethane
4-Methyl-2-pentanone (MIBK)	Tetrachloroethene
1,1,2-Trichloroethane	Toluene
1,1,1-Trichloroethane	Xylenes
Semivolatile Organic Compounds (SW8270, SW8310, and SW8040)	
Butylbenzylphthalate	N-Nitrosodiphenylamine
1,2-Dichlorobenzene	Naphthalene
1,3-Dichlorobenzene	Phenanthrene
1,4-Dichlorobenzene	Phenol
2-Methylnaphthalene	bis(2-ethylhexyl)phthalate
Pyridine	Benzo(a)anthracene
2-Methylphenol (o-cresol)	Benzo(a)pyrene
4-Methylphenol (p-cresol)	Benzo(b)fluoranthene
2-Nitrophenol	Benzo(k)fluoranthene
1,2,4-Trichlorobenzene	Chrysene
Benzoic Acid	Dibenzo(a,h)anthracene
Benzyl alcohol	Ethyl methacrylate
Dibutylphthalate	Indeno(1,2,3-cd)pyrene
Diethylphthalate	2,3,4,6-Tetrachlorophenol
Di-n-ocylphthalate	Styrene
Isophorone	

Table 3-1 (continued)

Pesticides (SW8080)	
4,4-DDD	Endrin Aldehyde
4,4-DDE	Heptachlor
4,4-DDT	Heptachlor epoxide
Aldrin	alpha-BHC
Dieldrin	beta-BHC
Endosulfan I	delta-BHC
Endosulfan II	gamma-BHC (Lindane)
Endosulfan Sulfate	Methoxychlor
Endrin	
Inorganic Compounds	
Aluminum	Manganese
Arsenic	Mercury
Beryllium	Nickel
Calcium	Nitrate/Nitrite
Chloride	Potassium
Chromium	Silicon
Cobalt	Sodium
Copper	Strontium
Iron	Sulfate
Lead	Vanadium
Magnesium	Zinc

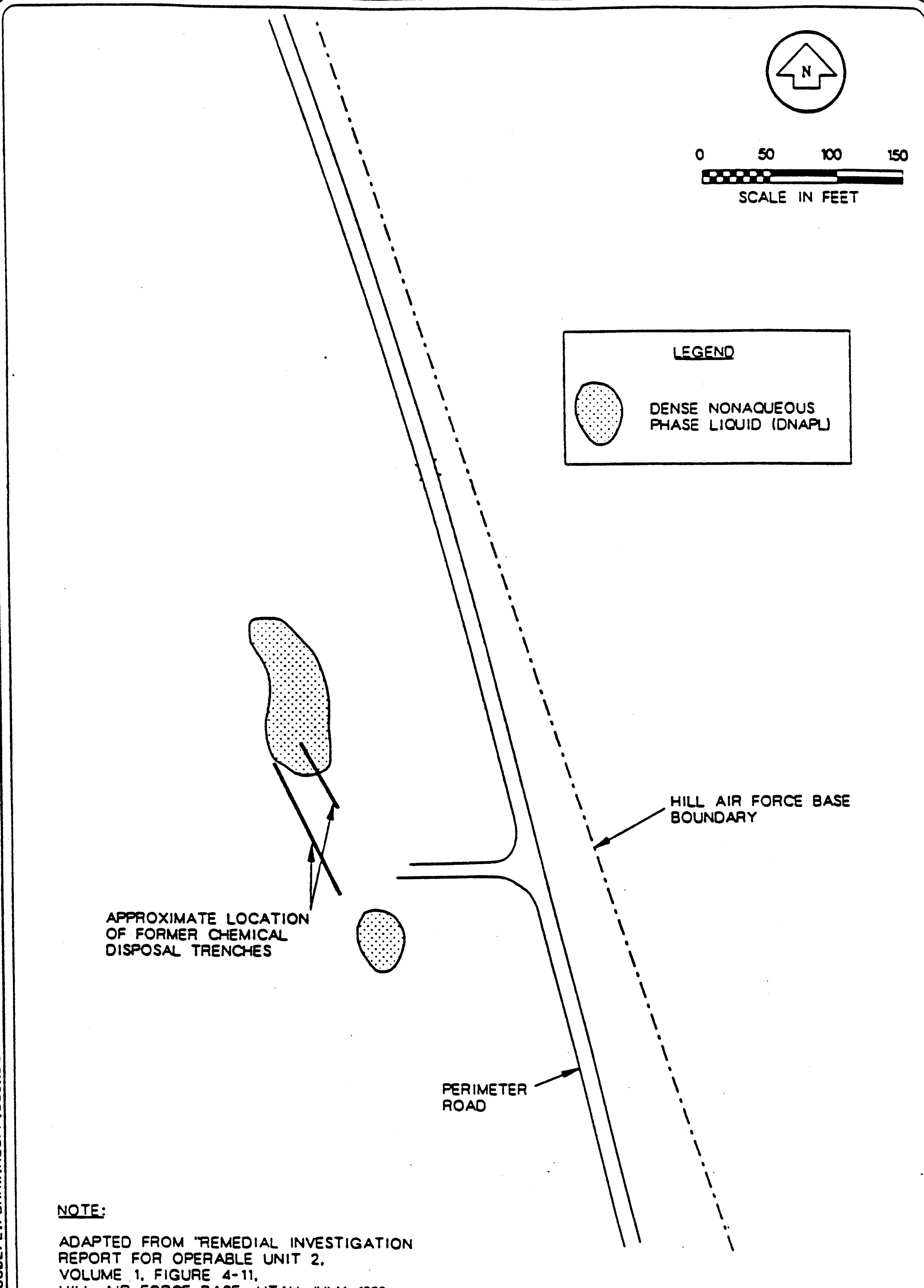

Figure 3-2
LOCATION OF DNAPL POOLS
Operable Unit 2, Hill Air Force Base, Utah

P:/108602/E1/DRAWINGS/FIG3.1.DGN

TCE is used as the primary indicator chemical for the extent of contamination at OU2, particularly in groundwater, because it is the most widespread. Other chemical contaminants exist within the extent of the TCE contamination. Groundwater samples obtained from on-Base monitoring wells installed in the shallow groundwater flow system were found to contain high levels of TCE, TCA, and PCE. Maximum concentrations of chemicals dissolved in groundwater include: 890,000 μg/l of TCE, 33,000 μg/l of TCA, and 9,800 μg/l of PCE. Other VOCs found included 460 μg/l of 1,2-dichloroethene (DCE), 18,000 μg/l of methylene chloride, 5,500 μg/l of 1,1,2-trichlorotrifluoroethane (Freon TF), and 4,400 μg/l of toluene. Figures 3-3, 3-4, and 3-5 present the extent of TCE, PCE, and TCA contamination, respectively, in groundwater at OU2.

Groundwater samples from off-Base wells installed in the shallow groundwater flow system also contained TCE; a maximum concentration of 6,300 μg/l was detected. In addition to TCE, both TCA (380 μg/l) and PCE (25 μg/l) were detected. Samples from the hillside groundwater flow system did not contain detectable concentrations of VOCs. Wells installed in the hillside system are apparently out of the principal migration pathway of organic contaminants towards the off-Base area. However, groundwater samples from monitoring wells completed in the Weber River alluvium flow system contained low levels of the chlorinated solvents known to be present from past waste disposal activities. A single non-chlorinated VOC (xylene) was found at a concentration below the reporting limit.

A variety of pesticides were detected. Most pesticides occurred in soil media throughout the area at relatively low concentrations (below health-based levels) and are believed to be related to agricultural and pest-control application activities rather than waste disposal. Semi-volatile compounds (SVOCs) were detected, but generally at levels at or below reporting limits. No PCBs were detected. Some metals concentrations are elevated above background concentrations in soils near the pits. Some of the data indicate levels of inorganics slightly above background in groundwater, but the available information suggests these are artificially elevated due to hydrogeological and well construction issues.

Surface water features in the OU2 area include springs and seeps located on the hillside between HAFB and the South Weber Valley. Several springs and seeps fed by groundwater occur along the hillside north of the Source Area. Discharge rates fluctuate with climatic and seasonal changes. Figures 3-3 through 3-5 present the location of canals, springs, and seeps. Most of the same contaminants found in groundwater are found in the seeps and springs.

The Davis-Weber Canal and the Bambrough Canal, two constructed irrigation canals, are surface water features within OU2. These canals are designated Class 4 waters (water for agricultural uses) by the Utah Division of Water Quality. The Davis-Weber Canal is situated above the shallow groundwater flow systems and is lined with concrete. No springs flow into the canal in the vicinity of OU2. The Davis-Weber Canal appears to be hydraulically isolated from potential sources of contaminants. No contaminants attributable to OU2 have been detected.

Ethylbenzene, toluene, and xylene were detected in the Bambrough Canal at concentrations less than the reporting limit (1 μg/l) and are not believed to be site related. SVOCs detected in the Bambrough Canal were below reporting limits and some pesticides were detected slightly above reporting limits. One sample of unfiltered water from the Bambrough Canal

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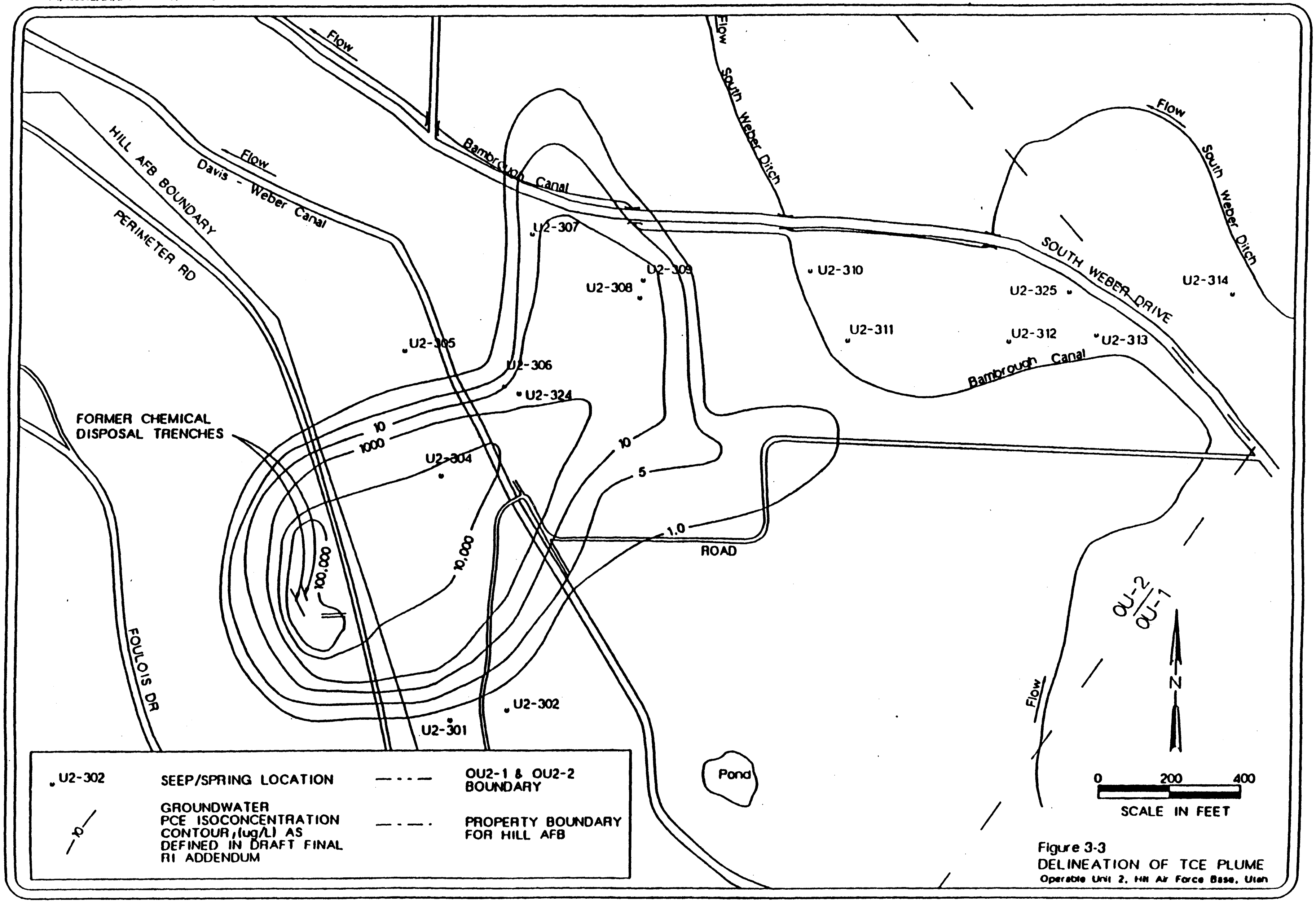

Figure 3-3
DELINEATION OF TCE PLUME
Operable Unit 2, Hill Air Force Base, Utah

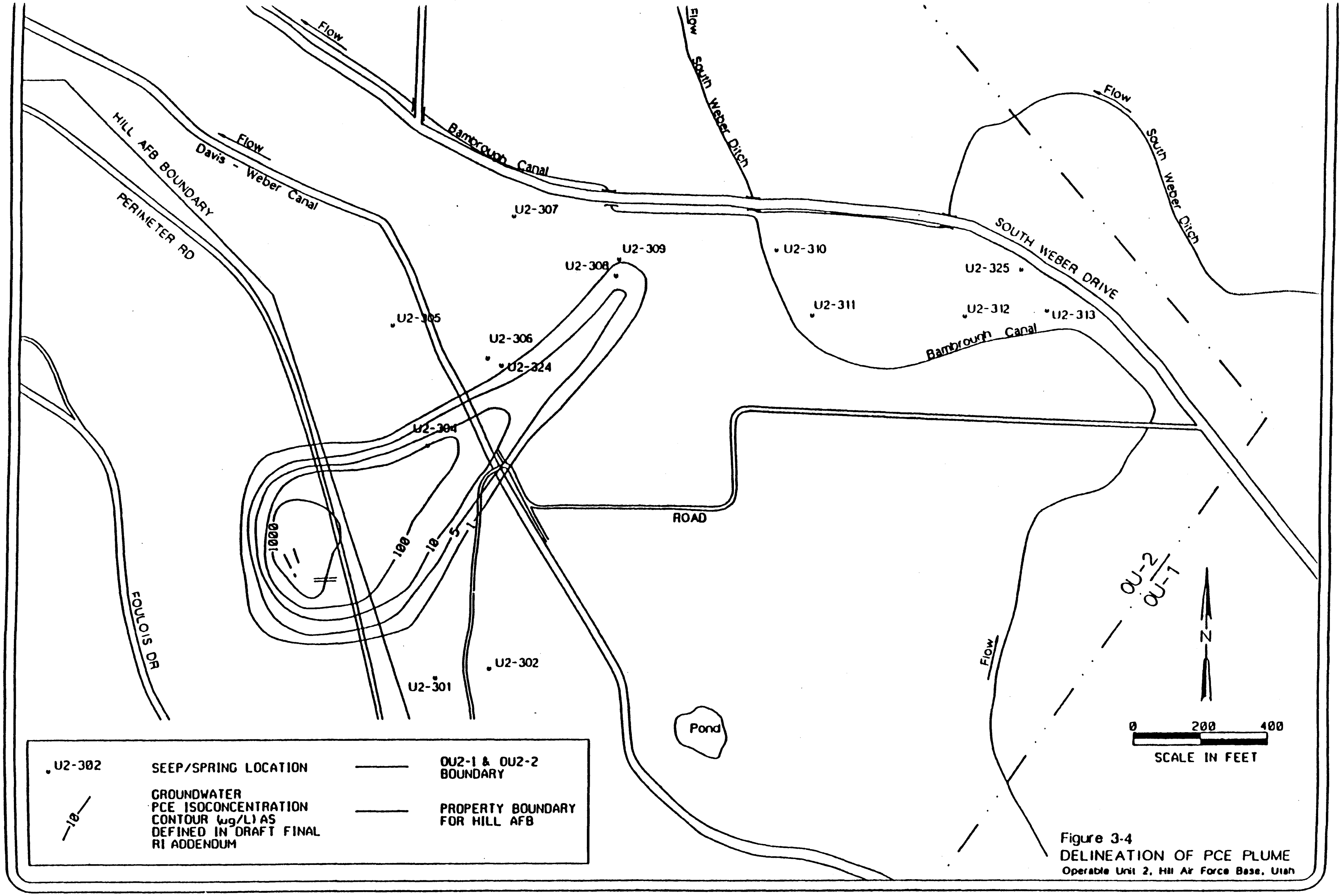

Figure 3-4
DELINEATION OF PCE PLUME
Operable Unit 2, Hill Air Force Base, Utah

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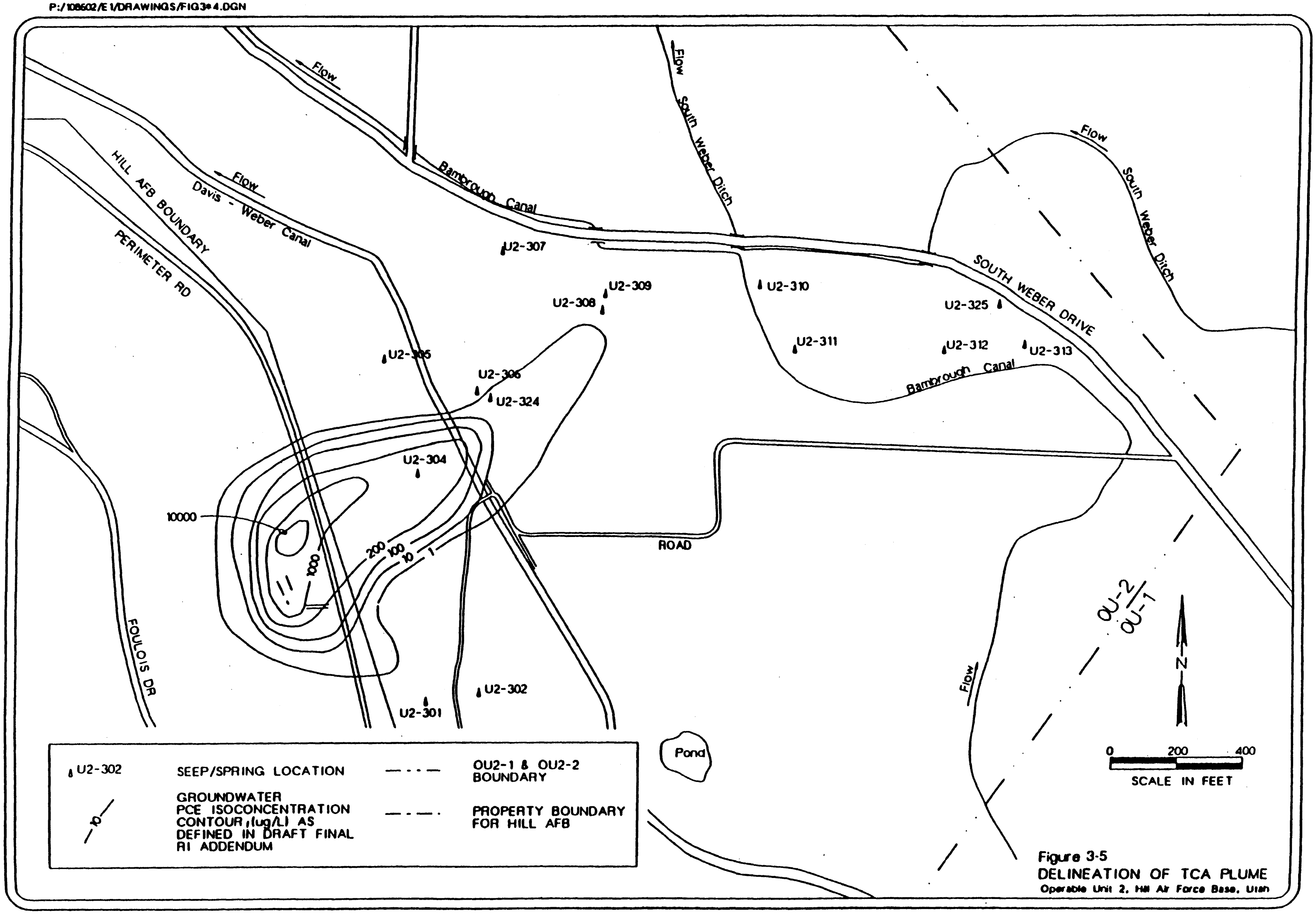


Figure 3-5
DELINEATION OF TCA PLUME
Operable Unit 2, Hill Air Force Base, Utah

contained a maximum of 0.12 mg/l of chromium, which exceeded the Utah Surface Water Quality Standard for Class 4 waters of 0.10 mg/l). All other inorganic constituents were below Utah Class 4 standards. None of these contaminants are believed to be site related.

Air emissions were based on flux chamber measurements in the source area where VOCs in soil gas exhibited the highest concentrations. The maximum measured flux concentration was reported for TCE (8.4 $\mu g/m^3$); TCA (0.7 $\mu g/m^3$); PCE (3.2 $\mu g/m^3$), and methylene chloride (0.48 $\mu g/m^3$).

3.3 Contaminant Transport

Populations and environmental receptors that could be affected, if exposed, include HAFB personnel, off-Base residents north of OU2, future on-Base residents, and plants and animals in the vicinity. The VOCs at OU2 are soluble in water and volatilize into air and the likeliest transport pathways are in water and air. The highest concentrations of contaminants occur on-Base in the vicinity of the former disposal pits. The DNAPL is a concentrated source for VOCs. Potential routes of contaminant transport by groundwater include infiltration through contaminated soils in the source area to the shallow groundwater, partitioning of VOCs from the DNAPL into groundwater and then transport of contaminants towards off-Base areas including seeps and springs. There are also potential volatilization pathways that include volatilization from contaminated soils to air or soil gas, volatilization from contaminated groundwater to soil gas, and volatilization from seeps and springs.

Current on-Base land use at OU2 is restricted. The OU2 on-Base area has not been used for military activity other than the documented waste disposal and is not used for any recurring HAFB function. The main activity is the Source Recovery System (SRS) used to recover the DNAPL in the subsurface. Consequently, HAFB personnel are not expected to encounter site-related contamination on a routine basis. Shallow groundwater in the area is not used as a domestic water source, edible plants are not cultivated, and the area is not subject to cattle grazing. Therefore, current exposures to site-related contamination within the OU2 on-Base area are not anticipated.

Contaminant migration in groundwater is the most significant pathway. The available information regarding operation of the waste disposal trenches indicates that spent liquid chlorinated organic solvents were poured into unlined earthen trenches. The liquid solvents infiltrated through the unsaturated soil to the water table. The solvents continued migrating downward as a DNAPL plume because their specific gravity is greater than water. Downward migration was impeded when the DNAPL reached the Alpine Formation, a low permeability layer composed mostly of silty clay with occasional, thin silty sand lenses. Continued transport of the contaminants occurred as dissolved constituents in groundwater. Some of the shallow groundwater at OU2 discharges to springs and seeps located on the hillside east of Perimeter Road. Several of these springs and seeps are contaminated with the same compounds found in contaminated shallow groundwater. Off-Base transport of site-related chemicals in groundwater has occurred as far as South Weber Drive.

Current land use in off-Base areas is low-density residential development and agriculture. Agricultural land uses include grazing cattle and sheep, in addition to growing alfalfa. Off-

Base residents rely on municipal water for their domestic supply. Shallow groundwater is not used as a source of drinking water in the area, but has been used for irrigation and cattle watering. Alternate water supplies have been provided or treatment units installed at springs to address this pathway to prevent exposures. The Summary of Site Risks (Section 4) discusses the potential exposures in more detail.

Surface soils at OU2 contain elevated inorganic and pesticide constituents in concentrations greater than background. These constituents may be carried by wind-borne dust. The air pathway for VOC contaminant transport at OU2 is through direct volatilization and vapor migration from the soils to the atmosphere. Contaminants from OU2 have been found in soil gas outside of the former Chemical Disposal Pit 3 area.

Based on information collected to date regarding OU2, effects of exposures to nearby ecosystems are expected to be minimal. Details regarding the population and environmental receptors that could be affected are discussed in Section 4, which summarizes the findings of the human health and environmental assessments.

4. SUMMARY OF SITE RISKS

A Baseline Risk Assessment (BRA) was prepared for OU2 to evaluate potential health and environmental effects caused by actual or potential releases of and exposure to OU2-related chemicals under current and hypothetical future conditions. The risk assessment identifies the contaminants of concern (COCs), current and future exposure pathways for humans and environmental receptors, and the probability of adverse effects resulting from exposure. Detailed descriptions of the risk assessment are available in the March 1992 *Baseline Risk Assessment* and April 1994 *Final Addendum to the Remedial Investigation Report for Operable Unit 2, Site WP07, SS21*. Assessment of risk to human health is summarized for each of the four basic components of the risk assessment: identification of chemicals of concern, exposure assessment, toxicity assessment, and risk characterization.

4.1 Human Health Risks

4.1.1 Chemicals of Potential Concern

Chemicals of potential concern (COPCs) are "chemicals that are potentially site-related and whose data are of sufficient quality for use in the quantitative risk assessment (EPA, 1989)." All data of acceptable quality from the Phase I and Phase II IRP investigations and both phases of the remedial investigation were used to identify COPCs. Detailed description of the screening and identification process and criteria are described in the risk assessment documents. Criteria used to select COPCs followed EPA guidance (1989). In addition, chemicals were screened against conservative risk-based concentrations based on calculated preliminary remediation goals for a residential exposure scenario. Chemicals contributing less than 1.0 percent of the relative carcinogenic risk, and less than 1.0 percent of the relative noncarcinogenic risk were eliminated. The COPCs associated with air were determined through modeling to identify those most mobile and posing the greatest potential carcinogenic and noncarcinogenic effects.

Table 4-1 lists the media-specific COPCs and associated exposure concentration data used for risk characterization.

The COPC list was further refined into a list of chemicals of concern (COC) which are chemicals that pose the greatest risk or exceed regulatory standards. Table 4-2 lists the COCs. A detailed description of the process used to identify COCs is presented in the Final Addendum to the Feasibility Study (February 1994).

Table 4-1
Media-Specific Chemicals of Potential Concern and Concentrations Used in Risk Assessment Addendum

Chemical	Maximum Concentration	95% Upper Confidence Limit
SURFACE SOILS		
Organics mg/kg		
Dieldrin	9.4	0.005
Inorganics (mg/kg)		
Beryllium	49	8.66
Lead	83	47.57
SUBSURFACE SOILS		
Organics (mg/kg)		
Tetrachloroethene	200	7.68
Trichloroethene	880	43.6
Aldrin	0.0065	0.0036
Dieldrin	0.013	0.0067
bis(2-ethylhexyl)phthalate	24	12.159
Inorganics (mg/kg)		
NONE		
SITE-WIDE GROUNDWATER		
Organics (mg/L)		
Trichloroethene	890,000	62,270
Tetrachloroethene	9,800	1,310
Methylene chloride	18,000	1,640
Dibenzo(a,h)anthracene	2.65	2.1
Benzo(a)pyrene	2.65	2.1
Dieldrin	0.088	4.98E-02
bis(2-ethylhexyl)phthalate	52	16.7
beta-BHC	0.4	0.3
gamma-BHC	0.48	0.3
Aldrin	0.024	1.55E-02
Heptachlor	0.063	3.62E-02
Heptachlor epoxide	0.026	1.69E-02
alpha-BHC	0.023	1.95E-02
1,1,1-Trichloroethane	33,000	31,950
1,2-Dichloroethene	500	119.7
Toluene	4,400	445

Table 4-1
(Continued)

Chemical	Maximum Concentration	95 % Upper Confidence Limit
Inorganics (mg/L)		
Nitrate-Nitrite	38,000	2,750
Nickel	2,700	565.4
Chromium	11,450	1,707.4
OFFSITE GROUNDWATER		
Organics (mg/L)		
1,1,1-Trichloroethane	3.85	1
1,2-Dichloroethene	0.12	0.12
Aldrin	0.011	0.013
alpha-BHC	0.0017	0.02
bis(2-ethylhexyl)phthalate	2.4	3
delta-BHC	0.02	0.02
Dieldrin	0.02	0.02
gamma-BHC	0.014	0.015
Heptachlor	0.013	0.016
Heptachlor epoxide	0.014	0.017
Methylene chloride	2.0	0.7
Tetrachloroethene	1.1	0.4
Toluene	1.4	0.6
Trichloroethene	53	1.9
Nitrate-Nitrite	38,000	2,750
Nickel	2,700	565
Chromium	11,480	1.710
AIR - Ambient[a]		
Organics (mg/m^3)		
1,1,1-Trichloroethene	3.00E-08	3.00E-08
Methylene chloride	1.90E-08	1.90E-08
Tetrachloroethene	5.10E-09	5.10E-09
Trichloroethene	9.67E-07	9.67E-07

[a] Fugitive dust concentrations in air are presented in Appendix N-2 of the Final RI Addendum.

Table 4-2
Chemicals of Concern

Ground and Surface Water
1,2-Dichloroethene
Methylene Chloride
Tetrachloroethene
1,1,1-Trichloroethane
Trichloroethene
Toluene
beta-BHC (in source area only)
gamma-BHC (Lindane) (in source area only)
Soil and Sediment
Tetrachloroethene
Trichloroethene

4.1.2 Exposure Assessment

The exposure assessment identifies:

- receptors (people) that could potentially be exposed to media containing COPCs by looking at land use both onsite and offsite (contaminants may have migrated from the site,) under current and hypothetical future conditions
- pathways of exposure (such as ingestion, inhalation, and dermal contact)
- how much exposure could occur (exposure point concentrations, frequency, and duration of exposure, the amount of media contacted)

Table 4-3 presents a matrix of potentially exposed populations and relevant exposure pathways. The following describes the exposure pathways in more detail.

4.1.2.1 Current Offsite Residential Exposure Scenario

The current land use in the off-Base areas immediately north and east of OU2 consists of small farms and scattered residential homes. The land area immediately east of the HAFB boundary is owned by the Davis-Weber Canal Company and private land owners. Portions of these areas are occasionally used as rangeland for horse, cattle, and sheep grazing. Farther east, beyond the Davis-Weber Canal, land uses consist of alfalfa fields intermixed with undeveloped rangeland, and residences (some with vegetable gardens).

Pathways for both child and adult receptors include the following:

- inhalation of volatile compounds in ambient air
- inhalation of contaminated fugitive dust from the site in ambient air
- ingestion of fruits and vegetables irrigated with contaminated groundwater
- ingestion of meat and dairy products from animals fed contaminated water or contaminated feed

Table 4-3 Matrix of Potentially Exposed Populations and Relevant Exposure Pathways										
Potentially Exposed Populations	**Inhalation of Ambient Air**	**Ingestion of Drinking Water**	**Dermal Contact with Residential Water**	**Inhalation of Vapor Phase Chemicals From Residential Water**	**Ingestion of Fruits and Vegetables**	**Ingestion of Meat and Dairy**	**Ingestion of Fish**	**Incidental Ingestion of Soil and/or Sediment**	**Dermal Contact with Soil and/or Sediment**	**Inhalation of Vapors at the Source Area**
Offsite Residents - Current Exposure - Future Exposure	√ √	X √	X √	X √	√ √	√ √	X √	X X	X X	X X
Future Onsite Residents	√	√	√	√	√	√	√	√	√	X
Future Onsite Construction Workers	√	X	X	X	X	X	X	√	√	√

Note: A "check mark" (√) indicates that the exposure pathway applies.
An "X" indicates that the exposure pathway does not apply.

Air emissions containing COPCs were estimated using an emission rate equation applicable to the volatilization of organic compounds from buried contamination. Soil exposure point concentrations were used to develop the fugitive dust concentration of inorganic COPCs. Models to estimate fruit and vegetable uptake used the same groundwater exposure point concentrations which were used to develop the route-specific contribution of COPCs. Groundwater exposure point concentrations were also used in a model to estimate beef and milk uptake.

Exposure parameters used for the current offsite receptors were obtained from EPA risk assessment guidance and were used when available and applicable. Site-specific and chemical-specific values were used when available data justified their use. These included, for the future onsite construction worker scenario, an ambient dust level of 486 $\mu g/m^3$. For soil adherence to skin, a value of 1 mg/cm^3 was used versus the value of 2.77 mg/cm^3 default value. For the showering pathway, inhalation of VOCs from water was calculated only for those COPCs with a volatilization factor greater than 0.5 liters per cubic meter, per EPA guidance.

4.1.2.2 Future Offsite Residential Exposure Scenario

Based on population demographics for Davis County, the population increased by 22 percent from 1980 to 1987 (146,540 to 179,000). Other areas proximate to HAFB saw population increases; adjacent Weber County population experienced an 8.5 percent increase. The City of Ogden also experienced slight population growth.

The most likely future changes in land use in the area include increases in residential housing and decreased agricultural activities. New residents will most likely be connected to the municipal water supply, but could use shallow wells and drains for lawn and garden irrigation. New residents may also elect to install shallow groundwater wells even though higher quality water is readily available from other sources (i.e., municipal sources and deeper aquifers).

Exposure parameters used for the future offsite receptors were obtained from risk assessment guidance and were used when available and applicable. Site-specific and chemical-specific values were used when available data justified their use; otherwise, conservative default values were substituted.

Pathways for child and adult receptors include the following:

- inhalation of volatile compounds in ambient air
- inhalation of contaminated fugitive dust from the site in ambient air
- ingestion of contaminated drinking water
- dermal contact with contaminated water while showering and dish washing
- inhalation of volatile compounds while showering, dish washing, clothes washing, and use of toilets
- ingestion of fish in contact with surface water contaminated via groundwater migration
- ingestion of fruits and vegetables irrigated with contaminated groundwater
- ingestion of meat and dairy products from animals fed contaminated water or contaminated feed

The site-wide list of groundwater COPCs were used as the basis for calculating exposure point concentrations for the domestic water use scenarios to estimate the risks associated with future offsite residential exposures. Air emissions containing COPCs were estimated using an emission rate equation applicable to the volatilization of organic compounds from buried contamination. Soil exposure point concentrations were used to develop the fugitive dust concentration of inorganic COPCs.

The 95 percent upper confidence level of the mean concentrations of COPCs were used to determine exposure point concentrations to estimate the intake of COPCs through direct ingestion of and dermal contact with groundwater during in-home use (e.g., showering). Use of contaminated water for bathing, showering, dish washing, clothes washing, and use of toilets may contribute to concentrations of volatile chemicals in the indoor air. A shower volatilization model was used to predict the concentration of volatiles released to the indoor air.

Models to estimate fruit and vegetable uptake used the same groundwater exposure point concentrations which were used to develop the route-specific contribution of COPCs.

4.1.2.3 Future Onsite Residential Exposure Scenario

Residential development is not a likelihood in the on-Base areas of OU2. However, to provide a conservative assessment of the potential risks associated with OU2, health risks based on a future onsite residential development were evaluated. The future potential exposure pathways associated with unrestricted, onsite residential land use include the following:

- inhalation of VOCs in ambient air
- inhalation of contaminated fugitive dust from the site in ambient air
- ingestion of contaminated drinking water
- dermal contact with contaminated water while showering and dish washing
- inhalation of VOCs while showering, dish washing, clothes washing, and use of toilets
- ingestion of fish in contact with surface water contaminated via groundwater migration
- ingestion of fruits and vegetables irrigated with contaminated groundwater
- ingestion of meat and dairy products from animals fed contaminated water or contaminated feed
- skin contact with and incidental ingestion of contaminated sediments
- skin contact with and incidental ingestion of contaminated soils

Assumptions and exposure point concentrations associated with all of the above exposure scenarios, except for the first one and the last two, were identical in evaluation to those considered for future offsite residents. Exposure point concentrations associated with inhalation exposures to VOCs were estimated using soil gas survey results and assuming that the emissions are trapped in the first 2 meters of the atmosphere. Exposure point concentrations associated with exposure to soil were based on the assumption that subsurface soil, when brought to the surface, would be available for contact through incidental ingestion and dermal contact. The concentrations of COPCs were used to derive the exposure point concentrations for both skin contact and incidental ingestion. In addition, future onsite residents could face exposure to surface and subsurface soil (brought to the surface as a result of excavation) through inhalation of fugitive dust.

4.1.2.4 Future Onsite Worker Scenario

If development occurs at OU2 in the absence of remediation, onsite construction workers could be exposed to site-related chemicals. Exposure pathways effecting workers engaged in construction activities include:

- inhalation of volatile compounds in ambient air
- inhalation of contaminated fugitive dust from the site in ambient air
- inhalation of VOCs close to the source
- skin contact with and incidental ingestion of contaminated sediments
- skin contact with and incidental ingestion of contaminated soil

As with the future onsite residential setting, exposure point concentrations associated with inhalation exposures to VOCs were estimated using soil gas survey results similarly to the future onsite resident. The concentrations of COPCs were used to derive the exposure point concentrations for both skin contact and incidental ingestion. The exposure point concentrations associated with exposure to soil were based on the assumption that subsurface soil, when brought to the surface, would be available for contact through incidental ingestion and dermal contact. Measured concentrations of COPCs were used to derive the exposure point concentrations for both skin contact and incidental ingestion. In addition, future onsite workers could face exposure to surface and subsurface soil (brought to the surface as a result of excavation) through inhalation of fugitive dust.

4.1.3 Toxicity Assessment

Contaminants may have carcinogenic (cancer-causing) effects or noncarcinogenic/systemic effects. Exposure to some of the chemicals detected at OU2 could potentially result in both types of effects. For carcinogens, it is assumed any amount of exposure to a carcinogenic chemical poses a potential for generating a carcinogenic response in the exposed organism.

Noncarcinogenic or systemic effects include a variety of toxicological end points and may include effects on specific organs or systems, such as the kidney, liver, lungs, etc. Threshold levels generally exist for noncarcinogenic effects, i.e., a dose exceeding a certain level must be reached before health effects are observed. No adverse effects are assumed for doses below the threshold.

Cancer potency factors (CPFs), or Slope Factors (SFs) are used to provide conservative estimates of excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. Slope Factors, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at the intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the SF. Use of this approach makes underestimation of the actual cancer risk unlikely. Slope factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied (for example, to account for the use of animal data to predict effects on humans).

Reference doses (RfDs) are used to indicate the potential for adverse health effects from exposure to chemicals causing noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimated threshold levels for daily exposure below which exposure is considered safe for humans, including sensitive individuals. Estimated intakes of COPCs from environmental media (for example, the amount of a COPC ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (for example, to account for the use of animal data to predict effects on humans).

Slope Factors and RfDs used in conjunction with chemical intake to estimate the potential for adverse health effects for the COPCs, are presented in Table 4-4. Slope factors and RfDs are specific to the route of exposure; for example, oral SFs are used to evaluate risk through ingestion of a carcinogenic COPC.

Oral SFs and RfDs are not available for all COPCs identified at OU2. When data are limited, toxicity values are sometimes derived from alternate data. The alternate data include unverified RfDs for TCE provided in "Drinking Water Regulations and Health Advisories" published by EPA. RfDs for DCE and nickel have not been verified but are listed in the EPA's Integrated Risk Information System (IRIS).

4.2 Summary of Risk Characterization

Carcinogenic and noncarcinogenic risks were calculated for each of the exposure pathways for the potential contaminants of concern and compared to acceptable levels of risk. For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. Risks are probabilities that are generally expressed in exponential form. An excess lifetime cancer risk of 1×10^{-6} indicates that an individual has a one-in-1 million additional chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under specific exposure conditions at OU2.

To address the range of exposures that may occur at the present time and in the future, both average and reasonable maximum exposures (RME) were considered. Inclusion of both average and RME exposures allows risks to be estimated for the upper-bound exposure situation and the more typical or average exposure. The resulting risk estimates then present a range of possible risks based on the range of possible exposure conditions.

The National Contingency Plan (NCP) uses 1×10^{-4} to 1×10^{-6} as a range within which the EPA strives to manage risks as part of a Superfund cleanup. Although waste management strategies achieving reductions in site risks anywhere within the risk range may be deemed acceptable by the EPA risk manager, the NCP expresses a preference for cleanups achieving the more protective end of the risk range (for example, 1×10^{-6}). Risks in the 10^{-4} to 10^{-6} range may be significant and remedial action may be warranted. Those risks exceeding a 10^{-4} are significant and remedial action is required. The use of the terms "significant", "potentially significant", and "insignificant" are not meant to imply acceptability. They are intended only to provide perspective. A specific risk estimate less than 1×10^{-4} may be considered unacceptable based on site-specific conditions, including any remaining uncertainties about the nature and extent of contamination and associated risks.

Table 4-4
Toxicity Values for Chemicals of Potential Concern

Compound	EPA Class	Chronic Oral RfD mg/kg/day	Chronic Dermal RfD(a) mg/kg/day	Chronic Inhalation RfC mg/m3	Oral SF 1/(mg/kg/day)	Dermal SF(a) 1(mg/kg/day)	Inhalation UR 1/(mg/m-3)
1,1,1-Trichloroethane	D	9.00E-02 (H)	4.50E-03	1.00E+03 (H)	—	—	—
1,2-Dichloroethene	—	1.00E-02 (H)	5.00E-04	—	—	—	—
Aldrin	B2	3.00E-05 (I)	1.50E-06	—	1.7E+01 (I)	3.40E+02	4.9E-03 (I)
alpha-BHC	B2	—	—	—	6.3E+00 (I)	6.47E+00	1.8E-03 (I)
Benzo(a)pyrene	B2	—	—	—	7.3E+00 (I)	9.13E+00(a)	
Beryllium	B2	5.00E-03 (I)	2.50E-04	—	4.3E+00 (I)	8.60E+01	2.4E-03 (I)
beta-BHC	C	—	—	—	1.8E+00 (I)	1.98E+00(a)	5.3E-04 (I)
bis(2-Ethylhexyl)-phthalate	B2	2.00E-02 (I)	1.00E-02(a)	—	1.4E-02 (I)	—	—
Chromium	-	1.00E+00 (J)	5.00E-02	—	—	—	—
delta-BHC	D	—	—	—	—	—	—
Dibenzo(a,h)-anthracene	B2	—	—	—	7.3E+00 (C)	—	—
Dieldrin	B2	5.00E-05 (I)	2.50E-05(a)	—	1.60E+01 (I)	1.46E+02	4.0E-03 (I)
gamma-BHC	B2/C	3.00E-04 (I)	2.98E-04(a)	—	1.30E+00 (H)	3.20E+01(a)	—
Heptachlor	B2	5.00E-04 (I)	3.00E-04(a)	—	4.50E+00 (I)	1.31E+00(a)	1.3E-03 (I)
Heptachlor epoxide	B2	1.30E-05 (I)	7.80E-06(a)	—	9.10E+00 (I)	7.50E+00(a)	2.6E-03 (I)
Lead	B2	—	—	—	—	1.52E+01(a)	—
Methylene chloride	B2	6.00E-02 (I)	3.00E-03	3.00E+03 (H)	7.50E-03 (I)	1.51E-01	4.7E-07 (I)
Nickel	A	2.00E-02 (I)	1.00E-03	—	—	—	—
Nitrate-Nitrite(b)		1.00E-01	5.00E-03	—	—	—	—
Phenanthrene	D	—	—	—	—	—	—
Silicon	—	—	—	—	—	—	—
Sulfate	—	—	—	—	—	—	—
Tetrachloroethene	B2/C	1.00E-02 (I)	9.80E-03(a)	—	5.20E-02 (E)'	5.50E-02(a)	5.8E-073 (E)'
Toluene	D	2.00E-01 (I)	1.00E-02	4.00E+02 (I)	—	—	—
Trichloroethene	B2/C	—	—	—	1.10E-02 (E)	1.10E-02(a)	1.70 E-06 (E)

Table 4-4 (Continued)

Compound	EPA Class	Subchronic Oral RfD mg/kg/day		Subchronic Dermal RfD(a) mg/kg/day	Subchronic Inhalation RfC mg/m3	
1,1,1-Trichloroethane	D	9.00E-01	(H)	4.50E-02	1.00E+00	(H)
1,2-Dichloroethene	—	1.00E-01	(H)	5.00E-03	—	
Aldrin	B2	3.00E-05	(H)	1.50E-06	—	
alpha-BHC	B2	—		—	—	
Benzo(a)pyrene	B2	—		—	—	
Beryllium	B2	5.00E-03	(H)	2.50E-04	—	
beta-BHC	C	—		—	—	
bis(2-Ethylhexyl)-phthalate	B2	2.00E-02	(H)	1.40E-02(a)	—	
Chromium	—	1.00E+01	(H)	5.00E-01	—	
delta-BHC	D	—		—	—	
Dibenzo(a,h)-anthracene	B2	—		—	—	
Dieldrin	B2	5.00E-05	(H)	2.50E-05(*)	—	
gamma-BHC	B2/C	3.00E-03	(H)	2.98E-03(*)	—	
Heptachlor	B2	5.00E-04	(H)	3.00E-04(*)	—	
Heptachlor epoxide	B2	1.30E-05	(H)	7.80E-06(*)	—	
Lead	B2	—		—	—	
Methylene chloride	B2	6.00E-02	(H)	3.00E-03	3.00E+03	(H)
Nickel	A	2.00E-02	(H)	1.00E-03	—	
Nitrate-Nitrite		—		—	—	
Phenanthrene	D	—		—	—	
Silicon	—	—		—	—	
Sulfate	—	—		—	—	
Tetrachloroethene	B2/C	1.00E-01		9.50E-02(*)	—	
Toluene	D	2.00E+00	(H)	1.00E-01	2.00E+00	(H)
Trichloroethene	B2/C	—		—	—	

(a) Dermal values were derived from oral values according to guidance in Risk Assessment Guidance for Superfund (EPA, 1989a).
(b) Toxicity values for Nitrate used as surrogate values for Nitrate-Nitrite.
(*) Derived from gastro-intestinal absorption values according to guidance in Risk Assessment Guidance for Superfund (EPA, 1989a.)
SF Cancer slope factor (risk per milligram pollutant per kilogram body weight per day)
RfD Reference dose chronic (milligrams pollutant per kilogram body weight per day)
RfC Reference concentration
(H) HEAST, FY 1993
(I) IRIS on line search (2/25/94) (EPA, 1991a)
(E) Slope Factor obtained from Superfund Health Risk Technical Support Center (EPA, 11/93).
(E)' EPA 10/93
(S) The RfD for endsulfan was used as a surrogate for endosulfan sulfate (Ito, 1975).
(C) Values calculated using the "Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons," (EPA, 1993).

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (for example, a lifetime) with a RfD derived for a similar exposure period. The ratio of a single substance exposure level over a specified time to a reference dose for that substance derived from a similar exposure period is called a hazard quotient (HQ). The HQ is the ratio of the chronic daily intake (CDI) to the RfD. The CDI and RfD are expressed in the same units and represent the same exposure period (that is, chronic, subchronic, or short-term).

If the CDI (exposure) is greater than the RfD, the HQ will be greater than one. An HQ greater than one indicates the potential for an adverse noncarcinogenic health effect from exposure to the chemical.

A Hazard Index (HI) is generated by adding the simultaneous subthreshold exposures of several chemicals that could result in an adverse health effect. HQs are added for all COPCs that effect the same target organ or system (for example, the liver or respiratory system) within a medium or across all media to which a given population may reasonably be exposed. If the HI for each toxic end point exceeds one, the potential for an adverse noncarcinogenic health effect from exposure to the medium is indicated.

The following describes the results of the risk characterization for each exposure scenario discussed above. Table 4-5 identifies key chemicals and exposure pathways associated with the potential for carcinogenic risks; Table 4-6 identifies key chemicals and exposure pathways associated with the potential for noncarcinogenic health effects. Tables 4-7 and 4-8 summarize the cumulative average and reasonable maximum carcinogenic and non-carcinogenic risks, respectively.

The carcinogenic and non-carcinogenic risk characterization for OU2 indicates that under realistic worst-case and most probable exposure scenarios, risks associated with current exposure pathways are mostly "insignificant". For the future construction worker, risks are potentially significant in the low probability range for carcinogens and non-carcinogenic effects are unlikely.

Potential risks are indicated for the future offsite residential exposure scenario:

- For adults, the estimated excess lifetime cancer risks for the average and RME conditions fall between about 3×10^{-3} to 2×10^{-2}. For the RME condition, TCE contributes about 92 percent of the total risk. Pathway-specific contribution to risk indicates inhalation while showering accounts for 42 percent of the total, followed by ingestion of water (38 percent), and dermal contact with water (20 percent). The HI associated with this scenario is 9 for the average condition and 20 for the RME condition. TCA (39 percent), PCE (21 percent), and methylene chloride (20 percent) are the major contributors to non-cancer risk. Ingestion (43 percent), dermal contact (43 percent), and inhalation (12 percent) account for 98 percent of the pathway-specific contribution to non-cancer risk.

- For children, the estimated excess lifetime cancer risks for the average and RME conditions fall between about 4×10^{-3} to 9×10^{-3}. For the RME condition, TCE contributes approximately 91 percent of the total risk. Pathway-specific contribution to risk includes ingestion (50 percent), inhalation (30 percent), and dermal contact (20 percent) exposures to groundwater. The HI associated with this scenario is 20 for the average case and 30 for the RME estimate. TCA (34 percent), PCE (25 percent), and methylene chloride (18 percent) are the major contributors to the RME HI. Ingestion (51 percent) and dermal contact (36 percent) account for 87 percent of the total pathway-specific contribution to non-cancer risk.

Table 4-5

Identification of Key Chemicals and Exposure Pathways in the RA Addendum That Drive the Carcinogenic Risk Assessment

Scenarios	Total Scenario Risk	Chemicals That Contribute Chemical-Specific Risk ≥ 1 in 1,000,000 (% Contribution to Total)	Exposure Pathways That Contribute Pathway-Specific Risk ≥ 1 in 1,000,000 (% Contribution to Total)
Current Offsite Residential			
- Adult, Average	6 in 10,000,000	None	None
- Adult, Reasonable Maximum	8 in 10,000,000	None	None
- Child, Average	1 in 1,000,000	None	Ingestion of vegetables (57%) Ingestion of fruits (32%)
- Child, Reasonable Maximum	3 in 1,000,000	Heptachlor epoxide (45%) Dieldrin (29%) alpha-BHC (6.9%) Aldrin (6.4%) Beryllium (5.6%) Heptachlor (3.9%) Bis (2-Ethylhexyl)phthalate (1.6%) gamma-BHC (1%)	Ingestion of vegetables (55%) Ingestion of fruits (29%)
Future Offsite Residential			
- Adult, Average	3 in 1000	Trichloroethene (91%) Tetrachloroethene (6%) Methylene chloride (3%) Dieldrin (<1%) Heptachlor epoxide (<1%) gamma-BHC (<1%) Aldrin (<1%)	Ingestion of drinking water (63%) Dermal contact with water (23%) Inhalation while showering (14%) Ingestion of fruits (<1%) Ingestion of vegetables (<1%)

Table 4-5 (Continued)

Scenarios	Total Scenario Risk	Chemicals That Contribute Chemical-Specific Risk ≥ 1 in 1,000,000 (% Contribution to Total)	Exposure Pathways That Contribute Pathway-Specific Risk ≥ 1 in 1,000,000 (% Contribution to Total)
- Adult, Reasonable Maximum	2 in 100	Trichloroethene (92%) Methylene chloride (4%) Tetrachloroethene (3%) Dieldrin (<1%) Heptachlor epoxide (<1%) gamma-BHC (<1%) Aldrin (<1%) Bis(2-Ethylhexyl)phthalate (<1%) Heptachlor (<1%) alpha-BHC (<1%)	Inhalation while showering (42%) Ingestion of drinking water (38%) Dermal contact with water (20%) Ingestion of meat (<1%) Ingestion of dairy products (<1%) Ingestion of fruits (<1%) Ingestion of vegetables (<1%)
- Child, Average	4 in 1,000	Trichloroethene (90%) Tetrachloroethene (6%) Methylene chloride (3%) Dieldrin (<1%) Heptachlor epoxide (<1%) gamma-BHC (<1%) Aldrin (<1%) Bis(2-Ethylhexyl)phthalate (<1%) Heptachlor (<1%)	Ingestion of drinking water (72%) Dermal contact with water (19%) Inhalation while showering (8%) Ingestion of fruits (<1%) Ingestion of vegetables (<1%)
- Child, Reasonable Maximum	9 in 1,000	Trichloroethene (91%) Tetrachloroethene (5%) Methylene chloride (4%) Dieldrin (<1%) Heptachlor epoxide (<1%) gamma BHC (<1%) Aldrin (<1%) Bis(2-Ethylhexyl)phthalate (<1%) Heptachlor (<1%) alpha-BHC (<1%)	Ingestion of drinking water (50%) Inhalation while showering (30%) Dermal contact with water (20%) Ingestion of vegetables (<1%) Ingestion of fruits (<1%) Ingestion of meat (<1%)

Scenarios	Total Scenario Risk	Chemicals That Contribute Chemical-Specific Risk ≥ 1 in 1,000,000 (% Contribution to Total)		Exposure Pathways That Contribute Pathway-Specific Risk ≥ 1 in 1,000,000 (% Contribution to Total)	
Future Onsite Residential					
- Adult, Average	3 in 1,000	Trichloroethene	(79%)	Ingestion of drinking water	(57%)
		Benzo(a)pyrene	(11%)	Dermal contact with water	(30%)
		Tetrachloroethene	(5%)	Inhalation while showering	(12%)
		Methylene chloride	(3%)	Ingestion of soil	(<1%)
		Dibenzo(a,h)anthracene	(1%)	Dermal contact with soil	(<1%)
		Beryllium	(<1%)	Inhalation of ambient air	(<1%)
		Heptachlor epoxide	(<1%)	Ingestion of soil	(<1%)
		beta BHC	(<1%)	Ingestion of fruits	(<1%)
		Dieldrin	(<1%)	Ingestion of vegetables	(<1%)
		gamma-BHC	(<1%)		
		Aldrin	(<1%)		
- Adult, Reasonable Maximum	3 in 100	Trichloroethene	(83%)	Inhalation while showering	(37%)
		Benzo(a)pyrene	(9%)	Ingestion of drinking water	(35%)
		Methylene chloride	(4%)	Dermal contact with water	(27%)
		Tetrachloroethene	(3%)	Inhalation of ambient air	(<1%)
		Dibenzo(a,h)anthracene	(<1%)	Ingestion of soil	(<1%)
		Beryllium	(<1%)	Dermal contact with soil	(<1%)
		Dieldrin	(<1%)	Inhalation of soil	(<1%)
		Aldrin	(<1%)	Ingestion of vegetables	(<1%)
		alpha BHC	(<1%)	Ingestion of fruits	(<1%)
		beta BHC	(<1%)	Ingestion of meat	(<1%)
		bis(2-ethylhexyl)phthalate	(<1%)	Ingestion of dairy products	(<1%)
		gamma BHC	(<1%)		
		Heptachlor	(<1%)		
		Heptachlor epoxide	(<1%)		
- Child, Average	5 in 1000	Trichloroethene	(80%)	Ingestion of drinking water	(66%)
		Benzo(a)pyrene	(9%)	Dermal contact with water	(25%)
		Tetrachloroethene	(6%)	Inhalation while showering	(7%)
		Methylene chloride	(3%)	Inhalation of ambient air	(<1%)
		Dibenzo(a,h)anthracene	(1%)	Ingestion of soil	(<1%)

Scenarios	Total Scenario Risk	Chemicals That Contribute Chemical-Specific Risk ≥ 1 in 1,000,000 (% Contribution to Total)	Exposure Pathways That Contribute Pathway-Specific Risk ≥ 1 in 1,000,000 (% Contribution to Total)
		Dieldrin (<1%) Heptachlor epoxide (<1%) Aldrin (<1%) Beryllium (<1%) beta BHC (<1%) bis(2-ethylhexyl)phthalate (<1%) gamma BHC (<1%) Heptachlor (<1%)	Dermal contact with soil (<1%) Ingestion of fruits (<1%) Ingestion of vegetables (<1%)
Child, Reasonable Maximum	1 in 100	Trichloroethene (82%) Benzo(a)pyrene (5%) Tetrachloroethene (4%) Methylene chloride (3%) Dibenzo(a,h)anthracene (1%) Dieldrin (<1%) Aldrin (<1%) alpha BHC (<1%) Beryllium (<1%) beta BHC (<1%) bis(2-ethylhexyl)phthalate (<1%) gamma BHC (<1%) Heptachlor (<1%) Heptachlor epoxide (<1%)	Ingestion of drinking water (47%) Inhalation while showering (27%) Dermal contact with water (26%) Inhalation of ambient air (<1%) Ingestion of soil (<1%) Dermal contact with soil (<1%) Ingestion of vegetables (<1%) Ingestion of fruit (<1%) Ingestion of meat (<1%)
Future Onsite Construction Worker			
- Adult, Average	5 in 1,000,000	Beryllium (75%)	Ingestion of soil (54%) Dermal contact with soil (29%)
- Adult, Reasonable Maximum	5 in 1,000,000	Beryllium (75%)	Ingestion of soil (54%) Dermal contact with soil (29%)

Table 4-6

Identification of Key Chemicals and Exposure Pathways in the RA Addendum That Drive the Noncarcinogenic Risk Assessment

Scenarios	Total Scenario Hazard Index	Chemicals That Contribute Chemical-Specific Hazard Index ^{3} 1 (% Contribution to Total)	Exposure Pathways That Contribute Pathway-Specific Hazard Index ^{3} 1 (% Contribution to Total)
Current Offsite Residential (Subchronic)			
- Adult, Average	0.06	None	None
- Adult, Reasonable Maximum	0.1	None	None
- Child, Average	0.2	None	None
- Child, Reasonable Maximum	0.5	None	None
Future Offsite Residential (Chronic)			
- Adult, Average	9	1,1,1-Trichloroethene (33%) Tetrachloroethene (28%) Methylene chloride (17%)	Ingestion of drinking water (56%) Dermal contact with water (38%)
- Adult, Reasonable Maximum	20	1,1,1-Trichloroethane (39%) Tetrachloroethene (21%) Methylene chloride (20%) Nickel (6%)	Ingestion of drinking water (43%) Dermal contact with water (43%) Inhalation while showering (12%)
- Child, Average	20	Tetrachloroethene (31%) 1,1,1-Trichloroethane (29%) Methylene chloride (15%) Nickel (8%) Nitrate-Nitrite (7%)	Ingestion of drinking water (64%) Dermal contact with water (31%)
- Child, Reasonable Maximum	30	1,1,1-Trichloroethane (34%) Tetrachloroethene (25%) Methylene chloride (18%) Nickel (8%)	Ingestion of drinking water (51%) Dermal contact with water (36%) Inhalation while showering (8%)

Scenarios	Total Scenario Hazard Index	Chemicals That Contribute Chemical-Specific Hazard Index ³ 1 (% Contribution to Total)	Exposure Pathways That Contribute Pathway-Specific Hazard Index ³ 1 (% Contribution to Total)
		Nitrate-Nitrite (5%) Toluene (3%)	Ingestion of vegetables (3%)
Future Onsite Residential (Chronic)			
- Adult, Average	9	1,1,1-Trichloroethane (33%) Tetrachloroethene (27%) Methylene chloride (17%)	Ingestion of drinking water (56%) Dermal contact with water (38%)
- Adult, Reasonable Maximum	20	1,1,1-Trichloroethane (40%) Tetrachloroethene (21%) Methylene chloride (20%) Nickel (6%)	Ingestion of drinking water (43%) Dermal contact with water (42%) Inhalation while showering (12%)
- Child, Average	20	Tetrachloroethene (31%) 1,1,1-Trichloroethane (29%) Methylene chloride (16%) Nickel (8%) Nitrate-Nitrite (7%)	Ingestion of drinking water (64%) Dermal contact with water (31%)
- Child, Reasonable Maximum	30	1,1,1-Trichloroethane (34%) Tetrachloroethene (25%) Methylene chloride (18%) Nickel (8%) Nitrate-Nitrite (5%) Toluene (1%)	Ingestion of drinking water (51%) Dermal contact with water (36%) Inhalation while showering (8%) Ingestion of vegetables (3%)
Future Onsite Construction Worker (Subchronic)			
- Adult, Average	0.03	None	None
- Adult, Reasonable Maximum	0.03	None	None

Table 4-7
Summary of Carcinogenic Risks by Exposure Scenario

Scenario	Carcinogenic Risk			
	Birth to 7 years		Adult	
	Average	Reasonable Maximum	Average	Reasonable Maximum
Current Offsite Residential	1×10^{-6}	3×10^{-6}	6×10^{-7}	8×10^{-7}
Future Offsite Residential	4×10^{-3}	9×10^{-3}	3×10^{-3}	2×10^{-2}
Future Onsite Residential	3×10^{-3}	3×10^{-2}	5×10^{-3}	1×10^{-2}
Future Onsite Construction Worker	NA	NA	5×10^{-6}	5×10^{-6}

Table 4-8
Summary of Noncarcinogenic Risks for Chronic and Subchronic Exposure Scenarios

Scenario	Chronic Hazard Index			
	Children		Adult	
	Average	Reasonable Maximum	Average	Reasonable Maximum
Future Offsite Residential	20	30	10	20
Future Onsite Residential	20	30	10	20
Scenario	**Subchronic Hazard Index**			
	Children		**Adult**	
	Average	**Reasonable Maximum**	**Average**	**Reasonable Maximum**
Current Offsite Residential	0.3	0.8	0.1	0.2
Future Onsite Construction Worker	NA	NA	0.1	0.1

Similar magnitudes of potential risk are indicated for the future onsite residential exposure scenario:

- For adults, the estimated excess lifetime cancer risks for the average and RME conditions fall between about 3×10^{-3} to 3×10^{-2}. For the RME estimate, TCE contributes about 83 percent of the total risk, followed by benzo(a)pyrene at about 9 percent. Inhalation while showering (37 percent), ingestion of groundwater (35 percent), and dermal contact with groundwater (27 percent) account for 99 percent of the total pathway-specific risk contribution. The HI associated with this scenario is approximately 9 for the average condition and about 20 for the RME condition. TCA (40 percent), PCE (21 percent), and methylene chloride (20 percent) are the major contributors to the HI. Ingestion of groundwater (43 percent), dermal contact (42 percent), and inhalation (12 percent) while showering account for about 97 percent of the total pathway-specific contribution to non-cancer risk.
- For children, the estimated excess lifetime cancer risks for the average and RME conditions fall between about 5×10^{-3} to 1×10^{-2}. For the RME estimate, TCE contributes approximately 82 percent of the total risk followed by benzo(a)pyrene at 5 percent. The most significant contribution on a pathway-specific basis is groundwater ingestion (47 percent) followed by inhalation of compounds while showering (27 percent), and dermal contact with groundwater (26 percent). The HI associated with this scenario is 20 for the average condition and 30 for the RME condition. For the RME condition, TCA, PCE, and methylene chloride are the major contributors at 34 percent, 25 percent, and 18 percent, respectively. Ingestion of groundwater (51 percent) and dermal contact exposure with groundwater (36 percent) are the major pathway-specific non-cancer risk contributors.

4.3 Environmental Evaluation

Qualitative evaluation of risk to ecological receptors indicates insignificant risks from contamination present at OU2. Critical habitat for a threatened or endangered species, as defined by the U.S. Fish and Wildlife Service, is not present at OU2. No threatened or endangered species that are full-time residents of HAFB have been identified at OU2.

Two endangered species reside near the Base: bald eagles and peregrine falcons. Bald eagles and peregrine falcons are not expected to receive significant exposure based on the following:

- Bald eagles feed primarily on fish. Fish resources in the vicinity of HAFB are restricted to Weber River, and evidence suggests that fish in the river have not been impacted by offsite migration of contaminants from OU2.
- Other routes of exposure for both bald eagles and peregrine falcons (for example, inhalation and direct ingestion of groundwater from springs and seeps are insignificant. Ambient air concentrations are estimated to be very low and drinking water sources are likely to be larger water bodies in the area.
- Bald eagles are part-year residents and spend only the winter months in the vicinity.

Potential impacts to alfalfa and cattle based on exposure to COPCs were evaluated. The uptake of organic COPCs detected in groundwater was calculated for alfalfa and cattle. Information on the toxic effects of the organic COPCs on alfalfa was not found in the literature. In addition, no information was found on the maximum tolerable dietary levels for cattle for the organic COPCs. Therefore, the toxicity of these compounds to alfalfa and cattle could not be evaluated. Also, based on the concentrations detected, combined with literature information on possible toxic effects, none of the inorganic COPCs are expected to cause phytotoxicity in alfalfa or toxic effects in cattle.

Evidence does not suggest that fish and other ecological receptors inhabiting the Weber River have been effected by offsite migration of groundwater from OU2. The TCE plume terminates more than 4,000 feet southwest of the Weber River. However, should the contaminant plume reach the Weber River sometime in the future, it is possible that fish could bioconcentrate site-related chemicals. The estimated concentration of a chemical in fish was estimated by the product of the concentration measured in groundwater and the chemical-specific bioconcentration factor.

4.4 Uncertainty in the Risk Assessment

The risk assessment methodology is based on a variety of assumptions, conditions, and factors. The purpose of the uncertainty analysis is to present key information that provides a level of confidence that may be placed on the quantitative risk assessment. In general, the risk assessment attempts to err on the side of safety by using conservative assumptions regarding exposure and risk. Table 4-9 presents a qualitative discussion of each of the above uncertainties and the potential impact on the BRA.

Major sources of uncertainty and their effects on the risk assessment include:

- The prediction of human activities that lead to contact with media and exposure to chemicals is highly uncertain. Assumptions used to estimate RME conditions are conservative. The assumptions used in estimating risk include on-Base residential land use, residential use of shallow groundwater, and individual risk threshold criteria are the same as used for the population as a whole. Removal of land use and use of shallow groundwater would make the risk negligible. Removal of the risk threshold would reduce the significance of inhalation risk estimates.
- Some data from earlier investigations are uncertain due to the limited number of chemicals analyzed and in some cases the analytical methods. The resulting data base lacked analysis of groundwater samples for several chemicals detected in soils at the site. In addition, nondetects or qualified values were used quantitatively as appropriate. This adds uncertainty to the selection of COPCs and could overestimate or underestimate exposure point concentrations.
- Large numbers of assumptions are made to estimate release rates, model environmental transport and fate, and quantify exposure. Food chain modeling introduces considerable uncertainty to exposure point concentration estimation. This adds uncertainty which could result in overestimation of risk.

Table 4-9
Summary of Uncertainties

Condition/ Assumption	Source of Uncertainty	Quantitative Effect	Impact of Risk Characterization
Physical Setting			
Onsite residential land use	Use of default assumption	Overestimates risk	Very high; removal of condition would make risk from onsite surface soils negligible.
Residential use of shallow groundwater	Use of default assumption	Overestimates risk	Very high; removal of condition would make shallow groundwater negligible contributor to risk for most scenarios
Individual risk threshold criteria same as population	Use of default assumption	Overestimates risk	Medium; would reduce significance of offsite inhalation risk estimates
Contaminant of Potential Concern			
Pesticide presence	Assumed to be due to waste disposal	Overestimates risks; condition is probably due to area-wide agricultural activities	Medium; major risk contributors for certain exposure scenarios
Polyaromatic Hydrocarbons (PAH) presence	Single groundwater sample	Overestimates risks; PAHs not widely found	Low; PAHs not a major risk
Background concentrations characterization	Data adequacy	Unknown	Low; data considered reasonably complete and representative
Use of filtered groundwater sample results vs. unfiltered sample results	Professional judgment	Filtered samples more repeatable. Turbidity may effect total concentration	Low to medium; some filtered samples show lower values
Exposure Assessment			
Pathways combine maximally in single individual	Use of default assumption	Possible overestimation of risk	Possibly large; unlikely that significant population will be maximally exposed by all pathways
100% bioavailability for absorption upon contact with media	Use of default assumption	Overestimation of risk	Moderate; inhalation/ingestion adsorption of contaminant varies
Toxicity Assessment			
Toxicity factors missing for Si, Co, delta-BHC, etc.	Factors lacking	Low underestimation	Unknown; could result in an underestimation of overall site risks
Use of unverified values for trichloroethene	Verified factors lacking	Moderate overestimation	Unknown; trichloroethene RfD under review
Possible synergistic or antagonistic effects of multichemical exposure	Data inadequacy	Unknown	Unknown; could lead to an over- or underestimation of risks

- The prediction of risks associated with the dermal exposure pathway is difficult because mechanisms to quantify the contribution of dermal absorption are not well established and considerable uncertainty surrounds estimates of dermal exposure and risk.
- Uncertainties associated with the toxicity assessment include use of alternate RfDs, use of oral RfDs as dermal RfDs, and lack of toxicity data. Risk and doses within an exposure route are assumed to be additive when, in fact, synergisms and antagonisms occur. This could act to overestimate or underestimate risk.

4.5 Overview of Site Risks

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

Remedial action at OU2 is warranted based on 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. VOCs associated with domestic groundwater use account for the majority of the risk by ingestion and inhalation pathways.

5. DESCRIPTION OF ALTERNATIVES

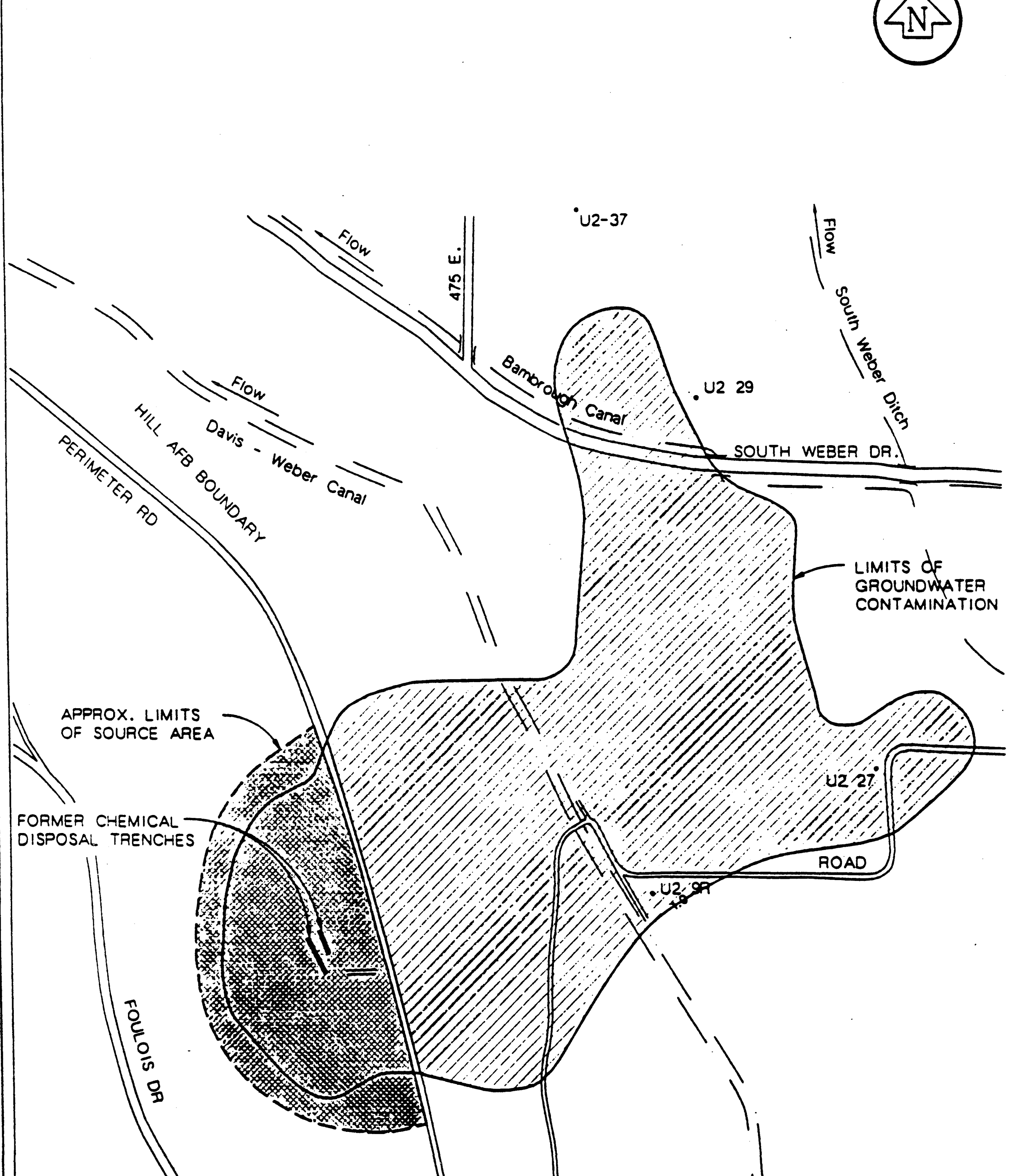
As part of the FS for OU2 (Radian, 1993, and CH2M HILL, 1994), media-specific remedial alternatives were developed for groundwater, springs and seeps, and soil. OU2 is addressed as source area and non-source area components (Figure 5-1), because it is technically more feasible to address different parts of the OU to best meet the media-specific remedial action objectives for protectiveness of human health and the environment. In the development of the source area alternatives, the following media were considered to address chemicals of concern: groundwater, unsaturated soil (vadose zone), and saturated soil. No surface water exists within the source area. In the non-source area, the following media were considered to address chemicals of concern: groundwater and water flowing from springs and seeps. The FS distinguished between unsaturated soil (vadose zone) and saturated soil (saturated zone) to better identify the use and feasibility of media-specific technologies.

Alternatives developed for both source and non-source areas incorporate and build upon prior response actions. These actions were implemented to address potential exposures or to achieve significant risk reductions quickly. The source area alternatives include the interim remedial action consisting of extraction and treatment of free-phase DNAPL in the source area by the Source Recovery System (SRS). DNAPL is further addressed in the source area alternatives. The non-source area alternatives include two prior removal actions: collection and treatment of water flowing from contaminated springs and seeps in the non-source area; and providing a permanent alternate water supply for residences in the OU2 non-source area.

5.1 Development Of Alternatives

Remedial alternatives are developed by assembling technologies into combinations appropriate to each medium. Steps used to develop remedial alternatives for OU2 include development of general response actions and remedial action objectives for each medium, followed by a preliminary screening and evaluation of technologies and process options.

General response actions for each medium identify basic actions that might be undertaken as part of a remedial action and include: prevention of human exposure to contaminated media, protection of uncontaminated groundwater for current and future use, restoration of contaminated media for future use, and prevention of cross-contamination of media. Several technologies may exist for each general response action. The preliminary screening of technologies for each general response action involves evaluation of technical implementability. In the process option evaluation, technically implementable technologies are evaluated with respect to effectiveness, implementability, and cost.



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NON-SOURCE AREA INCLUDES AREA OF GROUNDWATER CONTAMINATION EAST OF HILL AIR FORCE BASE BOUNDARY

Figure 5-1
DELINEATION OF SOURCE AREA AND NON-SOURCE AREA AT OU2
Operable Unit 2, Hill Air Force Base, Utah

Remedial action objectives (RAOs) are medium-specific goals for protecting human health and the environment. These include preliminary cleanup goals, areas of attainment, and estimated restoration time frames. The RAOs for OU2 include:

- Meet chemical-specific ARARs such as drinking water Maximum Contaminant Levels (MCLs) under the Safe Drinking Water Act. Meeting MCLs will also meet Utah Groundwater Quality Standards for the chemicals of concern.
- Limit cancer risk to less than 10^{-4} with a target of 10^{-6} due to incidental ingestion, dermal contact, or inhalation of vapors.
- Reduce contaminant concentrations low enough to avoid chronic health effects (as indicated by a hazard index of less than one).
- Remove as much of the DNAPL as practicable.
- 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.
- Prevent further degradation of groundwater quality in accordance with the Utah Corrective Action Cleanup Standards Policy - UST and CERCLA Sites.

The COCs consist of chlorinated solvents in the form of DNAPL, VOCs in the dissolved phase, and pesticides (source area). Inorganic compounds do not contribute significantly to cumulative risks. The major components of the DNAPL are: TCE (approximately 75 percent), TCA (18 percent), PCE (6 percent), toluene (1 percent), and smaller amounts of methylene chloride and Freon TF. The area of attainment for soils includes the original disposal pits, the known extent of DNAPL, and where groundwater concentrations are highest and may indicate the presence of residual DNAPL. For chemicals of concern (COCs) dissolved in groundwater, the area of attainment is defined by maximum contaminant levels (MCLs). TCE is used as the indicator chemical because it is the most frequently found and most widespread. All other chemicals dissolved in groundwater which exceed RAOs are located within the TCE area of contamination. Where chemical-specific ARARs are not available, risk-based concentrations corresponding to the 10^{-6} residential exposure scenario have been established as preliminary remedial goals (PRGs). Risk-based PRGs were established for VOCs found in soils in the source area and Beta BHC in the source area groundwater.

Twelve alternatives addressing source area contaminants and seven alternatives addressing non-source area contaminants were developed. The alternatives assembled for each medium begin with the No Further Action Alternative, which is required by the NCP to be included in the comparison process. The alternatives for each medium were initially screened for effectiveness, implementability, and cost. Alternatives which did not meet the criteria of protectiveness, compliance with ARARs, or performed poorly under the screening criteria were eliminated from further consideration. Tables 5-1 and 5-2 summarize the source area alternatives. Table 5-3 summarizes alternatives for the non-source area.

Table 5-1
Source Area Alternatives for Groundwater

Medium	Remedial Technology	Representative Process Options	Area or Volume	Alternative 1	4	5	7	8	9	10	11	12
Groundwater	Access Restrictions	Deed/Water Rights Restrictions	Source	√	√	√	√	√	√	√	√	√
	Monitoring	Groundwater	Source	√	√	√	√	√	√	√	√	√
	Capping	Clay	Source						√	√	√	√
	Vertical Barrier	Slurry Wall	Downgradient			√						
			Source Perimeter				√	√	√	√	√	√
	Extraction	Extraction Wells	Source	√	√	√	√	√			√	√
	Physical/Chemical treatment	Gravity Separation	Extracted Water	√	√	√	√	√			√	√
		Steam Stripping	Aqueous Phase	√	√	√	√	√			√	√
		Air Stripping	Aqueous Phase	√	√	√	√	√			√	√
	Offsite Treatment	Liquid injection incinerator	Organic Phase	√	√	√	√	√			√	√
	Onsite treatment	IWTP	Aqueous phase	√	√	√	√	√			√	√
	Offsite discharge	POTW	Aqueous phase	√	√	√	√	√			√	√
	In-situ thermal treatment	Steam stripping	Source			√				√	√	

√ Indicates that the remedial technology is an element of the alternative.

Table 5-2
Source Area Alternatives for Soil

Medium	Remedial Technology	Representative Process Options	Area or Volume	Alternative 1	4	5	7	8	9	10	11	12
Soil	Access Restrictions	Deed Restrictions and Fencing	Source		√	√	√	√	√	√	√	√
	Monitoring	Borings	Source	√	√	√	√	√	√	√	√	√
	Capping	Clay	---	**See "Capping" in Table 5-1**								
	Vertical Barrier	Slurry Wall	---	**See "Vertical Barrier" in Table 5-1**								
	Shallow excavation	Backhoe	Vadose Zone				√	√				
	Deep excavation	Clam Shell	Saturated Zone				√	√			√	√
	Ex-situ dewatering	Pressure Filtration	Staturated Zone				√	√				√
	Ex-situ chemical treatment	Fixation/Solidification	Vadose Zone Saturated Zone				√ √	√				√
	Offsite Disposal	Hazardous waste landfill	Vadose Zone Saturated Zone				√ √	√				√
	In-situ physical treatment	Vacuum extraction/soil venting	Vadose Zone			√				√	√	
		Soil flushing	Saturated Zone				√					√
		Steam stripping	Saturated Zone			√				√	√	
	In-situ dewatering	Extraction wells	---	**See "Extraction" in Table 5-1**								

√ Indicates that the remedial technology is an element of the alternative.

Table 5-3
Non-Source Area Alternatives

Medium	Remedial Technology	Representative Process Options	Area or Volume	Alternative 1	Alternative 3	Alternative 5	Alternative 7
Groundwater	Access Restrictions	Deed/Water Rights Restrictions	Plume > MCL	√	√	√	√
	Alternate Water Supply	Domestic	Residential		√	√	√
	Monitoring	Groundwater	Plume > MCL	√	√	√	√
	Vertical Barrier	Hydraulic Barrier	Plume > MCL			√	√
	Extraction	Extraction Wells	Plume > MCL			√	√
	Subsurface Drain	Interceptor Trench	Plume > MCL			√	√
	Physical/Chemical Treatment	Air Stripping	Extracted Water			√	√
	Onsite treatment	IWTP	Extracted Water			√	√
	Offsite discharge	POTW	Extracted Water			√	√
	In-situ Treatment	Air Stripping	Plume > MCL		√		√
Surface Water	Access Restrictions	Deed/Water Rights Restrictions	Plume > MCL		√	√	√
	Alternate Water Supply	Agricultural	Current Users		√	√	√
	Monitoring	Surface Water	Existing Seeps	√	√	√	√
	Interceptors	French Drain	Plume > MCL		√	√	√
	Physical/Chemical Treatment	Carbon Absorption	Collected Water		√	√	√
	Onsite Treatment	IWTP	Collected Water		√	√	√
	Offsite discharge	POTW	Collected Water		√	√	√
	Onsite Discharge	Stream	Collected Water		√	√	√
Soil	Access Restrictions	Deed Restrictions	Equipment		√	√	√
	Monitoring	Soil Gas	Residences	√	√	√	√
	In-situ Physical Treatment	Vacuum extraction/soil venting	Vadose Zone		√		√
		Air Stripping	Saturated Zone		√		√

√ Indicates that the remedial technology is an element of the alternative.

5.2 Detailed Analysis of Alternatives

To reduce the number of alternatives for detailed analysis, the original assembled alternatives were further screened against the criteria of: long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; short-term effectiveness; implementability; and cost. Five source area alternatives and four non-source area alternatives were the most promising and were carried forward for the detailed analysis.

There are three common elements to all of the alternatives carried forward into the detailed analysis of alternatives which are discussed here for conciseness. These include:

- Monitoring for contaminants in groundwater and treatment system performance. Groundwater monitoring will assess contaminant concentrations, location, and transport and will comply with RCRA requirements specified in 40 CFR, Part 264, Subpart F and Utah Administrative Code (UAC) R315-8-6.
- Because these alternatives will result in hazardous substances onsite above health-based levels, a review will be conducted within five years after commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.
- Institutional controls to prevent completion of potential exposure pathways or to protect facilities installed as part of the remedy.

Institutional Controls for properties not fee-owned by the Air Force will include: water rights and well drilling restrictions and advisories to prevent exposure to contaminated groundwater; and fencing with warning signs to restrict access to exposure areas, construction areas, and treatment facilities. Leases or easements may be needed to enact some of the institutional controls.

The Utah Department of Natural Resources, Division of Water Rights has developed a groundwater management plan for the Weber Delta sub-area of the East Shore area, which includes HAFB. Areas of groundwater contamination surrounding HAFB are identified as restricted. No new wells will be permitted in the restricted areas nor will change applications which propose to transfer water into these areas be granted. When the contamination is successfully cleaned up and no longer poses a threat to groundwater aquifers, the State Engineer will consider allowing the construction of wells in these areas.

Institutional controls for Air Force fee-owned property will include: (1) issuing 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, (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.

In the case of sale or transfer of property within OU2 by the United States to any other person or entity, the Air Force will place covenants in the deed restricting access and prohibiting disturbance of contaminated soils or the remedial action without approval of the United States. These covenants will be in effect until removed upon agreement of the

State of Utah, the U.S. Environmental Protection Agency, and the U.S. Air Force or their successors in interest. The Air Force will also include in the deed the covenants required by section 120(h)(3) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), which include a warranty that the United States will conduct any remedial action found to be necessary after the date of the transfer; and a right of access in behalf of the U.S. Environmental Protection Agency and the Air Force or their successors in interest to the property to participate in any response or corrective action that might be required after the date of transfer. The right of access referenced in the preceding sentence shall include the State of Utah for purposes of conducting or participating in any response or corrective action that might be required after the date of transfer.

In the event that the land use is changed or structures are removed, the Air Force will reevaluate the protectiveness of the remedy selected for OU 2, and will take any appropriate remedial action.

5.2.1 Source Area Alternatives

As a result of screening, Source Area Alternatives 1, 4, 5, 11, and 12 were carried forward in the FS for detailed evaluation.

In addition to the common elements for all alternatives, all of the source area alternatives include common elements. These are:

- Continued operation of the SRS. The SRS was installed to recover as much DNAPL as practicable and treat VOC-contaminated groundwater for discharge to the IWTP. Depending on the alternative, treatment systems within the SRS will be upgraded to handle the additional load and treatment needs. The IWTP currently operates in compliance with a pre-treatment permit from the North Davis County Sewer District (NDCSD).

- Uncertainty in the amount of DNAPL which can be effectively removed from the subsurface by conventional technologies, such as the pump and treat system at the SRS. The application of innovative technologies to residual DNAPL is expected to enhance this recovery, but it is uncertain to what degree. While a waiver to groundwater remediation standards in the source area is not included in this ROD, it will be considered in the future if application of planned innovative technologies demonstrate the standards cannot be achieved.

5.2.1.1 Source Area Alternative 1

Alternative 1, the No Further Action Alternative for the source area, involves continued operation of the SRS and implementation of the groundwater monitoring program. The SRS will continue operation as long as DNAPL can be practicably recovered. The SRS uses wells to pump DNAPL and the associated contaminated groundwater to the treatment system; gravity separation of the organic and water phases; offsite liquid injection incineration of the organic phase; onsite steam stripping of the aqueous phase; and transfer to the IWTP for further treatment and discharge to the POTW. When no more DNAPL can be practicably recovered, operation of the SRS would discontinue. No other containment, collection, treatment, discharge process options, or active treatment are included in this alternative.

The No Further Action Alternative in the source area relies on natural attenuation by physical, chemical, and biological processes to reduce contaminant concentrations. Under the No Further Action Alternative, the time frame for natural attenuation of contaminants to acceptable remediation levels has been estimated to be greater than 25,000 years.

Before the contaminants would naturally attenuate, the future carcinogenic risk under this alternative for off-Base residents would increase to levels comparable to hypothetical future on-Base residents and would range from a low of 1.6×10^{-3} to a high of 9.9×10^{-2}. This risk scenario and restoration time frame is not reasonable given the circumstances of the site, and thus would not comply with chemical-specific ARARs. The time to implement this alternative is estimated to be less than 3 months.

The total capital cost of this alternative is estimated at $28,000. The estimated operation and maintenance cost is $27,000 per year. The total 30-year present worth cost of this alternative is estimated at $450,000.

5.2.1.2 Source Area Alternative 4

This alternative consists of the elements described in Source Area Alternative 1, with the addition of the following: continued operation of the SRS with additional groundwater extraction wells to address dissolved phase contaminants; onsite treatment of the aqueous phase before discharge; and in situ treatment of the source area soils.

Installation of additional groundwater extraction wells would require about 2 months. An estimated 90 gallons per minute of extracted groundwater would be treated by the SRS, pumped to the Base IWTP, and eventually discharged to a POTW. The SRS would be modified to add air-stripping or other treatment processes as needed to comply with pre-treatment requirements.

In situ Soil Vapor Extraction (SVE) or technology with similar or improved performance expectations would be applied to the vadose zone source area volume of soils. SVE is an in-situ presumptive remedy for VOC-contaminated soils. Clean air is injected or passively flows into the unsaturated contaminated subsurface soils. VOCs are then removed as vapors by extraction wells. The vapors would be collected and treated at the surface using activated carbon filtering, catalytic oxidation, or other technologies. Construction of the SVE system is expected to take approximately 2 months. It is anticipated that the SVE system will be in operation for a minimum of 5 years.

Several planned innovative technologies offer enhanced recovery of DNAPL. One is an innovative application of SVE in which the saturated deep soils in the vicinity of former Chemical Disposal Pit 3 would be dewatered using the network of groundwater extraction wells and applying SVE to this zone. Other technologies include steam injection and the use of surfactants. Steam injected into the contaminated soils will physically move DNAPL and vaporize contaminants. Injecting a surfactant solution into the contaminated soils would increase the mobility and/or solubility of hydrophobic liquids such as DNAPL. The extracted fluids will be treated at the SRS with further treatment at the IWTP prior to discharge. Treatability studies will be conducted prior to full-scale use to verify any innovative technology will fulfill its performance expectations at OU2.

Additional ARARs with which Source Area Alternative 4 would comply pertain to air emissions and the injection of fluids into the subsurface. Best Available Control

Technologies (BACT) would be used to control air emissions. The SVE system would be designed to satisfy treatment ARARs associated with RCRA as well as standards for the control of air emissions (40 CFR Part 60; UAC R307-1-3). If soil surfactant flushing is used, it would be conducted in conformance with the State Underground Injection Control Regulations. Once the remedy is complete, it is expected that ARARs will be met.

Source Area Alternative 4 will remediate to chemical-specific remediation goals for chlorinated VOCs. The remediation time frame may substantially exceed 30 years. The residual carcinogenic risk for on-Base residents following remediation would range from a low of 3.7×10^{-6} to a high of 1.12×10^{-4}. Features of this alternative would require 6 to 12 months to construct. In situ treatment processes would be implemented in phases. The first phase would involve completion of the SRS DNAPL removal. The next stage would be dewatering of the source area and implementation of SVE treatment.

Steam injection is used as the representative process option for cost estimates, i.e., costs for Source Area Alternatives 5, 11, and 12 also include use of steam injection. The total capital cost of this alternative is $2,738,000. The annual operation and maintenance cost is estimated to be $2,329,000. The 30-year present worth cost is estimated at $19,137,000.

5.2.1.3 Source Area Alternative 5

This alternative is the same as Source Area Alternative 4, with the addition of a vertical barrier constructed along the downgradient edge of the DNAPL. The entire length of the 500-foot-long vertical barrier will be keyed into the low permeability clays and silty clays of the Alpine Formation with an average depth of approximately 70 feet. Instead of relying on the steep drawdown to direct water away from the eastern side of the source area, a vertical barrier will be constructed for added hydraulic control of groundwater. This would hinder contamination from migrating into the non-source area, but would not prevent the influx of uncontaminated groundwater or rain water into the source area.

The ARARs for Source Area Alternative 5 are the same as for Source Area Alternative 4, with the additional requirement of compliance with the Land Disposal Restrictions (LDRs) [40 CFR Part 268; UAC R315-13]. Soil excavated from construction of the barrier may contain VOCs. The Source Area and area immediately adjacent needed for construction will be defined as a Corrective Action Management Unit (CAMU). Soils from construction will be kept within the CAMU and will not trigger the LDRs. The excess soils will be replaced onsite to serve as the grading layer to establish proper slopes for the surface cap. The LDRs would otherwise be applicable to excavated soils which contain TCE or other spent solvents.

Source Area Alternative 5 will remediate to chemical-specific remediation goals for chlorinated VOCs. The remediation time frame may exceed 30 years. The residual carcinogenic risk for on-Base residents after remediation would range from a low of 3.7×10^{-6} to a high of 1.12×10^{-4}. The estimated time to construct all elements of this alternative is 12 to 15 months, including about 3 months for construction of the barrier.

The total capital cost of this alternative is $4,994,000. The annual operating and maintenance cost is estimated to be $2,376,000. The 30-year present worth cost of this alternative is estimated at $22,118,000.

5.2.1.4 Source Area Alternative 11

Source Area Alternative 11 is the same as Source Area Alternative 4, except an encircling barrier will be installed around the DNAPL zone and a surface cap will be constructed. The purpose of the encircling vertical barrier will be to prevent the down gradient migration of groundwater contaminants and the inflow of uncontaminated groundwater from the upgradient direction. The encircling vertical barrier and surface cap will provide containment of the DNAPL area and will be keyed into the Alpine Formation which lies at depths up to 70 feet below the ground surface. The type of vertical barrier will be determined during design. Options such as deep soil mixing and sheet piles will be considered in addition to a slurry wall. The estimated length of the barrier is 1,300 linear feet, encircling an area of about 1.4 acres. The surface cap will be designed to prevent erosion and decrease the inflow of surface water through contaminated soils to reduce transport of contaminants to groundwater. Construction of the surface cap over the former chemical waste disposal pits will be delayed until after source control and treatment systems are constructed and their effectiveness evaluated. This is to minimize disturbance to the cap from in situ treatment.

ARARs for Source Area Alternative 11 are the same as for Source Area Alternative 5, with the addition of landfill closure requirements under RCRA Subpart G [40 CFR Part 264; UAC R315-8-14]. Because no waste was placed in former Chemical Disposal Pit 3 after 1980, the RCRA closure requirements are relevant and appropriate for wastes left in place and applicable for the wastes generated by excavation.

Source Area Alternative 11 will remediate to chemical-specific remediation goals for chlorinated VOCs. The residual carcinogenic risk for on-Base residents after remediation would range from a low of 7.2×10^{-6} to a high of 2.4×10^{-4}. The encircling barrier will allow the isolation of the DNAPL zone providing the opportunity to reduce the restoration time from more than 30 years to a 15 to 30-year period. Containment of the DNAPL and highly contaminated groundwater will be achieved once the vertical barrier wall is constructed. This alternative will require 12 to 18 months to construct all of the elements, including about 4 months for the cap.

The capital cost of this alternative is estimated to be $6,897,000. The annual operation maintenance costs is estimated to be $2,012,000. The 30-year present worth cost of this alternative is estimated at $20,910,000.

5.2.1.5 Source Area Alternative 12

This alternative is similar to Source Area Alternative 11 in that an encircling vertical barrier around the DNAPL and a surface cap will be constructed. There are two added elements: excavation of shallow soils and soil flushing to treat deeper soils beneath the water table.

In the immediate area of the former trenches, the shallow soils will be excavated. Standard backhoe excavation methods will be used to remove the upper 25 feet of overburden in the immediate vicinity of the former Chemical Disposal Pit 3. Approximately 6,400 cubic yards of contaminated soil will be removed, treated as necessary, and disposed either onsite or offsite in compliance with the land disposal restrictions.

This excavation would remove shallow soils contaminated with VOCs. Clean material will be backfilled into the excavation. Shallow soils that are not excavated and treated will be treated using a network of SVE wells. The construction of the cap over the former disposal trenches will be delayed until after the source control treatment system is constructed. Soil flushing injects a surfactant solution into the contaminated soils to increase the mobility or solubility of hydrophobic chemicals such as those comprising the DNAPL. The surfactant solution, mobilized DNAPL, and dissolved VOCs will be recovered by extraction wells and routed to the SRS as in the other alternatives.

ARARs for Source Area Alternative 12 are the same as for Source Area Alternative 11. Once the remedy is complete it is expected that ARARs will be met.

Source Area Alternative 12 will remediate to chemical-specific remediation goals for chlorinated VOCs in soil. The residual carcinogenic risk for on-Base residents after remediation would range from a low of 7.2×10^{-8} to a high of 2.4×10^{-6}. It is estimated that the time to excavate the shallow soils is approximately 6 months. Containment of the DNAPL and highly contaminated groundwater will be achieved with construction of the vertical barrier. This alternative will require 18 to 24 months to construct all elements.

The estimated capital cost of this alternatives is $14,234,000. The annual operation and maintenance cost is estimated to be $740,000. The estimated 30-year present worth cost of this alternative is $24,070,000.

5.2.2. Non-Source Area Alternatives

Non-source area alternatives address contamination transported from the source area and focus on remediating the off-Base shallow contaminated groundwater and the contaminated springs and seeps. Of the seven non-source alternatives evaluated, Alternatives 1, 3, 5, and 7 were carried forward for detailed evaluation in the FS. In addition to the common elements for all alternatives, all of the non-source area alternatives include common elements. These are:

- Continued operation of systems to treat seeps and springs. The water is collected, treated onsite, and discharged. However, the flow rate of the seeps and springs have varied historically with seasonal and climatic changes. Also, implementing a pump and treat system may cause some of the seeps or springs to dry up. Operation of the seep and spring treatment system is required while there is sufficient flow for effective treatment. Discharge limits are subject to UPDES requirements for direct discharge to surface waters, subject to the pre-treatment requirements for the receiving POTW, or subject to limits set by the IWTP when discharging through the SRS.

- Alternate water supplies have been provided to effected property owners for agricultural use.

All of the non-source area alternatives, with the exception of Non-Source Area Alternative 1, would meet ARARs, including the chemical-specific groundwater standards as restoration goals. The residual carcinogenic risk after remediation for all non-source area alternatives, except Non-Source Area Alternative 1, would be in the lower part of the 10^{-4} to 10^{-6} cumulative risk range. In undeveloped areas, neither volatilization of organic compounds nor wind entrainment of contaminated dust are expected to pose a significant exposure pathway.

5.2.2.1 Non-Source Area Alternative 1

Alternative 1, the No Further Action Alternative for the non-source area, involves continued implementation of the alternate water supplies and systems to intercept and treat contaminated seep and spring discharge. No additional containment, collection, treatment, or discharge process options are included in this alternative. This alternative relies on natural physical, chemical, and biological processes to lower contaminant concentrations until cleanup levels are met. Concentrations in the source area are high, including separate phase liquids. These processes act slowly. The estimated remediation time will be hundreds to thousands of years before groundwater remediation standards would be met. This is an unacceptable time frame given the circumstances of the site, and would not comply with chemical-specific ARARs. This alternative includes periodic monitoring of groundwater as well as spring/seep locations.

MCLs are relevant and appropriate as ARARs for restoration of groundwater and seeps/springs. MCLs are identical performance standards to those under the Utah Groundwater Protection Rule, except for lead and copper which are not COCs for OU2. If onsite treatment satisfies all surface water discharge requirements, the treated water may be discharged to an onsite stream in compliance with water quality discharge standards of the Clean Water Act (40 CFR Part 122; UAC R317-8) instead of pumping the water to the IWTP prior to discharge to a POTW. Treated water discharged to the POTW will meet the requirements of the POTW to comply with pre-treatment permit conditions.

All current and future risks will remain under this alternative. The time to construct the additional groundwater monitoring wells is less than 6 months.

Non-Source Area Alternative 1 has an estimated capital cost of $130,000. The estimated annual operation and maintenance cost is $172,000. The estimated 30-year present worth cost of this alternative is $2,778,000. The duration of monitoring would exceed 30 years.

5.2.2.2 Non-Source Area Alternative 3

This alternative will include the elements of Non-Source Area Alternative 1 with the addition of the following innovative technology: in situ air sparging of groundwater with SVE in vadose zone soils to collect contaminated soil gas from air sparging. Air sparging operates by injecting air through wells which are below the water table. The air bubbles move upward through the groundwater into the vadose (unsaturated) zone. As the air passes through the contaminated groundwater, contaminants volatilize from the water and enter the air. The air is then collected by the SVE system, treated if required, and vented to the atmosphere.

Additional ARARs which will be met include compliance with air quality regulations [e.g., 40 CFR Part 60; UAC R307-1-3].

An estimated 3,050 pounds of contaminants would be removed from the subsurface. Construction of the system would take approximately 2 months. Estimates for restoration time frame is 15 years in the FS. Due to uncertainties in the hydrogeology, a longer time frame was considered likely, so present worth costs were estimated for 30 years. The time to construct the features of this alternative is 12 to 24 months.

The capital cost of this alternative is estimated to be $9,300,000. The annual operation and maintenance cost is estimated to be $1,160,000. The estimated 30-year total present worth cost of this alternative is $17,900,000.

5.2.2.3 Non-Source Area Alternative 5

This alternative is similar to Non-Source Area Alternative 3, except shallow groundwater will be extracted and treated, rather than being treated in situ. This extraction system will utilize one or more shallow groundwater extraction trenches and/or extraction wells to capture the groundwater. The initial phase will intercept the outer portion of the plume and additional monitoring will be used to estimate a remedial time frame. Onsite air stripping of the groundwater will be employed, if needed, to meet pretreatment requirements for discharge.

ARARs which will be met are the same as for Non-Source Area Alternative 3, except the air quality requirements would pertain to the air stripper.

An estimated 3,100 pounds of contaminants would be extracted from contaminated shallow groundwater. Complex hydrogeology makes accurate modeling difficult; time frames range from 15 to 70 years. Additional extraction systems will be installed in the plume if the monitoring results indicate an excessive remediation time frame, such as more than 30 years.

This alternative will require 12 to 18 months to construct. The installation of the groundwater collection system would be phased.

The capital cost is estimated to be $5,100,000. The annual operation and maintenance cost is estimated at $610,000. The estimated 30-year total present worth cost is estimated at $11,000,000.

5.2.2.4 Non-Source Area Alternative 7

This alternative combines the elements of Non-Source Area Alternatives 3 and 5. In situ air sparging with SVE will treat the interior of the shallow groundwater plume. A shallow groundwater extraction and treatment system (air stripping) will be used along the northern edge of the TCE plume.

ARARs are the same as for Non-Source Area Alternatives 3 and 5 and will be met.

An estimated 3,100 pounds of contaminants would be extracted from contaminated shallow groundwater. This alternative will require 12 to 24 months to construct. The installation of the groundwater collection system would be phased. Initially, the perimeter interception system would be installed along the north edge of the TCE plume to intercept the full width of the plume. Additional extraction systems will be installed in the plume if the monitoring results indicate an excessive remediation time frame, such as more than 30 years.

The capital cost is estimated at $8,700,000. The annual operation and maintenance costs is estimated at $950,000. The 30-year total present worth cost is estimated to be $17,000,000.

6. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The comparative analysis evaluates the relative performance of the alternatives within the nine evaluation criteria established in the National Oil and Hazardous Substances Contingency Plan (NCP) listed below. The first two evaluation criteria are threshold criteria which must be met by the selected remedial action. The five balancing criteria are balanced to achieve the best overall solution. The final two modifying criteria that are considered in the remedy selection are state acceptance and community acceptance.

Threshold Criteria

Threshold criteria include overall protection of human health and the environment and compliance with ARARs. These threshold criteria must be met by an alternative before it can be evaluated under the five balancing criteria.

1. Overall Protection of Human Health and the Environment addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled.

2. Compliance with Applicable or Relevant and Appropriate Requirements addresses whether a remedy will meet all federal and state environmental laws and/or provide grounds for a waiver.

Primary Balancing Criteria

The five balancing criteria form the basis of the comparative analysis because they allow tradeoffs among the alternatives requiring different degrees of performance.

3. Long-Term Effectiveness and Permanence refers to the ability of a remedy to provide reliable protection of human health and the environment over time.

4. Reduction of Toxicity, Mobility, or Volume Through Treatment refers to the preference for a remedy that reduces health hazards of contaminants, the movement of contaminants, or the quantity of contaminants at OU2 through treatment at the site.

5. Short-Term Effectiveness addresses the period of time needed until protection is achieved, and any adverse effects to human health and the environment that may be caused during the construction and implementation of the remedy.

6. Implementability refers to the technical and administrative feasibility of an alternative or a remedy and the availability of goods and services needed to implement the alternative.

7. Cost evaluates the estimated capital, operation, and maintenance costs of each alternative.

Modifying Criteria

The modifying criteria are generally addressed in response to comments from the State and the public, after issuance of the Proposed Plan.

8. State Acceptance indicates whether the State agrees with, opposes, or has no comment on the preferred alternative.

9. Community Acceptance indicates whether the community agrees with, opposes, or has no comment on the preferred alternative.

6.1 Threshold Criteria

6.1.1 Overall Protection of Human Health and the Environment

The NCP requires that all alternatives be assessed to determine whether they can adequately protect human health and the environment, in both the short- and long-term, from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the site by eliminating, reducing, or controlling exposures to such substances, pollutants, or contaminants. Overall protection of human health and the environment draws on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

6.1.1.1 Source Area Alternatives

Source Area Alternative 1 (No Further Action) will not be protective because contamination above ARARs and other performance standards will allow contaminants to migrate offsite and downward into shallow aquifers, increasing the risks for offsite receptors. All other source area alternatives will be protective because they prevent migration of contaminants above performance standards beyond the source area boundary through containment and collection, and treatment; meet ARARs; prevent exposure to contaminants within the source area through institutional controls; and monitor the effectiveness of remedial measures.

Source Area Alternative 12 removes soil contamination from depths to which direct exposure is likely. The inclusion of a surface cap and the encircling vertical barrier of Source Area Alternatives 11 and 12 will be protective of public health and the environment by preventing exposure to contaminants, preventing continued leaching of soil contaminants to groundwater, and preventing further migration of contaminants in excess of drinking water standards to the non-source area. Source Area Alternative 5 will reduce the rate at which contaminants would be transported to the non-source area in groundwater, but may not fully contain the contaminants.

6.1.1.2 Non-Source Area Alternatives

Non-Source Area Alternative 1 will not be protective because contamination will continue to migrate resulting in enlargement of the non-source area contaminant plume. All other non-source area alternatives will be protective because they will prevent further migration of contaminants above performance standards beyond the boundary of the non-source area through hydraulic containment and collection and treatment; meet ARARs; prevent exposure of contaminants within the non-source area boundary through use of institutional controls; monitor for vertical and horizontal migration of contaminants; and monitor the effectiveness of remedial measures. Non-source area Alternative 5, consisting of conventional pump and treat, provides the greatest degree of certainty for hydraulically capturing contaminants and treating to protective levels before discharge. Air sparging (Non-Source Area Alternatives 3 and 7) is not a proven technology at the field scale and the hydrogeology at OU2 is complex. Contaminated water flowing from springs and seeps will be captured and treated by all non-source area alternatives.

6.1.2 Compliance with ARARs

Applicable requirements are those cleanup standards, standards for control, and other substantive requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, or location at a CERCLA site. Relevant and appropriate requirements are similar requirements, that, while not applicable, clearly address problems or situations sufficiently similar to those encountered at a CERCLA site such that their use is well suited to the particular site. Compliance with ARARs for the source and non-source area alternatives are discussed in the following subsections.

Each alternative is assessed to determine whether they would attain applicable or relevant and appropriate requirements under federal environmental laws and state environmental or facility siting laws or provide grounds for invoking an ARARs waiver. The ARARs for alternatives at OU2 are presented in Appendix A. Compliance with some key ARARs is discussed in the description of alternatives and will not be repeated here.

6.1.2.1 Source Area Alternatives

Source Area Alternative 1 will not meet ARARs, which are groundwater restoration goals, within a reasonable time frame, given the circumstances of the site. Source Area Alternative 1 will be considered no further in this Record of Decision. All of the other alternatives are currently expected to meet chemical-specific ARARs for organic compounds in groundwater by the time the remedial action is completed. However, it is uncertain that the treatment technologies proposed can meet the clean up standards in the source area, particularly for TCE.

Other technologies may be used to extract greater amounts of DNAPL and/or enhance in situ treatment. Treatability studies will be conducted prior to full-scale use to verify the technology will fulfill its performance expectations at OU2. While a waiver to chemical-specific ARARs, specifically TCE and other VOCs within the DNAPL, is not contemplated at this time, it may be needed in the future to address restoration goals for groundwater in the OU2 source area.

All Source Area Alternatives would meet action-specific ARARs. Action-specific Federal and State ARARs are similar for the source area alternatives because the site activities are similar (monitoring, well drilling, groundwater pumping, offsite incineration of DNAPL, groundwater treatment, and discharge of water treated at the SRS to the IWTP). Monitoring will meet the requirements of 40 CFR Part 264 Subpart F [UAC R315-8-6]. Discharges from the IWTP meet ARARs through compliance with the IWTP pre-treatment permit issued by the North Davis County Sewer District. Air emissions from the steam stripper in the SRS are treated by vapor phase carbon and comply with substantive requirements under national primary and secondary air quality standards [40 CFR Part 50; UAC R307-1-3] and NESHAPs standards [40 CFR Part 61; UAC R307-10] which regulate specific volatile organic compounds, including TCE. The requirement to treat vapors from the air stripper is based on a Best Available Control Technology (BACT) analysis under UAC R307-1-3.

Source Area Alternatives 5, 11, and 12 include excavation of soils. The Source Area and area immediately adjacent needed for construction will be defined as CAMU. Soils from construction will be kept within the CAMU and will not trigger the LDRs. The excess soils will be replaced onsite to serve as the grading layer to establish proper slopes for the surface cap. The LDRs would otherwise be applicable to excavated soils which contain TCE or other spent solvents.

All alternatives will meet location-specific ARARs. All proposed siting of waste management units will be outside of the 100-year floodplain and will comply with the siting ARAR in 40 CFR Section 264.18 (UAC R315-8-2.9). No jurisdictional wetlands occur within OU2.

6.1.2.2 Non-Source Area Alternatives

Non-Source Area Alternative 1 will not meet the ARARs which are groundwater restoration goals within a reasonable time frame. Non-Source Area Alternative 1 will be considered no further in this Record of Decision. All of the other Non-Source Area Alternatives will meet chemical-specific ARARs, including groundwater restoration goals, within restoration time frames which are reasonable given the circumstances of the site.

All of the Non-Source Area Alternatives will comply with action-specific ARARs. Action-specific Federal and State ARARs are similar for the non-source area alternatives because the site activities are similar (monitoring, well drilling, groundwater pumping, treatment of groundwater or seeps and springs by air stripping or granular activated carbon, and discharge of treated water). Emissions from the air stripper must comply with substantive requirements set under national primary and secondary air quality standards [40 CFR Part 50; UAC R307-1-3] and NESHAPs standards [40 CFR Part 61; UAC R307-10] which regulate specific volatile organic compounds, including TCE. The requirement to treat vapors from the air stripper will also be based on a Best Available Control Technology (BACT) analysis under UAC R307-1-3.

Discharge options, after necessary treatment, include piping water to the IWTP, discharge to the sanitary sewer where it will be treated further at the Central Weber Sewer Improvement District, or onsite discharge to a surface drainage or storm sewer. Compliance with ARARs for SRS discharge is as described for the Source Area Alternatives. The other two discharge options are onsite actions regulated under the NPDES/UPDES [40 CFR Part 122; UAC R317-8] requirements of the Clean Water Act. Discharge to the sanitary sewer must meet the substantive pre-treatment requirements set by the POTW. Discharge to an onsite surface drainage will meet the substantive UPDES requirements.

The Non-Source Area complies with location-specific requirements which are applicable or relevant and appropriate. None of the Non-Source Area Alternatives would require siting of hazardous waste management units within the 100-year floodplain and will comply with the siting ARARs [40 CFR Part 264.18 and UAC R315-8-2.9]. The OU2 site is not located within an area that contains jurisdictional wetlands.

6.2 Primary Balancing Criteria

6.2.1 Long-Term Effectiveness and Permanence

The alternatives were assessed for the long-term effectiveness and permanence they afford, along with the degree of certainty that the alternative would prove successful. Factors that were considered include the following:

- The magnitude of residual risk from untreated waste or treatment residuals remaining at the conclusion of the remedial activities.
- The adequacy and reliability of controls such as containment systems and institutional controls that are necessary to manage untreated waste and treatment residuals.

6.2.1.1 Source Area Alternatives

Source Area Alternatives 11 and 12 are comparable and offer the highest degree of long-term effectiveness and permanence. They would remove as much or more contamination than Source Area Alternatives 4 and 5. The shallow excavation proposed for Source Area 12 would also remove contamination to a depth where exposure to contaminants would be unlikely if land use changes in the future. The encircling vertical barrier and cap element will reliably prevent further contamination in excess of the drinking water standards from migrating into the non-source area. Exposure to any surficial contaminants will be mitigated by a surface cap in both Source Area Alternatives 11 and 12. The residual risk after remediation for these alternatives ranges from a low of 7.2×10^{-8} to a high of 2.4×10^{-6}.

Source Area Alternatives 4 and 5 will reduce contaminant concentrations. However, these alternatives do not have an encircling vertical barrier and could allow contaminant migration to the Non-Source Area. Source Area Alternative 5 provides a vertical wall on only the down gradient side and would need to be supplemented with pumping wells to assure effective containment. Source Area Alternative 4 would rely strictly on hydraulic containment and is the least certain. Source Area Alternatives 4 and 5 will have a residual risk, after remediation, that ranges from a low of 3.7×10^{-6} to a high of 1.1×10^{-4}.

All of the alternatives will require long-term management. Institutional controls consisting of deed and water rights restrictions, as well as access restrictions consisting of fencing and signs will be implemented to prevent uncontrolled construction in the contaminated media, use of shallow contaminated groundwater, and unauthorized access to remedial equipment. These controls will result in limiting future potential exposure pathways and prevent the area from being used for residential purposes. The long-term effectiveness of institutional controls in the source area depends on cooperation of other governmental entities.

6.2.1.2 Non-Source Area Alternatives

Non-Source Area Alternative 5 offers the greatest degree of long-term effectiveness and permanence, because it will result in the least residual TCE contamination, as compared to the other non-source area alternatives and is an established technology. Non-Source Area Alternatives 3 and 7 will be expected to leave residual contamination. Air Sparging is not a proven technology at the field scale. Non-Source Area Alternative 3, unlike Non-Source

Area Alternatives 5 and 7, will not have a hydraulic barrier to prevent untreated groundwater from leaving the non-source area and migrating towards residences. All of the non-source area alternatives, with the exception of Non-Source Area Alternative 1, will result in residual risks within the 1×10^{-4} to 1×10^{-6} range.

Institutional controls consisting of restricting new water rights, as well as access restrictions consisting of fencing and signs have been implemented to prevent uncontrolled access to the contaminated media, use of shallow contaminated groundwater, and unauthorized access to remedial equipment. These controls will result in limiting potential exposure. The long-term effectiveness of institutional controls in the non-source area depends on cooperation of property owners and municipalities as well as other governmental entities.

6.2.2 Reduction of Toxicity, Mobility, or Volume Through Treatment

The degree to which alternatives employ treatment to reduce toxicity, mobility or volume at the site is assessed and considers the following factors:

- the treatment processes the alternatives employ and materials they would treat
- the amount of hazardous substances, pollutants, or contaminants that would be destroyed, or treated
- the degree of expected reduction in toxicity, mobility, or volume of the waste from treatment and the specification of which reduction(s) would be occurring
- the degree to which the treatment would be irreversible
- the type and quantity of residuals that would remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccumulate of such hazardous substances and their constituents
- the degree to which treatment would reduce the inherent hazards posed by principal threats at the site

6.2.2.1 Source Area Alternatives

All Source Area Alternatives reduce the volume of contaminants at the site. Source Area Alternatives 11 and 12 are comparable and provide the best overall reduction in toxicity, mobility, and volume through treatment at the site. Source Area Alternative 12 removes contaminated shallow soils, providing a greater reduction in the volume of contaminants than Source Area Alternative 11. Installation of an encircling vertical barrier and surface cap such as in Source Area Alternative 11 provides greater reduction in the mobility of the contaminants. Contaminants in shallow soils will not be treated in Source Area Alternative 11. However, the installation of a surface cap will reduce the mobility of these contaminants and prevent exposure at the surface.

DNAPL and dissolved contaminants removed from the subsurface will be permanently destroyed or treated. Use of SVE technology to treat contaminated soil has been successful at sites contaminated with VOCs. Possible enhancements to SVE to increase its effectiveness will require treatability studies. The contamination in the top portion of the Alpine Formation in the immediate area of the current location of the DNAPL could include localized pools and pockets or low-permeability lenses of sand and silt that could escape treatment because of preferential flow paths in the subsurface. These areas will receive minor reductions in toxicity.

Source Area Alternative 5 provides greater control over contaminant mobility than Source Area Alternative 4. However, Source Area Alternatives 4 and 5 will not fully address the mobility of contaminants because an encircling vertical barrier and surface cap are not proposed.

6.2.2.2 Non-Source Area Alternatives

Non-Source Area Alternative 5 provides the greatest reduction in toxicity, mobility, and volume. The principal threats to human health and the environment will be addressed by extracting contaminants from the groundwater and water flowing from springs and seeps. Groundwater extraction and treatment is a reliable, extensively used technology. It is expected that this alternative will meet remedial action objectives.

Non-Source Area Alternatives 3 and 7 are ranked as less effective than Non-Source Area Alternative 5 in removing contaminants from groundwater because they rely on in situ technologies for treatment. Air sparging is not a proven technology in the field. Additional process units may be required to treat extracted water and air emissions, adding to the complexity and potentially lowering the reliability of the system.

6.2.3 Short-Term Effectiveness

Factors that were considered include the following four features as components of short-term effectiveness:

- short-term risks to the community during implementation
- potential impacts to worker during implementation
- potential environmental impacts during implementation
- time until protection is achieved

6.2.3.1 Source Area Alternatives

Source area alternatives will result in minimal additional exposure risks to the community, workers, or the environment. Shallow groundwater will be extracted and treated in closed vessels. Source Area Alternative 4 will afford the highest degree of short-term effectiveness because no soil excavation will be required; hence less dust and traffic will be generated. Source Area Alternatives 5 ranks next and then Source Area Alternatives 11 and 12 on the basis of the degree of excavation required. Increased excavation increases the amounts of dust and traffic and provides greater potential for impacting site workers. However, the actual increased risk from excavation is expected to be low. Source Area Alternative 12 may require workers to be in an excavation that is approximately 20 feet deep.

Activities will not generally require workers to be in confined spaces or in deep trenches or excavations. A plan detailing health and safety procedures will be implemented and will meet the requirements of the Occupational Safety and Health Administration under 29 CFR 1910.120. Construction will also require dust suppression, if needed. Because activities are on HAFB, little or no adverse effects are expected for the adjacent community.

None of the source area alternatives will have adverse environmental impacts. There are no environmentally sensitive areas such as critical habitats located in OU2. No threatened or endangered species reside on HAFB. Source area alternatives 4, 5, 11 and 12 have comparable construction periods (12 to 24-months) and operations testing before initial protectiveness is achieved.

6.2.3.2 Non-Source Area Alternatives

The least amount of construction is associated with Non-Source Area Alternative 5, so it performs best in offering the least potential short-term risks to the community and site workers because the traffic and dust generation is the least. Non-Source Area Alternatives 3, 5, and 7 are comparable due to the similarity of activities. Potential risks to the community are expected to be minimal for all Non-Source Area Alternatives because the contamination is in mostly agricultural areas with very little residential development. The initial phase of installation of groundwater extraction wells or trenches will be installed near the leading edge of the TCE plume. This area is several hundred feet away from the nearest residence.

Implementation of Non-Source Area Alternatives 3, 5, and 7 will have minimal potential impacts to workers since most activities will be limited to installation of extraction wells or trenches and installation of pipelines to carry contaminated groundwater to a treatment facility and/or IWTP. Health and safety procedures will be implemented and will meet the requirements of the Occupational Safety and Health Administration under 29 CFR 1910.120.

There is a minimal potential to create environmental impacts during implementation. Non-Source Area Alternatives 3, 5, and 7 offer comparable and acceptable time frames until initial protectiveness is achieved. Groundwater extraction and treatment will begin operation within 12 to 18 months after the commencement of construction.

6.2.4 Implementability

The ease or difficulty of implementing the alternatives was assessed by considering the following types of factors:

- technical feasibility, including technical difficulties and unknowns associated with the construction and operation of a technology, the reliability of the technology, ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of the remedy
- administrative feasibility, including activities needed to coordinate with other offices and agencies and the ability and time required to obtain any necessary approvals and permits from other agencies
- the availability of services and materials, including the availability of adequate offsite treatment, storage capacity, and disposal capacity and services; the availability of necessary equipment and specialists, and provisions to provide any additional resources; the availability of services and materials; and the availability of prospective technologies

6.2.4.1 Source Area Alternatives

All of the Source Area Alternatives share the technical uncertainty of remediating DNAPL to the extent groundwater is permanently restored and protected against future contamination through leaching. While a waiver to chemical-specific ARARs or risk-based concentrations is not contemplated at this time, it may be considered for the future. Uncertainties exist in limitations to potential technologies, complex hydrogeology, and contaminant-specific factors.

All Source Area Alternatives are comparable in administrative implementability. The key treatment facility is the SRS which is already functional and operating within discharge limits set by ARARs and the pre-treatment permit conditions upon the IWTP. No additional permits would be required. Because the Source Area is exclusively on-Base, access issues are minimal.

Distinctions between the Source Area Alternatives are mainly in the context of technical feasibility. Source Area Alternative 4 is the most implementable because pumping well systems are easily installed and modified. The necessary materials, equipment, and expertise are readily available and no vertical barrier would be constructed. The large amounts of groundwater are within the capacities of the SRS and the IWTP, but pipeline modifications may be needed. Alternatives 5, 11, and 12 follow respectively in the ranking. The goods and services are available, but the degrees of construction, trenching, and amounts of materials handled increase progressively. Because Source Area Alternatives 11 and 12 propose encapsulation, substantially less shallow groundwater would need to be extracted and treated. Prospective innovative technologies are considered comparable in terms of materials, equipment, and expertise needed.

6.2.4.2 Non-Source Area Alternatives

No significant implementability problems are foreseen for the non-source area alternatives. All are comparable in terms of: (1) availability of goods and services; (2) similar access issues to private property; (3) constraints of topography on the steep hillside just off-Base; and (4) administrative feasibility in terms of complying with ARARs and/or permit requirements for discharges of treated water. Non-Source Area Alternative 5 is considered the most implementable because pump and treat is an established, reliable technology which can be readily modified if needed. Air sparging is considered less reliable and less easily modified because the technologies are not proven at the field scale. Because of this, Non-Source Area Alternative 7 would rank next, followed by Non-Source Area Alternative 3.

6.2.5 Cost

The types of costs that were evaluated include the following:

- capital costs, including both direct and indirect costs
- annual operation and maintenance cost
- net present value of capital and operation and maintenance (a 30-year period is used to calculate the present worth costs)

6.2.5.1 Source Area Alternatives

Source Area Alternatives 4, 5, 11, 12 all have comparable total present worth costs; however, the distribution of capital and operation and maintenance costs varies considerably. Source Area Alternative 12, because of the proposed soil excavation, has a capital cost over twice as high as the nearest alternative, but also a substantially lower operation and maintenance cost because soil flushing is less expensive to operate than in-situ steam stripping or other technologies. Source Area Alternative 11 has a significantly lower operation and maintenance cost compared to Source Area Alternatives 4 and 5 because it does not require the nearly continuous operation of a shallow groundwater extraction and treatment system. Table 6-1 summarizes the costs associated with each source area alternative.

6.2.5.2 Non-Source Area Alternatives

Non-Source Area Alternatives 3 and 7 have the highest estimated costs; Non-Source Area Alternative 5 is substantially less expensive than these alternatives, with Non-Source Area Alternative 1 having the least cost. The primary difference in costs between Non-Source Area Alternatives 3 and 7 versus 5 is the capital costs. The lower capital cost is a direct result of Non-Source Area Alternative 5 not requiring the lengthy trench or extraction wells for the air stripping system. Onsite discharge to a surface stream in Non-Source Area Alternatives 5 and 7 may lower costs. For the purpose of evaluation, this option is applied uniformly to all of the Non-Source Area Alternatives (except Non-Source Area Alternative 1) and does not make any alternative more cost effective than another. Table 6-1 summarizes the cost of each non-source area alternative.

6.3 Modifying Criteria

6.3.1 State Acceptance

The State of Utah agrees with the selected remedy. No change to the selected remedy is necessary.

6.3.2 Community Acceptance

A public meeting on the Proposed Plan was held on May 25, 1994. No comments were received from the public specifically agreeing with or opposing components of the preferred alternative. The concerns expressed related to location of residents relative to OU2 and contaminated springs and seeps, property values, risk assessment factors, potential health effects of site contaminants, and the schedule of the remedial action. These are further discussed in the Responsiveness Summary, which is part of this ROD.

Table 6-1
Summary of Costs for OU2 Source and Non-Source Area Alternatives

	Capital Cost	Annual Operation and Maintenance Cost	Total Present Worth Cost
Source Area Alternatives			
1	$28,000	$27,000	$450,000
4	$2,738,000	$2,329,000	$19,137,000
5	$4,994,000	$2,376,000	$22,118,000
11	$6,897,000	$2,012,000	$20,910,000
12	$14,234,000	$740,000	$24,070,000
Non-Source Area Alternatives			
1	$130,000	$172,000	$2,778,000
3	$9,300,000	$1,160,000	$17,900,000
5	$5,100,000	$610,000	$11,000,000
7	$8,700,000	$950,000	$17,000,000

7. THE SELECTED REMEDY

7.1 Description of the Selected Remedy

The selected remedy at HAFB OU2 is the combination of Source Area Alternative 11 and Non-Source Area Alternative 5. Under the selected remedy for OU2, contamination in groundwater, springs and seeps, and soil will be addressed. This remedy includes the interim action implemented in 1993 in the Source Area with the objective of extracting as much DNAPL as practicable. In the Non-Source Area, the remedy includes the prior response actions consisting of providing alternate water supplies and collection, and treatment of contaminated seeps and springs.

Elements of the remedy common to both the Source Area and Non-Source Area include:

- Groundwater from the Non-Source Area and Source Area will be pumped to the SRS for any necessary treatment. However, as concentrations change in time, it may become more cost effective to use other onsite discharge options. Other options, after necessary treatment, include discharge to the sanitary sewer where it will be treated further at the Central Weber Sewer Improvement District, or onsite discharge to a surface drainage or storm sewer. Water collected from seeps and springs may be added to the groundwater stream for treatment or may continue to be treated and discharged to the surface immediately at the site.

- Long-term monitoring for contaminants and treatment system performance. A performance and compliance sampling program (PCSP) will be implemented during the remedial action to monitor performance and compliance with remediation goals. This program will include locations of performance monitoring points, monitoring frequency, analytical parameters, sampling and analytical methods, and statistical methods for evaluating data.

- Institutional controls to prevent completion of potential exposure pathways or to protect facilities installed as part of the remedy. The institutional controls are described in Section 5.2 of this ROD. Institutional controls have already been applied to the future use of groundwater.

- Residuals management: Granular activated carbon filters may be used to remove contamination from groundwater and water from springs and seeps (when flowing) or organic vapors from air or steam stripping operations. After a granular activated carbon filter is used for the last time, it will be regenerated or disposed at an offsite permitted facility.

- Because the selected remedy will result in hazardous substances remaining onsite above health-based levels, a review will be conducted within 5 years after commencement of the remedial action to ensure the remedy continues to provide adequate protection of human health and the environment.

Elements specific to the Source Area (Alternative 11) include:

- A vertical barrier to encircle the DNAPL and associated highly contaminated groundwater in the Source Area. The vertical barrier will hinder contamination from moving into the non-source area, as well as decrease the inflow of uncontaminated groundwater into the contained area. This barrier will be keyed into the low-permeability clays and silts underlying the shallow aquifer in the source area.

- A surface cap will be constructed to decrease the inflow of precipitation and prevent erosion of surface soils by wind and water. The surface cap will also prevent human contact with surface soil contamination which may result from remedial activities.

- DNAPL and contaminated groundwater will continue to be pumped from extraction wells to the SRS for treatment. DNAPL will be separated by gravity and the organic phase incinerated at a permitted facility off-Base. The water phase will be treated by steam stripping. Air stripping will be added to the treatment process to increase the capacity to address the load of contaminants and to maintain compliance with IWTP pretreatment requirements.

- Soils in the source area will be treated by SVE. The source area will be de-watered to operate SVE in what is currently the saturated zone.

- Planned treatability studies include in-situ steam stripping and surfactant flushing in the DNAPL zone.

The Source Area and area immediately adjacent needed for construction will be defined as a Corrective Action Management Unit. Soils from construction will be kept within the CAMU and will not trigger the Land Disposal Restrictions. It is expected that most soils excavated would comply with the LDRs regardless because they will be consolidated within the Area of Contamination. The excess soils will be replaced onsite to serve as the grading layer to establish proper slopes for the surface cap.

Changes in groundwater levels due to the installation of the vertical barrier may present concerns for slope stability or the integrity of the vertical barrier wall. Additional groundwater level controls may be needed.

The goal of this remedial action is to restore the shallow groundwater to its beneficial use. At this site, the shallow groundwater is a potential drinking water source. However, there is no current use of the shallow groundwater in the Source Area. Groundwater contamination may be especially persistent in the Source Area, where free phase and residual DNAPL exist and concentrations are high. The ability to achieve cleanup levels at all points throughout the area of attainment, or plume, cannot be determined until the extraction system has been implemented, modified as necessary, enhanced by any promising innovative technologies, and contaminant levels monitored over time. If the selected remedy cannot meet the specified remediation levels at any or all of the monitoring points during implementation, the contingency measures and objectives described in this section may modify the selected remedy and remediation levels for these portions of the plume. Such contingency measures will at a minimum prevent exposure with a combination of containment technologies and institutional controls. These contingency measures are considered to protect human health and the environment, and are technically practicable under the corresponding circumstances.

The selected remedy will include groundwater extraction for an estimated period of 30 years, during which time the system's performance will be carefully monitored on a regular basis and adjusted as warranted by the performance data collected during operation. Modifications may include any or all of the following:

- Discontinuing pumping at individual wells where cleanup goals have been attained, but monitoring will continue for up to 5 years to assure cleanup goals have been attained
- Alternating pumping at wells to eliminate stagnation points
- Pulse pumping to allow aquifer equilibration and encourage adsorbed contaminants to partition into groundwater
- Installing additional extraction wells to facilitate or accelerate cleanup of the contaminant plume

If it is determined, on the basis of the preceding criteria and the system performance data, that certain portions of the aquifer cannot be restored to their beneficial use, all of the following measures involving long-term management may occur, for an indefinite period of time, as a modification of the existing system:

- Engineering controls such as physical barriers or long-term gradient control provided by low-level pumping, will be maintained as containment measures
- Chemical-specific ARARs will be waived for the restoration goals of those portions of the aquifer based on the technical impracticability of achieving further contaminant reduction
- Institutional controls will be provided and maintained to restrict access to those portions of the aquifer that remain above remediation levels
- Monitoring of specified wells will continue
- Remedial technologies for groundwater restoration will be periodically re-evaluated

The decision to invoke any or all of these measures may be made during a periodic review of the remedial action, which will occur at least every five years in accordance with CERCLA Section 121 (c).

Elements specific to the Non-Source Area (Alternative 5) include:

- Contaminated shallow groundwater will be pumped from a trench and/or extraction wells to the SRS for treatment. The initial phase will intercept the outer portion of the plume and additional monitoring will be used to estimate a remedial time frame. Complex hydrogeology makes accurate modeling difficult; time frames range from 15 to over 30 years. Additional extraction systems will be installed in the plume if the monitoring results indicate an excessive remediation time frame, such as more than 30 years. To provide a more accurate restoration time frame modeling and/or empirical estimates will be presented no later than five years from the commencement of remedial action.

- Water flowing from each contaminated spring and seep location will be collected, treated, and discharged. The seeps and springs at OU2 are fed by groundwater and flow rates vary with climatological conditions. Extracting groundwater may also influence the flow rates. The treatment system for the seeps and springs will be operated whenever there is sufficient flow to operate the system.

The goal of this remedial action for the Non-Source Area is to restore shallow groundwater, and the hydrologically connected seeps and springs, to beneficial use. Shallow groundwater and water from the seeps and springs is a potential drinking water source. However, there is no current domestic use of the shallow groundwater in the vicinity of the OU2 Non-Source Area plume. There is limited agricultural use currently addressed by alternate water supplies. Based on information in the Remedial Investigation and Feasibility Studies, the selected remedy will achieve this goal.

The selected remedy for the Non-Source Area will include groundwater extraction for an estimated period of 30 years, during which the systems performance will be carefully monitored on a regular basis and adjusted as warranted by the performance data collected during operation. Modifications may include any or all of the following:

- discontinuing pumping at individual wells where cleanup goals have been attained, but monitoring will continue for up to 5 years to assure cleanup goals have been attained
- alternating pumping at wells to eliminate stagnation points
- pulse pumping to allow aquifer equilibration and encourage adsorbed contaminants to partition into groundwater
- installing additional extraction wells to facilitate or accelerate cleanup of the contaminant plume

It may become apparent, during implementation or operation of the groundwater extraction system and its modifications, that contaminant levels have ceased to decline and are remaining constant at levels higher than the remediation goal over some portion of the contaminated plume. In such a case, the system performance standards and/or the remedy may be re-evaluated.

7.1.1 Remediation Goals and Performance Standards

The goals of this remedial action are described for each of the three media of concern in the following section. The performance of the remediation system, with respect to meeting the remediation goals, will be monitored according to the performance monitoring plan to be developed during the remedial design. The remedial action includes the ongoing response actions that have been implemented at OU2.

The remedial action goals for OU2 groundwater, soil, and springs and seeps are:

- Meet chemical-specific ARARs. Restoration goals are drinking water MCLs. Meeting MCLs will satisfy restoration goals of the State Groundwater Quality Protection Rule.
- Limit cancer risk to less than 10^{-4} with a target of 10^{-6} due to incidental 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 one).
- Prevent further degradation of groundwater quality in accordance with the Utah Corrective Action Cleanup Policy for CERCLA and UST Sites.
- Remediate groundwater, water flowing from springs and seeps, source contaminants, and soil in a timely manner in compliance with the selected remedy to achieve remedial action goals.

The long-term remediation objective for the DNAPL-contaminated zone is to remove the free-phase, residual, and vapor phase DNAPL to the extent practicable and contain DNAPL sources that cannot be removed. It may be difficult to locate and remove all of the subsurface DNAPL. Additionally, there is uncertainty in the ability of the technology to meet MCLs. If successful in remediation goals, the selected remedy would result in a residual risk that ranges from a low of 7.2×10^{-6} to a high of 2.4×10^{-4}.

The area of attainment over which these cleanup goals are to be achieved is defined as that portion of the groundwater and locations of springs and seeps where MCLs are exceeded. The area of attainment for groundwater is the area where TCE exceeds its MCL (5 µg/l). The area of attainment for soil is the area where contaminated soils exceed the risk-based cleanup level. Other chemicals in groundwater that may exceed their MCLs are within this defined area.

Table 7-1 presents the list of COCs and remediation goals. In summary, PCE and TCE were retained as COCs requiring remediation in soils. PCE, DCE, methylene chloride, TCA, and TCE were retained as COCs requiring remediation in shallow groundwater in the Source Area and Non-Source Area. Toluene and the pesticides beta-BHC and gamma-BHC were retained as contaminants requiring remediation in groundwater in the source area only. Other chemicals present were not considered COCs because of the low-risks posed, the data was questionable, or the detections were not believed to be site-related. The questionable data included detections by analytical methods suited for water but modified to detect contaminants in soils. Some metals in groundwater in older wells appeared to be elevated due to well construction or high turbidity. The distribution and concentration of most pesticides do not suggest they are site related and risks presented by these are within the acceptable risk range.

Table 7-1
Chemicals of Concern
and
Remediation Goals for HAFB Operable Unit 2

Chemical of Concern	Cleanup Standards[b]
Ground and Surface Water	**Concentration**
1,2-Dichloroethene	70 µg/l
Methylene Chloride [a]	6 µg/l
Tetrachloroethene	5 µg/l
1,1,1-Trichloroethane	200 µg/l
Trichloroethene	5 µg/l
Toluene	1,000 µg/l
Beta-BHC[a] (in source area only)	0.010 µg/l
Gamma-BHC (Lindane) (in source area only)	0.2 µg/l
Soil and Sediment	
Tetrachloroethene[a]	12.31 mg/kg
Trichloroethene[a]	58.21 mg/kg

(a) Remediation goals for these chemicals are risk-based levels
(b) 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

7.1.2 Restoration Time Frame

The restoration time for groundwater is estimated to be greater than 30 years in the Source Area and may range from 15 to 30 years in the Non-Source Area. The restoration time for springs and seeps is estimated to be 15 years. Complex hydrogeology precludes accurate modeling with the information available. Installation of the pumping systems will provide more hydrogeological and empirical information by which better estimates may be accomplished. The SVE treatment of contaminants in the source area is estimated to be greater than 30 years, although other technologies such as steam injection, surface flooding, or other technologies could substantially reduce this time. Treatability studies will be required to determine the effectiveness of other technologies.

7.1.3 Costs

The estimated capital cost for remediating OU2 using the selected remedy (Source Area Alternative 11 and Non-Source Area Alternative 5) is presented in Table 7-2. The total capital cost for the selected remedy is estimated at $11,997,000. The selected remedy includes the following capital costs items: an encircling vertical barrier and surfactant cap, a shallow groundwater extraction and treatment system, for the source area, an SVE system for the source area, a shallow groundwater extraction system for the non-source area with onsite treatment and discharge to the IWTP and/or POTW, and collection, treatment, and onsite discharge of springs and seeps.

Operation and maintenance costs have been calculated for a 30-year period and do not reflect costs that may be incurred if the remediation period lasts longer than 30 years. Annual operation and maintenance for the selected remedy is estimated to be $2,622,000.

The total 30-year present worth cost of the selected remedy, using an interest rate of 5 percent, was estimated at $31,910,000. The present worth cost is estimated with a +50/-30 percent accuracy for the 30-year period.

Table 7-2
Summary of Costs for the Selected Remedy at HAFB Operable Unit 2

Alternative	Capital Cost	Annual Operation and Maintenance	Total Present Worth Cost
Source Area Alternative 11	$6,897,000	$2,012,000	$20,910,000
Non-Source Area Alternative 5	$5,100,000	$610,000	$11,000,000
Total Cost	$11,997,000	$2,622,000	$31,910,000

7.2 Statutory Determinations

The selected remedy for HAFB OU2 meets the statutory requirements of Section 121 of CERCLA as amended by SARA. These statutory requirements include protectiveness of human health and the environment, compliance with ARARs, cost effectiveness, utilization of permanent solutions and alternative treatment technologies to the maximum extent practicable, and preference for treatment as a principal element. The manner in which the selected remedy for OU2 meets each of the requirements is presented in the following discussion.

7.2.1 Protection of Human Health and the Environment

The selected remedy for OU2 protects human health and the environment through the following treatments with engineering and institutional controls:

- Groundwater will be collected and treated onsite until contaminant concentrations meet drinking water MCLs and to reduce carcinogenic and noncarcinogenic risks to within acceptable ranges. The residual risk after remediation is estimated to range from a low of 7.2×10^{-6} to a high of 2.4×10^{-4}. Institutional controls, including well advisories and water rights and well drilling restrictions, and easements and leases as necessary for monitoring and installation of equipment, will be enacted.

- Water flowing from contaminated springs and seeps will be collected and treated onsite until contaminant concentrations meet drinking water MCLs and are within an acceptable range for both carcinogenic and noncarcinogenic risks.

- The source of contaminants, former Chemical Disposal Pit 3, will be encapsulated by an encircling vertical barrier and a surface cap to prevent further migration to shallow groundwater. The contaminated groundwater in the encapsulated area will be treated by groundwater collection and treatment.

Soil in the encapsulated area will be treated by in-situ soil vapor extraction. Institutional controls will help prevent exposure by restricting groundwater and land use.

- Ongoing monitoring of groundwater, water flowing from springs and seeps, and soil will provide the basis of determining the effectiveness of the remedial action. It will also allow for the evaluation of whether the goal of meeting the estimated residual risks will be met.

The selected remedy will not pose any unacceptable short-term risks. Institutional controls and proper health and safety procedures will be implemented during construction and monitoring to minimize short-term risks to site workers and off-Base residents. The selected remedy will minimize cross-media impacts. For example, contamination of groundwater will be reduced by remediating the area near former Chemical Disposal Pit 3, thus reducing impacts on springs and seeps fed by shallow groundwater.

Because this remedy will result in hazardous substances remaining onsite above health-based levels, a review will be conducted within 5 years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

7.2.2 Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d)(1) of CERCLA, as amended by SARA, requires that the remedial actions for OU2 must attain a degree of cleanup that assures protection of human health and the environment. In addition, remedial actions that leave any hazardous substances, pollutants, or contaminants onsite must, upon completion, meet a level or standard that at least attains ARARs under the circumstances of the release. All ARARs will be met upon completion of the selected remedy or a waiver will be available. Federal and State ARARs for the selected remedy are presented in Appendix A.

Chemical-Specific ARARs. The selected remedy will comply with chemical-specific ARARs related to groundwater, seeps and springs, air quality, and discharge limits from water treatment.

MCLs based on the Safe Drinking Water Act (Utah Primary Drinking Water Regulations) are relevant and appropriate as cleanup standards for contaminated groundwater and springs and seeps at OU2. The Utah Groundwater Quality Protection Rule provides identical standards for the chemicals of concern. While a waiver of MCLs as restoration goals for groundwater in the Source Area is not contemplated at this time, it may be contemplated in the future.

Water discharged from the SRS currently complies with chemical-specific pre-treatment conditions of the HAFB IWTP which is regulated under a UPDES/NPDES pre-treatment permit. Under 40 CFR Part 261.4(a)(2), discharges subject to regulation under Section 402 of the Clean Water Act are exempt from RCRA. Air stripping will be added to the SRS treatment train to adjust for the increased contaminant load in the water stream. Air emissions from the SRS are treated by carbon to comply with levels set by air quality ARARs (NESHAPS, Clean Air Act, Utah Air Quality Rules, Utah Air Conservation Act). The system is readily modifiable if needed to comply with the added contaminant load on the carbon. The SVE system will also comply with the same air quality ARARs.

Location-Specific ARARs. Few location-specific ARARs were identified for this site. The location standards for hazardous wastes management units are applicable (40 CFR Part 264.18; UAC R315-8-2.9), but no remediation units will be located on a fault or in a 100 year floodplain.

Action-Specific ARARs. The selected remedy will comply with all action-specific ARARs, as identified in Tables A-5 and A-6. Federal and State action-specific ARARs include those for air and water discharges as described under chemical-specific ARARs. Additional action-specific applicable ARARs include: the Solid Waste Disposal Act (SWDA), RCRA requirements for treatment, storage, and disposal of wastes generated from construction, Underground Injection Control, and State ARARs which are more stringent or for which there are no federal counterparts.

SWDA and RCRA requirements pertain to disposal of the DNAPL and the disposal of wastes generated from construction of the containment and treatment systems. The DNAPL is incinerated at an offsite permitted facility in compliance with RCRA.

The Source Area and area immediately adjacent needed for construction will be defined as a CAMU. Soils from construction will be kept within the CAMU and will not trigger the LDRs. The excess soils will be replaced onsite to serve as the grading layer to establish proper slopes for the surface cap. The LDRs would otherwise be applicable to excavated soils which contain TCE or other spent solvents.

Because the wastes originally disposed in Chemical Disposal Pit 3 were placed before November, 1980 the RCRA Subpart G landfill closure regulations are relevant and appropriate to the wastes closed in place and applicable to wastes generated by excavation. The cap design will comply with the relevant and appropriate requirements for landfills.

Treatability Studies and remedy(ies) which inject substances into the subsurface will comply with the substantive requirements of the Underground Injection Control Regulations (40 CFR Section 144-147; UAC R 317-7). The remedy incorporates DNAPL removal through continued pump and treat, SVE, and the encapsulation of the source area. The remedy will meet the action-specific requirements of the Utah Groundwater Quality Protection Rule.

Compliance with the Utah Cleanup Action and Risk Based Closure Standard [UAC R315-101] will be met with the treatment plus the long-term management provided by monitoring and institutional controls. Compliance with the Utah Corrective Action Cleanup Policy for CERCLA and UST Sites [UAC R311-211] will be met through source control. Other State of Utah action-specific ARARs are identified in Table A-6. These include standards for which there is no federal counterpart or are more stringent than federal requirements.

The alternative discharge options are onsite actions regulated under the NPDES/UPDES (40 CFR Part 122; UAC R317-8) requirements of the Clean Water Act. Discharge to the sanitary sewer must meet the substantive pre-treatment requirements set by the POTW. If the onsite treatment satisfies all surface water discharge requirements, the treated water may be discharged to an onsite stream in compliance with water quality standards (40 CFR Part 122; UAC R317-8) instead of pumping to the IWTP.

7.2.3 Cost-Effectiveness

The selected remedy is cost-effective in addressing the principal risks posed by the DNAPL, soils, groundwater, and seeps and springs within a reasonable period of time. Section 300.430(f)(ii)(D) of the NCP requires evaluating cost-effectiveness by comparing all of the alternatives which meet the threshold criteria against three additional balancing criteria which describe the alternatives overall effectiveness: long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; and short-term effectiveness.

The selected remedy for the Source Area (Alternative 11) provides the best overall effectiveness of all alternatives considered proportional to its cost. The engineering controls to contain the highest concentrations of contaminants reduces the scope of long-term management which would be needed due to the presence of the DNAPL. Transport of contaminants to the Non-Source Area off-Base is controlled without continually pumping high quantities of water which would be required by the non-encapsulating alternatives. Extraction of DNAPL and treatment of soils and groundwater will greatly reduce the toxicity, mobility, and volume of contaminants at the site. Alternative 12 would provide greater long-term effectiveness in addressing surface soils. However, risks posed from direct surface soil exposures are low in both residential and industrial construction scenarios. The cost increase of 20 percent for Alternative 12 over Alternative 11 is not justified, particularly since surface exposures will also be controlled in Alternative 11 by the cap. Also, Alternative 12 offers less short-term effectiveness in terms of worker and community protection.

The selected remedy for the Non-Source Area (Alternative 5) provides the best overall effectiveness of all alternatives considered proportionate to its cost. It is the least costly for capital and operations and maintenance costs of all of the alternatives which meet the threshold criteria. All alternatives which met the threshold criteria would reduce toxicity, mobility, and volume. The risks to the community and site worker concerns of short-term effectiveness are readily addressed. All are implementable. However, the innovative technologies are not proven at the field scale in terms of contaminant reduction efficiency or operations and maintenance for groundwater restoration.

7.2.4 Utilization of Permanent Solutions and Alternative Treatment Technologies

The selected remedy meets the statutory requirement to utilize permanent solutions and treatment technologies to the maximum extent practicable. The selected remedy provides the best balance of tradeoffs among all the alternatives with respect to the five balancing criteria which include:

- long-term effectiveness
- reduction of toxicity, mobility, or volume reduction through treatment
- short-term effectiveness
- implementability
- cost

The criteria most critical in the selection decision for the Source Area were long-term effectiveness; implementability; and cost. All alternatives which met the threshold criteria would reduce toxicity, mobility, and volume. Potential risks to the community and site worker concerns of short-term effectiveness are readily addressed. Continual pumping of the large volumes of water needed for Source Area Alternatives 4 and 5 present a costly long-term management concern which is lessened with the construction of the vertical barrier. Cost becomes a greater concern considering it may take longer than 30 years to restore the source area, with corresponding increases in operations and maintenance costs. Construction of such a barrier is implementable and would contain the highest concentrations of contaminants.

The criteria most critical in the selection decision for the Non-Source Area were long-term effectiveness and cost. Conventional pump and treat offers fewer long-term effectiveness concerns and well and pump systems are readily modified. The selected alternative for the Non-Source area provides comparable performance at about half the cost estimated for the air sparging alternatives.

7.2.5 Preference for Treatment as a Principal Element

The selected remedy for OU2 utilizes permanent solutions and treatment technologies to the maximum extent practicable. The use of SVE (with possible enhancements such an in situ steam stripping or soil flushing) to remediate contaminated shallow groundwater, carbon adsorption to treat (or pretreat) extracted groundwater, and treatment of vapors from the SVE system satisfies the statutory preference for treatment that permanently and significantly reduces the volume, toxicity, and mobility of hazardous substances. These treatment processes are expected to permanently reduce the concentrations of contaminants. The vertical barrier and encapsulation provide permanent solutions in the event treatment is unable to meet restoration goals.

7.3 Documentation of Significant Changes

The Proposed Plan for HAFB OU2 was released for public comment on May 11, 1994. A public meeting on the Proposed Plan was held on May 25, 1994. The Proposed Plan identified Source Area Alternative 11 and Non-Source Area Alternative 5 as the preferred combination of alternatives. This remedy included: an encircling vertical barrier and surface cap; shallow groundwater extraction and treatment; soil vapor extraction; shallow groundwater extraction and onsite treatment and discharge to the IWTP and POTW; collection, treatment, and onsite discharge of springs and seeps; and monitoring of shallow groundwater. The public was informed of the low likelihood of restoring the groundwater in the on-Base Source Area to drinking water standards. All written and verbal comments received during the public comment period were reviewed. No changes to the preferred alternative, as originally presented in the Proposed Plan, were required based on review of written and verbal comments.

8. References

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U.S. EPA, 1991e. Record of Decision Checklist for Summary of Site Risks in FY91 ROD Analysis: Final Action, EPA Office of Emergency and Remedial Response, undated (circa 1991).

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9. Responsiveness Summary

Overview

This responsiveness summary provides information about the views of the community with regard to the proposed remedial action (RA) for Hill Air Force Base (HAFB) Operating Unit 2 (OU2), documents how public comments have been considered during the decision making process, and provides responses to concerns.

The public was informed of the selected RA in the following ways:

- established USAF, EPA, and State contacts for citizens
- all items contained within the Administrative Record have been on file at the subject repositories since the final version of each document was issued
- a copy of the Proposed Plan was sent to all effected and interested parties prior to the public comment period
- a public comment period was held from May 11, 1994, through June 10, 1994
- a public availability session was held on May 19, 1994
- a public meeting was held on May 25, 1994, at South Weber Elementary School in South Weber, Utah
- written comments by the public were encouraged

The public meeting was well attended and residents voiced numerous concerns about the nature, extent, and risks associated with the contamination. A transcript of the public meeting is attached as Appendix B. No comments were made that would effect the proposed RA for OU2. One written comment and two written requests were received during the public meeting. The comment and requests are included in Appendix B.

Background on Community Involvement

The public participation requirements of CERCLA Sections 113(k)(2)(B)(i-v) and 117 were met. HAFB has a Community Relations Plan that is based on community interviews which was finalized February 1992. The community relations activities include:

- a Restoration Advisory Board (RAB) that meets at least quarterly and includes community representatives from adjacent counties and towns
- a mailing list for interested parties in the community
- a bi-monthly newsletter called "EnviroNews"
- visits to nearby schools to discuss environmental issues

- community involvement in a noise abatement program
- semi-annual town council meetings
- opportunities for public comment on remedial actions
- support for the community for obtaining technical assistance grants (TAGs)
- administrative record and information repository

In addition, a public meeting was held on April 28, 1993, to explain the risk assessment process at site-specific risk issues for the communities north of HAFB that are effected by OU1, OU2, and OU4.

The RI Report (Radian, 1992), RI Addendum (Radian, 1994), Feasibility Study Report (Radian 1993), FS Addendum (CH2M HILL, 1994), and the Proposed Plan for OU2 (CH2M HILL 1994) were released to the public, and are available in the Administrative Record maintained in the Davis County Library and at the Environmental Management Directorate at HAFB. The notices of availability for these documents were published in the Salt Lake Tribune. A public comment period was held from May 11, 1994, through June 10, 1994. In addition, a public meeting was held on May 25, 1994. At this meeting, representatives from HAFB, EPA, and the State of Utah answered questions about the site and the preferred alternative. A court reporter prepared a transcript of the meeting. Copies of the transcript and all written public comments received during the comment period have been placed in the Administrative Record. In addition, copies of the transcript were sent to all meeting attendees who requested them. Responses to the comments received during the public comment period are included in the Responsiveness Summary, which is part of this ROD. The decision process for this site is based on the Administrative Record.

The HAFB Community Relations Plan and the history of community relations for OU2 are described in Section 2.4 of the Decision Summary for the ROD.

Summary of Public Comments and Agency Responses

The major community concerns are discussed in the following sections.

Extent and Area of Contamination

Comment

Members of the community were interested in the current location, rate of migration, and origin of the contaminant plume. A general misunderstanding of what defines an "operable unit" was apparent from the public comments, as well as the terms "onsite" and "offsite."

Response

In response to those comments, a review of where all eight OUs are located and the type of pollutants present were conveyed at the meeting. Many operable units are adjacent to disposal areas; some are adjacent to places where operations were conducted, such as where solvents were spilled on the ground. The boundaries of the OU2 area were clarified and a description of the associated trenches (used for the disposal of solvents), described.

Definitions of "onsite" and "offsite" were given as "on-the-base," and "everything-outside-the-base," respectively.

Comment

Numerous questions were raised about the location of the contaminant plume and the associated hydrogeology. The public expressed concern about the rate of plume migration and the past, present, and future areas of contamination.

Response

Using visual aids, the plume boundaries and associated pollutant concentrations were pointed out by Mr. Kirchner (HAFB). In response, scenarios of how the plume may have been defined 5 years ago were given, as well as a general estimate of the rate of migration of the contaminant plume: feet per year.

Comment

It was also brought to the panels' attention that the state has piped the groundwater (from OU4) so that it runs into our agricultural drain across the road. The question was asked "is the piped groundwater causing additional exposure?"

Response

The investigation team would be interested in knowing where all the groundwater is going and control of the groundwater flow is paramount. It was requested that the person who asked the question write his name and address and HAFB will take care of the piping of groundwater from OU4 across agricultural drains. The HAFB OU4 project manager has responded to this citizen's request.

Hydrogeology and Lithology

Comment

An explanation was requested by the citizens concerning the general hydrogeology of the OU2 area, the driving force moving the plume, depth of the confining clay layer, and what effect hill slides may have on the area of concern.

Response

In response, the citizens were informed that OU2 lays on top of the Weber Delta; therefore in elevation, it is a high point in the vicinity. Precipitation that lands in the vicinity of OU2 infiltrates down through the ground and stops vertically at the impermeable layer, thus forming the water table. Rain falling on the east side of the runway also creates shallow groundwater. The impermeable clay layer, which starts 40 to 50 feet below ground surface (bgs), is several hundred feet thick. This clay layer apparently has held the contamination (vertical migration) for 20 years.

Comment

A citizen expressed concern about CH2M HILL's December 21, 1993, report which stated that both upper and lower hill sliding has occurred; moreover, inspection on the surface of the hill reveals yellow and green sludge, in addition to obnoxious odors. The citizen asked, what effect does this hill movement and sliding have on the 40- or 50-foot aquifer underneath; namely, is it possible that the aquifer is leaching some of it (contamination) above and below the canals (as the result of hill movement).

Although the area in question is outside OU2, Mr. Kirchner did relate to the citizens that several 100-foot borings were drilled into the clay layers near OU2. Inclinometers were installed at this site. Mr. Kirchner further explained that inclinometers are used to measure ground movement.

Types and Concentration of Contaminants

Comment

The amount and extent of groundwater sampling was raised by several members of the community; specifically, the number of sampling locations located offsite. The number of sampling events were also of interest to a number of citizens.

Response

In response to these questions, the citizens were informed that there are 19 wells and 10 springs sampled 4 times a year for the OU2 area. The contamination from the Weber-Davis Canal was also of concern. The citizens were informed the contamination does not go into the canal. However, the canal (as all concrete canals of that age and construction) leaks. The leakage has the potential to spread contamination further, but the OU2 contamination does not impact the canal area. At this time, there are plans to line the Weber-Davis canal. A description of the pollutant source area (where did the contamination come from?) was requested by the citizens. The disposal site and type of pollutants were described as follows: the trenches were unlined, dug into the ground, probably 10 feet deep; the solvents were collected, after they degreased and cleaned the landing gear parts, in drums and dumped into these two trenches.

Comment

An inquiry concerning the "wide-scale" estimate of the spill size was verbally submitted.

Response

In reply, it was stated that nobody kept logs of the amount of solvents dumped into the trenches 20 years ago, so high and low estimates were calculated taking into consideration: reuse, evaporation rates, and standard practices at HAFB in the 1960s and 1970s and calculations based on known occurrence in the subsurface. Currently, the range has been refined to a value between 30,000 and 100,000 gallons. This estimate is a result of the amount that has already been pumped from the site. The citizens were informed that the Risk Assessment is concerned with DNAPL contamination. DNAPLs are very difficult to extract using currently available technologies and sometimes containment is the only feasible alternative. However, HAFB will continue to review emerging technologies and assess their applicability to OU2. In addition, measures to enhance the recovery of DNAPL will be addressed during remedial design.

Risk Assessment Methods

Comment

Questions were raised by those in attendance about risk assessment factors, the meaning of a Hazard Quotient of 1, potential pathways, and how the risk numbers are brought about.

Response

It was explained that all pathway exposure times and the type of chemicals are factored into the risk assessment analyses. The citizens were referred to the Baseline Risk Assessment document found in the Administrative Record that describes the process and equations for risk assessment analyses. Also conveyed was that these factors are nationwide standards approved by the EPA. The Hazard Quotient of 1 is the ratio of the concentrations that an individual would be exposed to over the number that represents the lowest observed effect level. Some explanation on "lowest observed first effect" with laboratory animals was expanded on, as well as adequate protection, balancing criteria, and safety factors.

Potential Health Risks

Comment

Additional questions were raised by the citizens concerning the health, or risk of the contaminants on vegetation, livestock, and food consumption.

Response

It was stated that since current practice does not include spraying potentially contaminated groundwater onto the crops, there is no reason for concern. Agricultural, engineering and scientific communities have studied the entire process and there is no reason for concern. The type of contamination is not likely to be taken up by vegetation. Because they are volatile, the pollutants would likely evaporate very quickly if exposed to the atmosphere.

Comment

The other concern about potential health risks included a question about the health risk now, compared to 5 years ago.

Response

The extent or spread of the contamination is greater now, but the contaminant concentrations are somewhat less. A definition of non-cancer-causing health effect was also explained to the attendees during this discussion.

Remedial Action Schedule

Comment

A question was asked about the actual time required to implement the RA.

Response

In response, Mr. Kirchner indicated 15 months was allotted by law to implement the RA. The panel expounded that the construction of the remedial systems would start in the middle of winter; weather conditions could delay the construction activities and this remedial cleanup time schedule.

Comment

If HAFB was to close, one citizen inquired, what effect would that have on the RA schedule?

Response

If a closure occurs, Mr. Kirchner responded, before the property can be turned over to private industry or the public, each site would have to be remediated before the property could be purchased. Mr. Elliott interjected that the money associated with this program is no different than Superfund, which provides money for private section sites. The funding will continue to be there as long as Congress continues to pay for the program. It was stated that the clean-up will take 30+ years in the source areas and 15 years for clean-up in non-source area.

Current Treatability Studies

Comment

One question was raised concerning the amount of, or fraction of, contaminants that will be removed from the groundwater in the long term.

Response

In response, there was a discussion by panel members about the properties of the contaminant: TCE. There is a lack of any proven technology to meet the MCL for TCE in drinking water. The MCL for TCE is 5 parts per billion (ppb). There is no technology that can remediate DNAPLs in groundwater to that level in a short period of time. The best knowledge that we have today is being applied to the OU2 site. To date, a total of 30,000 gallons of DNAPL have been pumped out of the OU2 area.

Proposed or Suggested Remediation Technology

Comment

The preferred Source Area Alternative 11, which consisted of a vertical barrier and a surface cap, was questioned by Louis Cooper of the Davis County Department of Heath. He stated that the vertical barrier at OU1 was not effective.

Response

An explanation of why pollutants migrated out of the OU1 area after placing vertical barriers followed. Migration of contaminants from OU1 did occur after this type of technology was used and an inquiry concerning the integrity of the barriers was conducted. The vertical barrier at OU1 was incorrectly constructed which allowed contaminants to migrate. The alternatives for installing vertical barriers at OU2 were discussed. The citizens were informed that the underlying clay layer is 100-feet thick; the vertical barriers such as Z-channel steel sheet piles could be used and would extend into the underlying clay layer several feet.

PART II-

Comprehensive Response to Specific Legal and Technical Questions

Specific legal and technical questions raised by the community are described below.

Property Values

Comment

The issue of property devaluation and the adversarial process of being compensated for land loss was submitted in writing by Brent Poll, who represents the South Weber Landfill Coalition. Mr. Poll's letter was received on May 25, 1994. He expressed concern that the burden of proof is thrust on those who claim injury (citizens), the HAFB legal office denies negligence and hides behind the Federal Torts Claims Act. The letter strongly suggests that the environmental and legal offices of HAFB must find a way to genuinely safeguard its neighbors against the negligent dumping of toxic wastes on the steep bluffs above South Weber.

Response

Although no response was presented during the meeting, the response will be presented in this document. Compensation paid by the Air Force to date has been in the form of lease payments made for access to property to conduct remedial investigations and to compensate land owners for losses they suffer as a result of that investigation. The formal claims process will be handled on a case-by-case basis in regard to compensation for damages.

Remaining Concerns

Comment

L. Richard Peek requests testing of the springs and groundwater by his and his father's house, 174 and 120 W. South Weber Drive, phone number is 479-5055.

Response

HAFB responded by directing Mr. Peek's request to the Program Manager at OU4.

Comment

Peggy Bon of 2485 East 7800 South, South Weber, Utah 84405 wrote that she would like to know which OU she and her daughter are located in. Her daughter resides at 1271 East 7600 South, South Weber, Utah.

Response

HAFB responded to Ms. Bon in writing that neither she nor her daughter live within the boundary of an OU. HAFB stated that both Ms. Bon and her daughter would be placed on the mailing list so that they will receive information about work being done in the South Weber area.

Table A-1

Identification of Federal Chemical-Specific ARARs for Operable Unit 2

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate	Documentation
		Safe Drinking Water Act - 42 USC § 300		
National Primary Drinking Water Standards	40 CFR Part 141	Establishes health-based standards for public water systems and specifies maximum contaminant levels (MCLs).	No/Yes	Clean-up standards will be based on MCLs since groundwater is a potential future source of drinking water.
National Secondary Drinking Water Standards	40 CFR Part 143	Establishes welfare-based standards for public water systems and specifies secondary maximum contaminant levels (SMCLs).	No/Yes	Clean-up standards may be based on SMCLs since groundwater is a potential future source of drinking water.
Maximum Contaminant Level Goals	40 CFR Part 141	Establishes drinking water quality goals set at levels of no known or anticipated adverse health effects, with an adequate margin of safety.	No/Yes	The groundwater clean-up standards may be based on non-zero MCLGs since groundwater is a potential future source of drinking water.
		Clean Water Act - 33 USC §§ 1251-1376		
Water Quality Criteria	40 CFR Part 131	Establishes criteria for water quality based on toxicity to human health.	No/Yes	The groundwater clean-up standards will be based on water quality criteria since groundwater is a potential water supply if other standards for drinking water clean up are not available

Table A-1 (Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate	Documentation
Ambient Water Quality Criteria	40 CFR Part 131	Establishes criteria for water quality-based on toxicity to aquatic organisms.	No/Yes	The groundwater clean-up standards will be based on ambient water quality criteria if no other drinking water standards or water quality criteria are available.
Toxic Pollutant Effluent Standards	40 CFR Part 129	Establishes effluent standards or prohibition for certain toxic pollutants: aldrin/ dieldrin, DDT, endrin, toxaphene, benzidine, and PCBs.	No/Yes	Aldrin, dieldrin and endrin have been detected in low concentrations at OU2.
Solid Waste Disposal Act - 42 USC §§ 6901-6987				
Criteria for the Identification and Listing of Hazardous Waste	40 CFR Part 261	Establishes solid wastes which are subject to regulation as hazardous waste under 40 CFR Parts 124, 262-265, 268, and 270.	Yes/--	Wastes generated during the remediation phase have been determined to contain RCRA hazardous constituents and will be subject to identification and listing as hazardous wastes.
Requirements for Releases from Solid Waste Management Units	40 CFR Part 264, Subpart F	Establishes maximum concentrations for hazardous constituents in the groundwater	No/Yes	The groundwater clean-up standards may be based on these maximum concentrations if they are more stringent than MCLs or non-zero MCLGs, or if no standards exist.
Land Disposal Restrictions	40 CFR Part 268	Establishes maximum concentrations for hazardous constituents prior to land disposal.	Yes/--	Hazardous wastes generated during the remediation phase will be subject to land disposal restrictions and may be required to meet BDAT technologies and/or constituent concentrations

Table A-1 (Continued)

Clean Air Act - 42 USC § 7401				
Standard, Requirement, Criteria, or Limitation	**Citation**	**Description**	**Applicable/Relevant and Appropriate**	**Documentation**
National Ambient Air Quality Standards	40 CFR Part 50	Establishes primary and secondary standards for six pollutants: PM_{10}, SO_2, CO, ozone, NO_2, and lead.	Yes/--	Emissions from the remediation process will be subject to the National Ambient Air Quality Standards unless state standards are more stringent.
National Emissions Standards for Hazardous Air Pollutants (NESHAP)	40 CFR Part 61	Establishes regulatory standards for specific air pollutants: arsenic, asbestos, benzene, beryllium, mercury, radionuclides, and vinyl chloride.	No/Yes	Beryllium in source area soils has been identified as a chemical of concern.
New Source Performance Standards	40 CFR Part 60	Establishes performance standards for certain types of new stationary sources.	No/No	No new major sources (for example incinerators) are proposed as part of remedial activities.

Table A-2

Identification of State Chemical-Specific ARARs for Operable Unit 2

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate	Documentation
Utah Safe Drinking Water Act - Title 19 UCA Chapter 4				
Utah Primary Drinking Water Standards	R39-103-1 UAC	Establishes maximum contaminant levels for inorganic and organic chemicals as primary drinking water standards.	No/Yes	Requirements are relevant and appropriate for OU2. Some MCLs established for contaminants are not Federally regulated (e.g., total dissolved solids).
Utah Secondary Drinking Water Standards	R309-103-2 UAC	Establishes maximum contaminant levels for inorganic and organic chemicals as secondary drinking water standards.	No/Yes	Requirements are relevant and appropriate for OU2.
Utah Solid and Hazardous Waste Act - Title 19 UCA Chapter 6 Part 1				
Land Disposal Restrictions	R315-13 UAC	Outlines land disposal restrictions for hazardous waste. Utah incorporates Federal LDRs by reference.	Yes/--	Hazardous wastes generated during remediation will be subject to land disposal restrictions and may be required to meet BDAT technologies and/or constituent concentrations.
Criteria for the Identification and Listing of Hazardous Waste	R315-2-1 UAC	Establishes solid wastes that are regulated as hazardous wastes under the Utah Solid and Hazardous Waste Act. Definition of hazardous waste mirrors federal definition.	Yes/--	Wastes generated during the remediation phase have been determined to contain hazardous constituents and will be subject to identification and listing as hazardous wastes.

Table A-2 (Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate	Documentation
Ground Water Protection Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	R315-8-6.5 UAC	Establishes maximum concentrations for hazardous constituents in ground water.	No/Yes	The ground water clean-up standards may be based on these maximum concentrations if they are more stringent than MCLs or non-zero MCLGs, or if no standards exist.
Utah Water Quality Act - Title 19 UCA Chapter 5				
Ground Water Quality Protection Rule	R317-6 UAC	Establishes ground water quality standards for different aquifer classes.	* (See Documentation column for explanation)	*The Utah Ground Water Quality Protection Rule establishes numerical clean-up levels and other performance standards for contaminated ground water. Although no determination has been made concerning whether this Rule is an applicable or relevant and appropriate standard at OU2, the standards required by the Ground Water Quality Protection Rule will be met by complying with drinking water MCLs.
Underground Injection Control (UIC) Standards	R317-7 UAC	Establishes general requirements, definitions, permitting procedures, and operating standard. UIC standards adopt by reference the federal UIC regulations with the exception of a 2-mile radius from the borehole instead of a one quarter-mile radius from the borehole to an underground source of drinking water.	Yes/--	The UIC regulations would be applicable for remedial activities that involve injection of surfactants, steam injection, or soil flooding. State counterpart to 40 CFR Parts 144-147.

Table A-2 (Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate	Documentation
Water Quality Standards	R317-2 UAC	Establishes standards for the quality of surface waters in the State.	No/Yes	These rules are specific to Utah, although they are derived, in part, from federal criteria. May be relevant and appropriate since ground water is a potential water supply if other standards are not available.
Utah Air Conservation Act - Title 19 UCA Chapter 2				
State Adoption of the National Ambient Air Quality Standards (NAAQSs)	R307-1-3 UAC	Specifies NAAQSs for PM_{10}, SO_2, CO, ozone, NO_2, and lead. State adoption of Federal NAAQS and Best Available Control Technology (BACT).	Yes/NA	Emissions from remedial activities cannot result in exceedance of NAAQS.
Standards for Visible Emissions, PM10 Attainment Areas, Emissions from Internal Combustion Engines, and New Source Performance Standards	R307-1-4 UAC	Establishes air quality standards for visible emissions, PM_{10} attainment areas, emissions from internal combustion engines, and new source performance standards (NSPS).	Yes/NA	This rule is applicable for emissions generated from remedial activities. Davis County is a non attainment area for PM_{10}. Remedial system that require electrical backup systems powered by diesel internal combustion engines must meet emission standards.
National Emission Standards for Hazardous Air Pollutants (NESHAPs) as Implemented by Utah	R307-10 UAC	Specifies emission standards for hazardous air pollutants from various source categories	Yes/NA	Emissions from remediation systems subject to NESHAPs.
Fugitive Dust Emission Standards	R307-12 UAC	Establishes fugitive dust emission standards.	Yes/NA	Fugitive dust emissions generated during remedial action construction activities will be subject to these standards.
Ozone Non Attainment Area Standards for Davis County, Utah	R307-14 UAC	Establishes area standards for sources that emit air pollutants that are precursors for the formation of ozone.	Yes/NA	Emissions from the remediation process will be subject to emission standards for area sources.

Table A-3

Identification of Federal Location-Specific ARARs for Operable Unit 2

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate	Documentation
Solid Waste Disposal Act - 42 USC §§ 6902-6987				
Location Standards for Hazardous Waste Management Units	40 CFR § 264.18	Establishes site characteristics which are unsuitable for location of hazardous waste management units.	Yes/--	Standard is an ARAR for hazardous waste remediation units at OU2. Remediation units will not be located on a fault or in a 100-year floodplain.

Table A-4
Identification of State Location-Specific ARARs for Operable Unit 2

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate	Documentation
Utah Solid and Hazardous Waste Act - Title 19 UCA Chapter 6 Part 1				
Location Standards for Hazardous Waste Management Units	R315-8-2.9 UAC	Establishes site characteristics which are unsuitable for location of hazardous waste management units.	Yes/--	Standard is an ARAR for hazardous waste remediation units at OU2. Remediation units will not be located on a fault or in a 100-year floodplain.

Table A-5

Identification of Federal Action-Specific ARARs for Operable Unit 2

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate	Documentation
Clean Water Act - 33 USC §§ 1251-1376				
National Pollutant Discharge Elimination System Requirements	40 CFR Part 122	Establishes requirements for permits to authorize the point source discharge of pollutants into waters of the Unites States. Also, regulates discharges of stormwater.	Yes/--	Discharge of treated surface water into waters of the United States and stormwater discharges may be associated with the remediation strategy.
National Pretreatment Standards	40 CFR Part 403	Establishes standards for controlling pollutants which pass through or interfere with treatment processes in publicly owned treatment works or which may contaminate sewage sludge.	Yes/--	Remediation strategy will include pretreatment at the existing HAFB industrial wastewater treatment plant prior to treatment in publicly owned treatment works.
Underground Injection Control Program under the Safe Drinking Water Act	40 CFR Parts 144-147	Establishes regulations for the subsurface emplacement of fluids through an injection well	Yes/--	The UIC regulations would be applicable for remedial activities that involve injection of surfactants, steam injection, or soil flooding.
Solid Waste Disposal Act - 42 USC §§ 6901-6987				
Criteria for Classification of Solid Waste Disposal Facilities and Practices	40 CFR Part 257	Establishes criteria for use in determining when solid waste disposal facilities pose a reasonable probability of adverse effects on health or the environment.	Yes/--	Land disposal of solid nonhazardous waste may be part of the remediation strategy.

Table A-5 (Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate	Documentation
Criteria for Municipal Solid Waste Landfills	40 CFR Part 258	Establishes minimum national criteria under RCRA for all municipal solid waste landfill units.	Yes/--	Site does not include any municipal solid waste landfills. Would be applicable for disposal of non-hazardous solid waste. Ground water monitoring requirements could become relevant and appropriate for a no action alternative.
Standards Applicable to Generators of Hazardous Waste	40 CFR Part 262	Establishes requirements for generators of hazardous waste.	Yes/--	Remediation strategy includes generation of hazardous waste.
Standards Applicable to Transporters of Hazardous Waste	40 CFR Part 263	Establishes requirements for transporters of hazardous waste.	Yes/--	Remediation strategy may include the transportation of hazardous waste (e.g., soil).
General Facility Standards	40 CFR Part 264, Subpart B	Establishes general facility management standards for hazardous waste treatment, storage, and/or disposal facilities.	Yes/--	Certain general facility standards are applicable and facility management plans may be developed, as needed, to implement other 40 CFR Part 264 requirements.
Security Standards for TSDFs	40 CFR Part 264.14	Establishes security requirements to prevent unauthorized access to TSDFs.	Yes/--	Remedial activities will require security measures to prevent access to TSDFs by unauthorized persons.
General Inspection Standards	40 CFR Part 264.15	Establishes inspection standards for TSDFs.	Yes/--	Remedial activities that involve onsite TSDFs will require the preparation and implementation of an inspection plan.
Personnel Training Standards	40 CFR Part 264.16	Establishes training requirements for personnel that manage TSDFs.	Yes/--	Remedial activities that involve onsite TSDFs will require the preparation and implementation of a personnel training program.

Table A-5 (Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate	Documentation
General Requirements for Ignitable, Reactive, or Incompatible Wastes	40 CFR Part 264.17	Establishes requirements to prevent storage, treatment, and management of incompatible hazardous wastes.	Yes/--	Procedures are applicable to prevent storage, management, and treatment of incompatible hazardous waste that may be generated during remedial activities.
Construction Quality Assurance	40 CFR Part 264.19	Establishes the requirement to prepare and implement a construction quality assurance plan.	Yes/--	Remedial activities will involve construction activities. Preparation and implementation of a construction quality assurance plan is applicable.
Standards of Preparedness and Prevention	40 CFR Part 264, Subpart C	Establishes requirements for preparedness and prevention at hazardous waste treatment, storage, and/or disposal facilities.	Yes/--	Preparedness and prevention measures may be developed, as needed, to implement other 40 CFR Part 264 requirements.
Contingency Plan and Emergency Procedures	40 CFR Part 264, Subpart D	Establishes requirements for a contingency plan and emergency procedures at hazardous waste treatment, storage, and/or disposal facilities.	Yes/--	A contingency plan and emergency procedures may be developed, as needed, to implement other 40 CFR Part 264 requirements.
Manifest System, Recordkeeping, and Reporting Requirements	40 CFR Part 264, Subpart E	Establishes requirements for the manifest system as well as recordkeeping and reporting at hazardous waste treatment, storage, and/or disposal facilities.	Yes/--	Requirements for the manifest system, recordkeeping, and reporting will be developed, as needed.
Requirements for Releases From Solid Waste Management Units	40 CFR Part 264, Subpart F	Establishes requirements for detection and containment of releases from waste management units at hazardous waste treatment, storage, and/or disposal facilities.	Yes/--	Solid waste management units associated with the remediation strategy will have secondary containment to preclude releases. If the selected alternative involves capping/ containment and/or continued ground water monitoring, ground water monitoring requirements will be applicable.

Table A-5 (Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate	Documentation
Closure and Post-Closure Standards	40 CFR Part 264, Subpart G	Establishes general standards for closure and, if required, post-closure at hazardous waste treatment, storage, and/or disposal facilities.	Yes/Yes	Closure and, if required, post-closure will be needed for any hazardous waste management units.
Standards for the Use and Management of Containers	40 CFR Part 264, Subpart I	Established design and operational standards for the use and management of containers storing hazardous waste at TSDFs.	Yes/--	Use of containers storing hazardous waste will not be part of the remediation strategy. However, all temporary storage and management of containers containing hazardous waste will be in accordance with the requirements of this subpart.
Standards for Tank Systems	40 CFR Part 264, Subpart J	Establishes design and operational requirements for the storage and/or treatment of hazardous wastes in tanks at hazardous waste treatment, storage, and/or disposal facilities.	Yes/--	Tank systems for the storage and/or treatment of hazardous waste will be in accordance with the requirements of this subpart.
Standards for Landfills	40 CFR Part 264, Subpart N	Establishes design and operational requirements for hazardous waste landfills.	No/Yes	Standards for a surface cap will be relevant and appropriate. The standards for closure and post-closure are relevant and appropriate.
Standards for Incinerators	40 CFR Part 264, Subpart O	Establishes design and operational requirements for hazardous waste incinerators.	No/Yes	Remediation strategy does not include onsite operation of an incinerator. Incinerator standards may be relevant and appropriate for low temperature thermal treatment alternative.
Corrective Action Management Unit (CAMU)	40 CFR Part 264 Subpart S	Establishes requirements for designation of a CAMU and defines management practices.	Yes/--	Applicable to remedial activities in which treated soil is returned to the site of removal. Allows exemption to LDRs if clean-up goals are achieved.

Table A-5 (Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate	Documentation
Air Emissions Standards	40 CFR Part 264, Subparts AA and BB	Establishes monitoring and recordkeeping requirements for process vents and equipment leaks.	Yes/--	Equipment meeting the applicability requirements will be monitored in accordance with the requirements of these subparts.
Standards for Thermal Treatment	40 CFR Part 265 Subpart P	Establishes standards for other thermal treatment of hazardous wastes.	To-Be-Considered	If other thermal treatment is performed as part of the remediation, this unit will be designed and operated in accordance with the requirements of this subpart.
Standards for Chemical, Physical, and Biological Treatment	40 CFR Part 265 Subpart Q	Establishes standards for chemical, physical, or biological treatment of hazardous wastes that do not occur in tanks, surface impoundments, or waste piles.	To-Be-Considered	This regulation is to be considered for remedial activities including soil vapor extraction (SVE) and the Source Recovery System.
Land Disposal Restrictions	40 CFR Part 268	Establishes hazardous wastes that are restricted from land disposal and describes those circumstances where treated waste may be land disposed.	Yes/--	Hazardous wastes generated during remediation will be managed in accordance with the requirements as specified in this rule.
Clean Air Act - 42 USC § 7401				
Standards of Performance for Incinerators	40 CFR Part 60, Subpart E	Establishes standards of performance for solid waste incinerators.	Yes/--	Hazardous waste that is treated by low temperature thermal treatment will be in accordance with the requirements of this subpart.
Standards of Performance for Volatile Organic Liquid Storage Vessels (Post 7/23/84)	40 CFR Part 60, Subpart K,	Establishes standards of performance for storage tanks containing volatile organic liquids.	Yes/No	Hazardous wastes that are defined as volatile organic liquids will be stored in accordance with the requirements of this subpart.

Table A-5 (Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate	Documentation
Occupational Safety and Health Act - 29 USC §§ 651-678				
Worker Safety Standards	29 CFR Part 1910	Establishes standards for worker safety at hazardous waste facilities.	Yes/--	Worker safety requirements will be in accordance with the requirements of this part.
Hazardous Materials Transportation Act - 49 USC §§ 1801-1813				
Hazardous Materials Transportation Requirements	49 CFR Parts 107 and 171-177	Establishes requirements for transportation of hazardous materials.	Yes/--	Transportation of hazardous materials off-site will be in accordance with the requirements of these parts.

Table A-6
Identification of State Action-Specific ARARs for Operable Unit 2

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate	Documentation
UCA 73-3-25				
Well Drilling Standards	R655-4 UAC	Establishes standards for drilling and abandonment of wells	Yes/--	The selected remedy includes ground water monitoring and extraction wells.
Utah Occupational Safety and Health Act - Title 35, UCA Chapter 9				
Worker Safety Standards	R574 UAC	Establishes occupational safety and health standards. Rules mirror Federal OSHA regulations.	Yes/--	All remediation standards will require worker safety procedures and practices.
Utah Air Conservation Act - Title 19 UCA Chapter 2				
Definitions and General Requirements for Air Conservation	R307-1-1 and R307-1-2 UAC	Outlines general requirements and provides definitions for Utah Air Conservation rules.	Yes/--	General requirements and definitions will be applicable for remediation strategies which include pollutant emissions.
Standards for the Control of Installations	R307-1-3 UAC	Establishes notification requirements, details operating limitations, requires implementation of Best Available Control Technology (BACT), and specifies criteria for NAAQS violations and Prevention of Significant Deterioration (PSD) review.	Yes/--	Notification and reviews for NAAQS violations and PSD will be required for remediation strategies which include pollutant emissions. NAAQS violations and PSD review are not expected due to the low emission rates.
National Emission Standards for Hazardous Air Pollutants (NESHAPs)	R307-10 UAC	Establishes NESHAPs for specific source categories.	Yes/--	Remediation systems that generate HAP emissions may be subject to these regulations.

Table A-6 (Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate	Documentation
Fugitive Dust Emissions	R307-12 UAC	Establishes limits of the amount of fugitive dust emissions.	Yes/--	Remedial action construction activities may result in the generation of fugitive dust emissions. These emissions are regulated by this rule.
Continuous Emission Monitoring System Requirements	R307-13 UAC	Establishes continuous emission monitoring system requirements for those air emission sources subject to this rule.	Yes/--	Remediation systems that have air emissions may be required to install continuous monitoring systems in accordance with this rule.
Ozone Attainment Area Standards for Davis County, Utah	R307-14 UAC	Establishes limits on emission that are precursors for the formation of ozone in Davis County, Utah. Davis County is a non attainment area for ozone and these regulations have been issued as part of the State Implementation Plan.	Yes/--	Remediation systems may have emissions that are subject to this regulation.
Utah Solid and Hazardous Waste Act - Title 19 UCA Chapter 6 Part 1				
Definitions and General Requirements for Solid and Hazardous Waste	R315-1 and R315-2 UAC	Outlines general requirements and provides definitions for Utah Solid and Hazardous Waste Regulations.	Yes/--	General requirements and definitions will be applicable for the management of solid and/or hazardous waste.
Hazardous Waste Manifest Requirements	R315-4 UAC	Details requirements for manifesting shipments of hazardous waste in the State.	Yes/--	All offsite shipments of hazardous waste will require manifests meeting State requirements.
Hazardous Waste Generator Requirements	R315-5 UAC	Outlines requirements for generators of hazardous waste.	Yes/--	Generator requirements will be applicable for all hazardous waste generated during remediation.
Hazardous Waste Transporter Requirements	R315-6 UAC	Outlines requirements for the transportation of hazardous waste.	Yes/--	Requirements will be applicable to remediation strategies which include offsite transportation of hazardous waste.

Table A-6 (Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate	Documentation
Standards for Thermal Treatment	R315-7-23 UAC	Establishes standards for other thermal treatment of hazardous wastes.	To-Be-Considered	If other thermal treatment is performed as part of the remediation, this unit will be designed and operated n accordance with the requirements of this subpart.
Standards for Chemical, Physical, and Biological Treatment	R315-7-24 UAC	Establishes standards for chemical, physical, or biological treatment of hazardous wastes that do not occur in tanks, surface impoundments, or waste piles.	To-Be-Considered	This regulation is to be considered for remedial activities including soil vapor extraction (SVE) and the Source Recovery System.
Security Standards for Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDFs)	R315-8-2.5 UAC	Outlines security requirements at active portions of a TSDF.	Yes/--	Establishes minimum requirements to prevent unauthorized access by persons or livestock into an active portion of a TSDF and describes other security procedures.
General Inspection Requirements	R315-8-2.6 UAC	Outlines inspection requirements at TSDFs.	Yes/--	Establishes the requirements that owners/operators of a TSDF inspect their facilities to minimize potential unplanned releases of hazardous waste constituents to the environment. This rule requires that an inspection schedule be developed.
Personnel Training	R315-8-2.7 UAC	Describes training requirements for TSDF staff.	Yes/--	Establishes facility personnel training requirements
General Requirements for Ignitable, Reactive, or Incompatible Waste	R315-8-2.8 UAC	Outlines requirements to prevent accidental ignition or reaction of ignitable or reactive wastes.	Yes/--	Establishes requirements for TSDFs to prevent storage, treatment, or disposal of incompatible hazardous waste that could result in accidental ignition or reaction of waste. Requires the TSDF to document compliance with this regulation.

Table A-6 (Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate	Documentation
Construction Quality Assurance Program	R315-8-2.10 UAC	Establishes the requirement for a Construction Quality Assurance Program for all landfill units including liners and final cover systems.	Yes/--	Remedial construction activities will require the preparation and implementation of a Construction Quality Assurance Program.
Preparedness and Prevention	R315-8-3 UAC	Outlines facility design requirements, required equipment. testing and maintenance of equipment, communication and alarm systems, aisle space requirements, and arrangements with local authorities in the event of an accidental release.	Yes/--	This rule will be applicable as hazardous waste storage and treatment will be part of remedial activities.
Contingency Plan and Emergency Procedures	R315-8-4 UAC	Outlines the requirements for development of contingency plans and establishment of emergency procedures.	Yes/--	This rule is applicable to remedial activities.
Manifest System, Recordkeeping, and Reporting	R315-8-5 UAC	Outlines procedures for manifesting, recordkeeping, and reporting at TSDFs.	Yes/--	This rule is applicable as hazardous waste will be generated during remedial activities. State counterpart of 40 CFR Part 264 Subpart E.
Groundwater Protection	R315-8-6 UAC	Describes groundwater monitoring requirements for TSDFs.	Yes/--	Applicable to remedial activities involving storage, treatment, and disposal at on-site facilities. State counterpart of 40 CFR Part 264 Subpart F.
Closure and Post Closure	R315-8-7 UAC	Establishes closure and post-closure performance standards and plan requirements for TSDFs	Yes/--	Applicable to remedial activities that involve on-site TSDFs. State counterpart to 40 CFR Part 264 Subpart G.
Standards for Use and Management of Containers	R315-8-9 UAC	Establishes standards for use and management of containers	Yes/--	Applicable to use and management of containers holding hazardous waste. State counterpart of 40 CFR Part 264 Subpart I.

Table A-6 (Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate	Documentation
Standards for Use and Management of Tanks	R315-8-10 UAC	Establishes standards for use and management of tanks containing hazardous waste.	Yes/--	This regulation will be applicable if remediation system require the use of tanks to treat or store hazardous waste. State counterpart of 40 CFR Part 264 Subpart J.
Landfills	R315-8-14 UAC	Establishes design, operation, and management requirements for disposal of hazardous materials in landfills.	No/Yes	Applicable to remedial activities that will involve capping of portions of the source area. State counterpart of 40 CFR Part 264 Subpart N.
Incinerators	R315-8-15 UAC	Establishes design, operation, and management requirements for incinerators.	No/Yes	Remediation strategy does not include onsite operation of an incinerator. Incinerator standards may be relevant and appropriate if low temperature thermal treatment of excavated soil is employed. State counterpart of 40 CFR Part 264 Subpart O.
Air Emissions Standards for Process Vents	R315-8-17 UAC	This regulation incorporates the requirements as found in 40 CFR Subpart AA Sections 264.1030 through 264.1036, 1990 ed.	Yes/--	This regulation is applicable for Source Recovery System and other treatment process that are part of remedial activities.
Air Emission Standards for Equipment Leaks	R315-8-18 UAC	This regulation incorporates the requirements as found in 40 CFR Subpart BB Sections 264.1050 through 264.1065, 1990 ed.,	Yes/--	This regulation is applicable for Source Recovery System and other treatment process that are part of remedial activities.
Corrective Action Management Unit (CAMU)	R315-8-21 UAC	Establishes requirements for designation of A CAMU and defines management practices.	Yes/--	Applicable to remedial activities in which treated soil is returned to the site of removal. Allows exemption to LDRs if clean-up goals are achieved. State counterpart of 40 CFR Part 264 Subpart S.
Chemical, Physical, and Biological Treatment	R315-7-24 UAC	Establishes design, operation, and maintenance requirements for chemical, physical, and biological treatment units.	To-Be-Considered	This regulation is to be considered for remedial activities including soil vapor extraction and the Source Recovery System.

Table A-6 (Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate	Documentation
Land Disposal Restrictions	R315-13 UAC	Outlines land disposal restrictions for hazardous waste. Utah incorporates Federal LDRs by reference	Yes/--	This regulation is applicable as hazardous waste will be generated during remediation activities.
Clean-up Action and Risk-Based Closure Standards	R315-101 UAC	This rule establishes risk-based closure and corrective action requirements.	Yes/--	This rule is applicable for remedial activities including site management, corrective action, and closure.
Underground Injection Control Standards	R317-7 UAC	Establishes regulations for the subsurface implement of fluids through an injection well	Yes/--	The UIC regulations would be applicable for remedial activities that involve injection of surfactants, steam injection, or soil flooding. State counterpart to 40 CFR Parts 144-147.
Corrective Action Clean-up Policy for CERCLA and Underground Storage Tank (UST) Sites	R311-211 UAC	This rule addresses clean-up requirements at CERCLA and UST sites.	Yes/--	Remediation strategy must achieve compliance with the policy. The policy sets forth criteria for establishing clean-up standards and requires source control or removal, and prevention of further degradation.
Utah Water Quality Act - Title 19 UCA Chapter 5				
Definitions and General Requirements	R317-1 UAC	Details definitions and general requirements for water quality in Utah.	Yes/--	General requirements and definitions will be applicable for remediation strategies including point source discharges.
Design Requirements for Wastewater Collection, Treatment, and Disposal Systems	R317-3 UAC	Outlines design requirements for the collection, treatment, and disposal of domestic wastewater.	No/Yes	Treatment of domestic wastewater will not be part of remediation strategies. Hydraulic design requirements may be relevant and appropriate.
Ground Water Quality Protection Rule	R317-6 UAC	Details standards, classes, protection levels, and implementation criteria for ground water protection. Also, outlines certain activities permitted by rule.	* (See Documentation Column for explanation)	*The Utah Ground Water Quality Protection Rule establishes numerical clean-up levels and other performance standards for contaminated ground water. Although no determination has been made concerning whether this rule is an applicable or relevant and appropriate standard at OU2, the remedy will meet the action-specific requirements of the rule.

Table A-6 (Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate	Documentation
Underground Injection Control Standards	R317-7 UAC	Establishes general requirements, definitions, permitting procedures, and operating standards. UIC standards adopt by reference the federal UIC regulations with the exception of a two-mile radius from the borehole instead of a one-quarter-mile radius from the borehole to an underground source of drinking water.	Yes/--	If soil flushing involves injection of treated ground water, UIC standards would be applicable
Utah Pollutant Discharge Elimination System Requirements	R317-8 UAC	Establishes general requirements, definitions, permitting procedures, and criteria/standards for technology-based treatment for point source discharges of wastewater. Also establishes pretreatment standards for discharge to a POTW.	Yes/--	If selected alternative involves a point source discharge of wastewater, UPDES requirements would be applicable. Pretreatment standards would be applicable if selected alternative involved discharge to a POTW.

OUR FILE NO. 44048-145 ~~ORIGINAL~~

COPY

PUBLIC MEETING
OPERABLE UNIT 2 PROPOSED PLAN

SOUTH WEBER ELEMENTARY SCHOOL
7:00 P.M.
MAY 25, 1994

Reported by SHIRLYN SHARPE, CSR, RPR, CM
Utah CSR License 67

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One Utah Center, Suite 900
201 South Main Street

* * * * *

Public Meeting of Residents of South Weber regarding Operable Unit 2, held on Wednesday, May 25, 1994, 7:00 p.m., at South Weber Elementary School, South Weber, Utah.

* * * * *

IN ATTENDANCE:

Colonel Steven Emory
Ms. Gwen Brewer
Mr. Rob Stites
Mr. Bob Elliott
Mr. Howard Saxion
Mr. Marc Aurelius
Ms. Diane Simmons
Mr. John Peterson
Mr. Chris Mikell
Mr. Chuck Neeley
Mr. Steve Godard
Mr. L. Richard Peek
Mr. Steve Brown
Other members of the public

P R O C E E D I N G S

* * * * ** *

MS. BREWER: I think we'll get started. You can all hear me can't you? My name is Gwen Brewer, Coordinator for Environmental Public Affairs at Hill Air Force Base. We welcome all of you to the public meeting this evening.

During the meeting, we will be discussing some things that to some of you may sound technical. If they go over your heads, let us know. We try to adjust our language so that everybody can understand, but sometimes I don't understand. Don't be afraid to say anything.

This meeting is for the record. You will notice that we do have a recorder. She will take down all of the proceedings for this meeting. That will be entered into our Administrative Record. Any comments or questions you have this evening will be addressed in a follow-up document. Once an alternative is decided upon, based on your input, we'll do a follow-up document and then you will know what alternative was selected.

We have a few rules this evening. Because of the way it is structured, we ask you to hold your questions or comments until after the presentations. In all of your packets, there is a sheet that you can write the comments on. You can either ask them this evening, or if you are bashful and don't want to ask anything this evening, you can leave it at the table in the back or you can mail it to us. Sometimes you don't think of anything until the meeting is over. It isn't over until the 11th of June. We'll be 19:09:00 taking comments until then. So, if you think of something afterwards, please let us know by a phone call or even send in that comment sheet.

The most important part of this meeting is to get feedback from you as to what method or how you would like the situation handled here. We'll give you several alternatives. We'll tell you the one that we prefer. We'll also tell you why it is the one that we prefer.

19:09:30 We have several things on the agenda this evening. First, we're going to start with Colonel Emory who will go through some other things with you.

COLONEL EMORY: First of all, I would like to introduce a few people. Myself, for starters. I'm the Air Base Group Commander at Hill Air Force Base. That is kind of like mayor of a small town we have out there.

I might as well introduce Pam Jones back there, 19:10:00 Councilwoman in South Weber, my counterpart in South Weber.

We have a lot of people that are working on this project with us. From the Environmental Protection Agency, we have Rob Stites. John Peterson from the Utah Department of Air Quality. Hal Dunning, an expert with the EPA that is part of the Gwen Brewer and Bob Elliot combination where we translate all of the vernacular that we have got and tell you what we're doing and why we are -- how we are going to get our sites cleaned up, what it looks like, what sort of a threat it is to you.

That is part of our purpose here this evening, to give you the current status of what we've got out there, how it got there, what the potential threat is to you, the community, and then what we're doing, what we're planning to do to clean that up, all of the official policy and procedures that go along with how we got there, show you some of the logic that we used -- that you helped us with, by the way -- some of the logic in determining the options that we kind of zeroed in, on and our primary plan that we'll recommend for cleaning up the problem.

This is a formal meeting, an official part of the process. You know, in the past, we came and talked to you to get interaction with you to see what is going on. Part of the unofficial is to keep you informed. This is for the record, as Gwen explained.

Bob Elliot runs the whole remediation program, if you would, for Hill Air Force Base. Operable Unit 2 and South Weber is one part of that operation. Our engineer for the site, Kyle Kirchner, will be the one that will spend most of the evening with you, speaking with you about what the recommendations are for the site.

Let me echo what Gwen talked to you about; that is, our primary purpose for laying this out is for all our experts out there that are in this business to review our process, get a head nod, make sure we have all our ducks in a row as far as pressing on further in this process, and to get your inputs on any sort of questions that you have, 19:12:30 recommendations that you've got, problems, all that sort of business, so that we can make sure we have got the community totally wrapped up in our game plan.

Without further ado, I think, Bob, you are kicking it off next.

MR. ELLIOT: I am Bob Elliot. Can everyone hear me okay? I want to take a couple of minutes to explain the 19:13:00 process. It looks like we will have enough light. We were a little concerned about that.

I wanted to explain the Superfund process, which is the process under which this particular project is being worked on. This process is called the -- or is regulated under the Comprehensive Environmental Response Compensation 19:13:30 Liability Act. That is a huge acronym for Superfund, and this is the process.

As many of you know, the process is a very long process. There has been a lot of frustration across the country about the length of this process and the amount of review. Let me just point out some of the key milestones here.

Initially, Hill Air Force Base was -- as we went down through this process and looked at and evaluated the site -- Hill Air Force Base being the site. We were listed on the National Priorities list, which is the Superfund list, if you will. That sort of kicked in the rest of this road to the Record of Decision, which is what we are working towards and asking for public comment on that decision.

We've been through extensive work here to look at investigating this site, trying to understand what contamination exists there, looking at the feasible alternatives associated with trying to clean up this site, and finally reaching a Proposed Plan. This Proposed Plan is the Air Force's proposal on how we would like to proceed in cleaning up the site. The Proposed Plan is where your public comment is so important, because we want to know what your feelings are and if there are any concerns about our proposal from your perspective.

From here, we will finalize the remedy in what is called the Record of Decision, which is a legal document requiring the Air Force to enact the proposal. And then, we go through a design phase, a remedial action phase or a construction phase. Then we'll operate that for a period of time until such time as we clean up the site. Then it will be delisted from the Superfund list.

It is important to recognize that this process will take a number of years to do the design work associated with the project. It is important to understand that the construction will take a number of years, and there will be a number of phases associated with the project that will be implemented.

19:16:00

I think people, in my discussions with them, have felt like we would come to a decision and we would go out and clean up the site and, in a year or two, the site would be cleaned up. These sites are very complex. It is important for you to understand that it is going to take a long time to clean up these sites. We want to be straightforward and make sure that you understand that this isn't a simple one or two year fix. It will take many years to clean up these sites.

19:16:30

The other thing I wanted to make sure you understand is that we feel we have gathered together a group of some of the finest engineers and scientists in the country, including our counterparts with the EPA and State Department of Environmental Quality, to review and evaluate the proposal and to work through this long process. But we are at a point in time where we -- we are wanting to make a decision.

19:17:00

We can't say that, in twenty years, that decision will be the best decision. It is important to understand

that this process does not end right here with the Record of
19:17:30 Decision. In five years, there will be a review done
associated with this site to evaluate its progress, and
maybe open it up to a new set of alternatives.

So, it is important to realize that the process is
going to go on and there will be additional opportunities
for changes and moving and flexing as we learn more about
how well these cleanup alternatives are going to work.

19:18:00 We have not drilled any holes and, you know, put
in any ground water treatment systems yet. When we do that,
we'll probably learn some new things and may need to make
some additional changes.

Again, as I mentioned, we are very interested in
your comments. It is important. We have been through a lot
of preparation for this meeting and it is hard for our
19:18:30 engineers, sometimes, to not talk engineering talk. So, if
you hear that, please raise your hand and ask a question so
that we can get the issues clarified. Thank you.

MR. KIRCHNER: My name is Kyle Kirchner and I have
19:19:00 been working on Operable Unit 2, what we are here to
discuss, for approximately the last year. Operable Unit 2
is located on the eastern part of the boundary, right here,
The Base boundary runs up to here, Davis-Weber Canal is
there, South Weber Drive is along here, 475 East is right
there, and we're now over at the school in this area.

Operable Unit 2 consists of two former disposal trenches. They were known as Chemical Pit 3, and they were unlined trenches that were dug in the soil and the waste solvents, which was a chemical used to degrease the landing gear on the aircraft, they were brought out here and disposed of in these trenches, the way solvent was disposed of and from 1967 to 1975. And the solvents consisted of trichloroethylene, or TCE as it might be referred to, tetrachloroethylene, PCE, trichloroethane, TCA, and some other solvents. It was estimated that between approximately ten and a hundred thousand gallons of waste solvents were disposed of in those trenches during that time period.

The waste solvents have now migrated down through the soils and pooled on a clay layer about 50 feet below the ground surface. The shallow groundwater in this area flows across the site and flows down to the out-Base area to the east. As it passes over the pools, it dissolves into the ground water, and that is why it gets carried over to the off-Base area.

There was a treatment plant that was built, constructed up here in this area. Its primary purpose was to extract the waste solvent. That started up in October '93 and, to date, we have pulled out about 30,000 gallons of waste solvent.

At Operable Unit 2, which consists of areas off-Base that was included in the investigation, as well as the trenches on base, we have identified three different ground water zones. One zone, the yellow, is called the shallow system. It carries those contaminants off in this direction, into this shallow system. There is another system over here that is separated by this knoll that we have called the hillside system. We haven't found any contamination in that system. Then the blue out here, the light blue is identified as the Weber River alluvial system. That is the upper portion of that deposit out there.

Then the next slide I'm going to show is a cross-section view, vertical view through the ground surface that basically runs in this direction. It gives you a look inside the ground as to how these systems are positioned. The shallow system right here, the trenches are located up here, and that has now settled down and pooled in what is represented here as a little triangle trough. Then the ground water flows off this way and carries that contamination in this shallow system about 30, 40 feet below the ground surface, off Base and down toward South Weber Drive.

The Davis-Weber Canal is located there and that is above the shallow ground water approximately 5 to 7 feet. So, the contamination from Hill Air Force Base does not migrate into the Davis-Weber Canal. Then again, the hillside system that we have shown is separated by that knoll, and any rainfall that falls, part goes this direction, the other part goes in that direction, for those three systems that we have. And then this is the shallow alluvial material of the Weber River.

19:23:30 Then, for clarification purposes of municipal water for South Weber, where they might be getting their drinking water, the wells -- the contamination that we are talking about with Operable Unit 2 is limited to the shallow ground water that flows right up along here. There is a couple hundred feet of clay that separates this water system from the deeper water, the Delta aquifer, which the city 19:24:00 drills their wells in. So, down here in South Weber, that is approximately 400 feet below the ground surface that this source of water comes from.

With this slide, I would like to show the extent of contamination we did find during the remedial investigations. This is the TCE, trichloroethylene, 19:24:30 constituent of waste solvent. It makes up 68% of that solvent. We have mapped that from the source area, where the pools of the solvent were, into the off-Base area that goes beneath the Davis-Weber Canal. This is a pond that is naturally occurring.

Then the contamination to the lighter colors is

lower and lower concentrations. This light green here would
19:25:00 be between 1 and 10 parts per billion and increases in
increments of -- or order of magnitude, this is 1 to 10 and
10 to a hundred.

As I mentioned, there were some other compounds
with the waste solvent. This is tetrachloroethylene, PCE,
19:25:30 that has migrated off Base but to a lesser extent. This is
basically down here, the canal, and South Weber Drive.

This is another compound that was found there.
Again, it shows that it is in less extent than the
trichloroethene, TCE. The TCE is what we use to identify
the full extent of the area that needs remediation.

19:26:00 Once we have identified the extent of the
contamination, you look at what risk that poses to us as
humans and people who live within that area. We found that,
under the current residential scenario -- which means that
the way we developed that was that we said the spring water
or shallow ground water was used to irrigate crops. Nobody
was drinking that. So, when you have one excess cancer risk
19:26:30 in a million people, that would be one in a million, I
guess, chance to get cancer or have excess risk. That's
considered -- less than that is nonsignificant.

As you can see the current conditions, we are --
in the average, everyday situation, we are at that level for
19:27:00 a child of 7, and then 3 in a million, slightly more. One

in 10,000 is where it is considered a significant risk that needs to be looked at. Then for the adults, they are below the one in one million.

However, what is driving the cleanup of the site is the future residential scenario. That would be, if somebody built a house in that pool area and drilled a well into the shallow ground water and used that well in their house for drinking, showers, cleaning the vegetables, everything, and you are exposed up to 70 years. Then you start adding risks that would be above the level here. That's what is driving us to do the cleanup is to restore that ground water so that it could be used for that situation.

UNIDENTIFIED VOICE: I have a question. Can you put the last one back up? People that are living in that area now, right in that section, what area are they? Are they current on the site?

MR. KIRCHNER: Current off site.

UNIDENTIFIED VOICE: Are they considered off site?

MR. KIRCHNER: I should clarify that. "On site" is on the Base and "off site" is everything outside of the Base. It is off site, meaning it is on Operable Unit 2 but off site. I guess the better thing would have been off-Base residential.

COLONEL EMORY: Did that answer your question?

UNIDENTIFIED VOICE: It did.

MR. KIRCHNER: So, this overhead shows the long-term noncancer-causing effects, such as skin rashes or liver problems, et cetera. Again, we look at the current off-site, off-Base residential scenario. For the children and in adults, that is below the indicated level of one.

19:29:30 Looking at the future, to again use the shallow water for drinking purposes, plunk it into your house, that would be above that and that is what we --

MR. PEEK: Richard Peek. How are these figures brought about? Is this some formula, some idea that 19:30:00 ratchets this all together? What is the chances of getting hit crossing the road? It is not a big deal unless you are the one that gets hit.

MR. KIRCHNER: There is a spreadsheet that puts it all together. You look at the contamination you have. A pathway, that would be ground water that you are drinking or spring that you come in contact with. All those things are put together.

MR. STITES: Type of chemical.

19:30:30 MR. KIRCHNER: All these things are looked at and how you are exposed and the length of time. It is a pretty complicated spreadsheet that takes into account breathing it, ingesting it, putting it on the vegetables. It is a complicated process.

We do have some people that could expand on that if you want that. But it is not -- this is what we think. There is a formula or a format to follow.

19:31:00 UNIDENTIFIED VOICE: (Inaudible)...exposure time and how you were exposed?

MR. STITES: There is a doctor in the Administrative Record that describes how this is arrived at, this assessment. It is about that thick. You know, if you want to see all of the actual equations and what we know about the toxicity or cancer-causing potential of some of these chemicals, you can look at this. This is literally a brief summary of all of that analysis that went into this.

19:31:30 COLONEL EMORY: This is the nationwide standard, the standard equations used to direct risk assessment.

MR. STITES: These are EPA methods of --

COLONEL EMORY: They are from the samplings that have been taken at the site. It is from the EPA approved process for sampling the amount of this material that is on 19:32:00 site, and then applied to these equations so we have the standard processes for determining the site-specific risk associated with it.

MR. KIRCHNER: Did you have a question?

MS. ODEKIRK: Jenny Odekirk. I had a question on the hazard index where is says "0.10 regulates potential for 19:32:30 human health." My question on that was, what kind of potential is that? Is that one in a million, one in two thousand, or is it determined by what type of chemical you're talking about?

MR. STITES: We are talking about a different kind of effect when we are talking about noncancer-causing effects. Like a skin rash or liver disease or potential for mutation, something like that. And this 1.0, what this 19:33:00 number is is the ratio of the concentrations which you would be exposed to over the number that represents the lowest observed effect level.

In other words, if we had a set of test animals that we increased dose on, found the level on which that first effect occurred, that would be that number, that lowest. Below that, we say we have never seen any effect. 19:33:30 Then there is a factor of safety put in there, and then it is extrapolated to humans.

Have I answered it or muddled it?

MS. ODEKIRK: I'll think on it.

MR. KIRCHNER: Okay. Again, the future scenario is what is driving us towards the cleanup. We have developed a number of alternatives that address the source 19:34:00 area, the on-Base area and the non-source area and the off-Base area.

Each alternative was evaluated against the nine criteria identified by EPA. The first one addresses whether

19:34:30 the remedy provides adequate protection and how risks posed through each pathway are eliminated, reduced or controlled. The second addresses whether the remedy will meet all federal and state environmental laws. These two criteria must be met before you can move on and be considered by the primary balancing criteria.

The balancing criteria, they form the basis for comparison, allowing trade-offs among the alternatives. You know, require different degrees of performance. You can do 19:35:00 something that maybe assures a slight more margin of reduction in massive contaminant, yet it costs a hundred times more. So then you run that through and look at how that affects the protection of human health.

The third one referred to ability of a remedy to provide reliable protection of human health over time.

The fourth one refers to a preference for a remedy that reduces health hazards and contaminants, movement of 19:35:30 the contaminant, or the quantity of contaminant through treatment processes.

The fifth one addresses the period of time to complete a remedy and any adverse effects on the human health or environment during the construction or implementation of the remedy.

"Implementability" refers to the technical and administrative feasibility of an alternative remedy. This includes the availability of materials and services needed to carry out that remedy. It also includes coordination of 19:36:00 federal, state and local government efforts.

And "Cost" evaluates the estimated capital, operation and maintenance costs, and each alternative in comparison to the other equally protected alternatives.

Then the modifying criteria, what we're hoping from the community, is whether they support the technical 19:36:30 effort to restore the site, and also the state's acceptance.

So then, for the source area and the on-Base area, there were twelve alternatives that were compiled that would address the contamination in that area. Going through the nine criteria, five of them were selected for detailed 19:37:00 evaluation.

The first alternative of "No Action," that is just monitoring of the site. That is included in the process by law. We have to consider that one. So essentially, we have four active alternatives to restore the ground water and the soil in that area; that is, 4, 5, 11 and 12.

Then in the non-source area, the off-Base area, 19:37:30 there were seven alternatives developed. They were screened through the same nine criteria. Four of them passed the screening. And again, there is a "No Action" alternative that is carried through, and that is by law. So then, we have alternatives 3, 7 and 5. I will be addressing the source area ones first.

19:38:00 Source area alternatives would include a number of ground water extraction wells. That would be to lower the ground water in this area down towards that clay layer that is 50 feet below the ground surface. We would have extraction wells placed around here that would vent vapor, and we would have injection wells that would inject steam 19:38:30 down into the former pools, contamination of waste solvents. That steam would migrate and volitilize these compounds and move them to the extraction wells which would pull that vapor out of the ground. It would also include monitoring of the ground water that was described in the earlier alternative, or No Action.

No Action would have ground water monitoring to see what the extent of that contamination was, what it was 19:39:00 drawing or producing. That would be taken to the treatment plan that is there, the Source Recovery System. That would be treated and then it would be pumped over to the industrial treatment plant on Base and it gets further treatment and is taken off to the North Davis sewer.

Alternative 5 consists of everything that was in 19:39:30 Alternative 4, the steam injection, steam cleaning wells with the vapor extraction wells, the dewatering wells here. However, it would also include a trench, or another method

is to construct a vertical wall that is tied down into that clay layer. So, if we have these pools here, we would install a wall to the material down into this ground water
19:40:00 to prevent any migration down over the hillside from the Base. That's what this wall would do. It would limit that migration.

Alternative 12 again consists of -- I'm sorry. Alternative 12 consists of a completely encircling wall. We
19:40:30 would put that wall completely around those waste solvent pools. They would be tied down into the clay layer. It would prevent any ground water from entering this area and also prevent any contamination from leaving the area.

Where the former trenches were, this area would be excavated down to 20 feet below the ground surface. It would be treated on site and backfilled. There is potential for some minerals associated with those pits and they would
19:41:00 be solidified and placed back in place.

Instead of injecting steam into these areas where the pools used to be and extracting them as vapors as it swept toward the extraction wells, we would have injection wells of water and we would flush water through here and extract them out at these other wells. So, it would be like
19:41:30 a washing -- aggressive washing type of process.

Finally, for the source area, Alternative 11, this is the one that is preferred by Hill Air Force Base. It

19:42:00 consists of a completely encircling wall. That would be the trench that is dug down into that clay layer and a mixture of clay would be installed, or we could use steel sheet piles that could be driven from the land surface down into that clay. In this alternative, it would again consider the steam injection or steam cleaning-type process to get at those waste solvents that remain behind. It would also dewater that area through the wells that we have in place. But in addition, we would place a cap across the area that is completely encircled. It would be a clay cap or a 19:42:30 texture -- fiber texture-type of cap, geomembrane cap. That would limit any human exposure to these soils that are in those areas of the trenches.

The reasons for selection of the Alternative 11 or why we would prefer that, it totally encircles, while 19:43:00 alternatives 4 and 5, the ones I showed earlier, do not completely contain the waste in a passive manner. That would mean, power failure of the pumps or anything like that that would happen, we would lose control of that site. The ground water would migrate. Where, if you have a completely encircled area, we eliminate that type of contamination. It eliminates more TCE than the other alternatives. It does 19:43:30 not include any excavation of the soil with the potential of releases into the air, dust generation from that alternative, which would be carried elsewhere.

And as far as the cost, all alternatives were comparable.

In summary, we feel it is most effective for human health and environment; that is, the source area and on-Base 19:44:00 area.

In the off-Base area, the non-source area, we have three alternatives that were carried through that are considered active or aggressive in cleaning this up. The blue that I've outlined is that extent of the contamination I showed you with the one side of the TCE. The Alternative 3 would involve installing a number of what is 19:44:30 known as air sparging wells, which would inject or blow air down into the ground water. This would be constructed into the ground water. Then you would have a row of soil vapor extraction wells, wells that you draw vacuum on and suck the vapor out of the soil material. As the air is bubbled into the ground water, contaminants are in those air bubbles and 19:45:00 brought to the surface and extracted through the vapor removal wells. It consists of a number of rows with quite a few wells that are located along each row.

Then, Alternative 7 for the non-source area, it includes the air sparging wells that I described, in the center portion of the plume. However, at the north end, 19:45:30 over toward the east, we would install a normal well that pumps the ground water out. That would capture the

19:46:00 19:46:30 19:47:00 19:47:30

contamination in these areas and limit any further migration of that contamination. We also have a trench that we would install up near here that is at a spring that has some high concentrations. We currently have a shed there where we're treating it now.

Then lastly for the non-source area, this is the alternative that is preferred by Hill Air Force Base. It would involve using only wells to capture the contamination in the off-Base area. At this time, they are shown on the map, nine wells that later will be defined during the design phase, the exact number of wells and the positioning of these wells.

We felt that this technology, extracting the ground water through the wells, is most reliable. The air sparging, there is some debate about its effectiveness. This has a slightly less impact on the land surface or on the land that those would be installed in.

Then, the reasons that we do prefer that, I touched on a few of them, but as far as it removes and destroys the most contaminants, the air sparging does not include treatment of that air for air emissions. I guess, by "remove and destroy," we mean remove from the ground water and actually destroy it at some point. That air, by the air sparging, would be captured and taken off site or off the non-source area, the off-Base area. But those would be vented to the atmosphere. Much less intrusive to the property owners, the equipment that would need to be installed. Then, there is some question about the technology of air sparging.

The costs were relatively the same. And again, we feel like this is the most protective of human health and environment than the alternatives.

So, in summary, of all the alternatives that were considered, the costs that are shown here represent the amount of money that you would have to put in the bank today or the day we begin to construct these alternatives. The ones highlighted in green are the ones that we prefer. You can see the cost range in the source area is between 19 and 24 million dollars, and in the non-source area, it is between 11 and 17 -- 18 million dollars.

So, with that, I would open it up for questions.

MS. PETERSEN: Iris Petersen. I'm wondering, we are in that area where it is leaking down into our area. How much worse is it going to get as you are doing this? Is it going to continue to migrate down and be worse as you are fixing it, for years to come?

MR. KIRCHNER: I guess, to address the first question, I think this is the field that we're talking about?

MS. PETERSEN: Yes, right across the road.

MR. KIRCHNER: This is, I think, the other part of the property?

MS. PETERSEN: That's in our field.

19:49:30 MR. KIRCHNER: Right. Once we begin implementation of these actions, we'll actually be drawing this contamination back towards the heart or towards the higher level of contamination, back towards the source. Once these actions are in place, it is not going to spread any farther. We'll be monitoring that to evaluate that. That's our primary objective, is to limit the spread of this contamination and get this out of the soil to reduce any 19:50:00 more exposure to what is already there.

MS. PETERSEN: And how many years do you think it will be before you actually implement?

MR. KIRCHNER: To actually implement this, we are looking for the -- on the alternatives tonight, we are looking for the approval and to move forward. Then we will prepare what is called a Record of Decision. That is where Hill Air Force Base signs a contract, basically, with the EPA and the state on which method is acceptable, the chosen alternative. We have 15 months, by law, that we have to be 19:50:30 out implementing a remedial action, the technology to clean that up. So, that would be December '95 we would be in the field. Then we have a couple of months -- well, more than a couple of months. Probably six months to two years to construct the alternatives, depending on what they are, to drill the wells, connect the piping and run it up to Hill Air Force Base.

19:51:00 MR. ELLIOTT: Well, it is important to realize that December is in the middle of the winter, and we'll start what we can, but heavy construction really wouldn't be able to start until the following spring because of the snow and weather conditions. We will have some limitations on when we get started.

MS. PETERSEN: You know, we're talking about the future. What about back when we were using water to water 19:51:30 our lawns and different things? Is the danger there higher than it was -- than it is now?

MR. KIRCHNER: Well, the danger, I guess, so to speak, is growing each day. I mean, every day that we don't do something, that ground water carries the contamination farther. So, if we go back in time, this would get smaller and smaller.

So, you know, I'm just taking a guess here, but 19:52:00 five years ago or whatever, this darker green may have been where this lighter green is now. Or ten years ago, I don't know exactly what that would be. You know, it is getting worse by the day, so to speak, but it is not what I would say, you know, is -- it is not going to migrate and be under your house and be six miles away and you will be in the worst part of it. This is moving very, very slow. It is not posing any health hazards to people living there.

MR. ELLIOT: Bob Elliot again. How many feet a year or a day would you estimate this is moving?

MR. KIRCHNER: We have limited data to get a precise number on that. We have a year's worth of sampling data that shows, in this area at one point, we do have some contamination by this well here, and then it moves back. With grade fall patterns and absorption of these chemicals into the soils, the outer trenches of this plume is maybe, if we want to put a number on it, five feet in a year or something like that.

MR. ELLIOTT: That was the point I was trying to make. It is moving in feet per year, feet per month. It is not moving in miles per day or anything. It is moving fairly slowly. I think that can be represented by the fact of how long those solvents have been there and the amount of time it has taken for them to move as far as they have. So, that gives you some framework to understand how fast that might be moving.

MR. KIRCHNER: It has taken 1967 to -- 1967 to 1975 is when those chemicals were disposed of. So, we have twenty years to get to this condition.

MS. JONES: Pam Jones. I'm not sure I understand. Are you saying it was worse five years ago or

19:54:30 worse now?

MR. KIRCHNER: It was -- it is worse now than it was five years ago.

COLONEL EMORY: The reason for that is that it has moved from on Base to off Base in the last twenty years. When we say it is worse, what we're talking about is that the concentration we have is gradually creeping along. From that standpoint, it is worse.

MR. JONES: What this lady was saying before, when she was watering and using that for her vegetable gardens five or ten years ago, she is at more risk now than she was four years ago?

19:55:00 MR. RAY: Ivan Ray. How many off-Base operable sampling units do you have at this present time, approximately?

MR. KIRCHNER: Off-Base areas that have contamination?

MR. RAY: That you are doing the sampling.

UNIDENTIFIED VOICE: Wells.

MR. KIRCHNER: We have a number of Operable Units, we are calling them. We have -- this is No. 2. We have 1 through 8.

MR. RAY: You have eight sites?

19:55:30 COLONEL EMORY: You are talking about in this particular --

MR. RAY: No, totally, along the whole spectrum of the cleanup process, not just those two.

MR. STITES: We have eight defined to date.

MR. KIRCHNER: The number of wells that that involves, I don't know. I know that we currently sample 19 wells associated with this, and ten springs, if they are flowing or wet or if they have water there. So, we have 29 sampling points associated with this operable unit that we sample four times a year and take water level measurements out of the wells on a monthly basis.

MR. RAY: Ivan Ray again. Is there -- has there been any determination to detect where the water sources in the aquifer 40 feet under that you are talking about, 40 to 50 feet, where those sources are that is moving the contaminants? If so, has it been determined, can anything be done?

MR. KIRCHNER: I can address Operable Unit 2. That is what I'm managing and what I know. The Base -- this here is the Air Force Base property. As we know, it is all on top of the Delta River formation, so it is kind of a high point in the area. In this area, you get precipitation that lands in the vicinity of that Operable Unit 2. So, any precipitation that falls in this area infiltrates down through the ground and pools or, you know, hits an impermeable layer and forms the water table.

So, in this area, there is a topography that controls, and so it takes the rain that has fallen on the east side of the runway, and that's what creates that shallow ground water. Then it moves off-Base.

MR. STITES: Were you asking about the source of 19:58:00 the ground water or the source of the contaminants?

MR. RAY: No, the source of the water that is moving the contaminants. And about how much volume of water are we looking at? Is there any determination of that?

MR. KIRCHNER: No, I don't know.

MR. SMITH: Phil Smith. You estimated the flow rate that we would need to extract out, which is roughly the same amount of water that would be pushing this, 200 gallons a minute for the whole extraction system?

19:58:30 MR. KIRCHNER: For the whole site?

MR. SMITH: For the whole site.

MR. COOPER: Louis Cooper, Davis County Department of Health. What is the level of competence on that clay layer that you discussed, on your slurry wall and cap? It has been a long time ago, and maybe Bob remembers, but Operable Unit 1, where they put a slurry wall and cap in, 19:59:00 initially that was thought it would control most of the off-Base migration. Due to the resistivity testing, they were relatively confident that they had a clay layer in the same level that you are talking about. To my knowledge, 19:59:30 they had some upward migration that continued to move it off site. They picked up galleries (sp) to collect it and take it and treat it. Is this site different? What is your level of confidence on that clay layer and your upward migration of the deeper water under that shallow pool?

MR. KIRCHNER: That clay layer is several hundred feet thick. We have sort of different contaminations. Bob can probably address what happened at Operable Unit 1. He is more familiar with that than I am.

20:00:00 At this site, though, we're not looking -- this clay layer has held. We have actually held that waste solvent there for 20 years or more. So, as far as that going down any farther, we are pretty confident there. Looking at the horizontal movement, that moving off-Base, we're looking at a number of different technologies.

20:00:30 What was used at Operable Unit 1 was where they dug the trench and backfilled that with a clay mixture to form a less permeable wall. We are also looking at steel sheet piles. That's where you have like a 60-foot long piece of metal that is Z-chained and has interlocking grooves on it. You would connect those one-by-one, drive that down, connect the next one, and you would seal that joint where those interlock.

There is ways to construct that containment wall that is a little different than digging the trench and using a mixture of clay and native material. There is other methods where there is big augers that can drill down, and 20:01:00 as you drill and move those augers back and forth through the soil material, you can inject clay or soil mixture and get a good consistent integrity wall. There are things at Operable Unit 1 that are unique and different from this.

MR. ELLIOT: Bob Elliot. Let me explain. In the 1985 and '86 time frame when we constructed that wall, we constructed that in a response action, recognizing that 20:01:30 there was contamination coming out of -- coming out into some springs along the hillside. When the wall was constructed, we had somewhat limited geologic data at the time that was constructed.

But the primary thing we think that caused problems associated with that wall was, the contractor who 20:02:00 was constructing that wall, we had a hundred percent inspection of that wall for the entire period of the project except for one week when the inspector was on vacation. As we went back and looked at the boring log or the logging of that wall, the depth, his logs, what we call "straight lined." There was no more -- we no longer saw him following the contour of the clays to tie into those clays. So, we 20:02:30 feel that the primary reason that wall isn't as effective as it could have been was because the contractor didn't actually dig it down into the clays.

Kyle is talking about, with Operable Unit 2, going into the clays a number of feet to insure that it is tied down into the clay. There are some sand lenses that exist in those clays. We have much stronger geologic information, bore holes that have been drilled down into the clays to understand what they look like and what the potential is for water to go around and short-circuit underneath those walls.

20:03:00

Even if it did, that's okay. There is nothing wrong with that, because with this proposal, the water would simply be extracted from inside of that wall and treated.

MR. RAY: Ivan Ray. Approximately, on Base, through the years, how many disposal sites were there? Do we know about how many there were?

20:03:30

MR. KIRCHNER: There are a number of disposal sites. Operable Unit 2 just happens to have one set, Chemical Pit 3, that consisted of two trenches. Operable Unit 1 --

MR. ELLIOT: Six sites.

MR. KIRCHNER: Two or three landfills, a fire training area, a waste phenol-type of oil.

20:04:00

MR. ELLIOTT: Operable Unit 1, there are two landfills, two chemical disposal pits, two fire training areas and one waste phenol oil pit.

MR. KIRCHNER: Then here we have Operable Unit 4 that is a landfill. Operable Unit 3, I think is some stormwater ponds that have been backfilled. So, I don't --

20:04:30 MR. RAY: It would be around 10?

MR. STITES: More than that. As a rough order of magnitude, I would say dozens --

MR. KIRCHNER: Those are individual --

THE REPORTER: One at a time, please.

MR. RAY: Sorry about all these questions, but in 20:05:00 effect, if there is a base closure, what effect would this have on the program as it is thus in place now, or would it be dissolved, or has the government provided something to finish taking care of the situation if that takes place?

MR. KIRCHNER: If the Base closure happens, before that property can be turned over to private industry or the public, each site would have to be remediated before that property can be turned over. So then, I guess we're talking 20:05:30 about a matter of how quickly or how aggressive do you want to do it to meet that criteria, based on the committee that evaluates that. I think that would --

MR. ELLIOTT: Bob Elliot again. The money associated with this program is no different than the Superfund which provides money for private sector sites. This funding, however, was set aside by Congress for defense 20:06:00 sites. The funding will continue to be there as long as Congress continues to pay for the program.

MS. ODEKIRK: How deep were these trenches, and were they just earthen trenches or were they lined?

MR. KIRCHNER: They were unlined, just dug into the ground, probably about ten feet deep, just in the shallow soils. The solvent that was collected, after they degreased and cleaned the landing gear parts, was collected in drums and taken out there and disposed of in those trenches. Those trenches were above this clay layer we are talking about. They were 10, 15 feet at the most.

MS. ODEKIRK: The trenches were 10 or 15 feet deep?

MR. KIRCHNER: Right.

MS. ODEKIRK: The contaminants were stored in barrels?

MR. KIRCHNER: They were actually emptied into those trenches, transported in barrels. That was -- at the time, that was the accepted disposal practice. It wasn't midnight dumping.

COLONEL EMORY: Just like people used to drain their oil pumps in the cars, drain them in the back yard in the grass. That wasn't the mentality where people get interested in the ground water.

MS. ODEKIRK: It was stated there was between ten and a hundred thousand gallons of contamination?

MR. KIRCHNER: Yes.

MS. ODEKIRK: How come that is such a wide scale?

MR. KIRCHNER: Because there was nobody at these trenches to keep a log to say so-and-so brought a 50-gallon drum and disposed of it this day. What we had to do was go back and go through the use of that solvent and say, if they cleaned this many airplanes over this period of time -- we tried to estimate how much did they recycle, catch and try to reuse. The hundred thousand would be if they sprayed the parts and ran it into the collection drum, and the ten thousand is if they sprayed the part down, and it wasn't that dirty, so the solvent could be reused. We don't really have any record of what was taken to these trenches to be emptied.

You know, based on earlier comments I said, from the system we had on site that started operating in October, we pulled out 30,000 gallons. We have learned a lot. We know it is more than ten thousand. It has to be more than 30,000. We are probably in the upper range of fifty to a hundred thousand gallons. What we pull out is only going to be a fraction of what remains there. The chemical absorbs in the soil. So, when you pump, it doesn't come out immediately. So, you know, 30,000 is a percentage of what's there.

MS. ODEKIRK: You are saying, what you pull out is only going to be a fraction. What you pull out in long-term?

MR. KIRCHNER: With the system we have today. These actions address the whole part of the contamination. You know, at this site, remediating TCE out of the soils, there is no proven technology to meet what is considered the maximum contaminant level for drinking water, the MCL of 20:09:30 five parts per billion. There is no technology out there that can do that in a short period of time. We are putting forth the best knowledge that we have today. And you know, five years from now, we may come up with a better technology that can go in and get that stuff like that, in a year's time.

For the source area, we are looking at thirty years to clean that up. That level is probably thirty-plus years. In the nonsource area down in the fields, we are 20:10:00 talking about -- we have developed those alternatives, but a 15-year period for remediation.

MR. STITES: I would like to interject something here along the same lines. EPA's experience with this kind of contamination, that we refer to as a DNAPL, is that it is very difficult to extract or remediate. In fact, in many cases, it cannot be fully cleaned up. In those cases, 20:10:30 sometimes the best we can do is some sort of containment around it and to try to prevent exposure, minimize the ability of the contaminants to move and affect anybody else.

If that does turn out to be the case here -- I mean, the Air Force is proposing technologies to go after this as aggressively as possible with what we know now. But I also think it is only fair to get it out there that, even with all of that, the aggressive attempts, we may not be that fully successful. If that's the case, we may not be able to clean up to the ground water drinking water standards in that immediate source area. That would not apply to anything off Base, but strictly in that source area on Base.

MS. BON: Peggy Bon. I'm a relatively new resident of South Weber, so I've got a lot to learn. Operable Unit 2, that implies there are others. We have heard about Operable Unit 1. Where are the other units? How many are there and where are they and what problems do they have?

MR. KIRCHNER: This identifies all of the Operable Units that we have. I'm the project manager of Operable Unit 2, so I don't know all of the specifics of every other one. But at least this will give you an idea where they are located. I guess Operable Unit 4 -- let's see. Davis-Weber County line, I think runs right in this area. Bob, is --

MR. ELLIOTT: Let me help you out here. We have had him focus so much on Operable Unit 2, he hasn't had a chance to be involved in the others.

Operable Unit 4, the Riverdale City/South Weber City line runs right through that area. So, it is essentially split into two cities, if you will, city boundaries.

Operable Unit 1 up here is in the City of South Weber. Operable Unit 2 is in South Weber. Operable Unit 6 is also in the city of Riverdale. Operable Unit 5 is in the city of Sunset. Operable Unit 3 -- excuse me, Operable Unit 8 moves off Base into the city of Layton. The rest of the Operable Units, 7 and 3, are on-Base areas. The soil contamination --

20:13:00

20:13:30

MS. BON: What does that mean? Does that mean they found problems in those places?

MR. ELLIOTT: We have found ground water contamination in the shallow drinking water -- excuse me, shallow nondrinking water aquifer that is maybe 10 to 40 feet deep in areas surrounding the Base. Many of those are adjacent to disposal areas. Some are adjacent to places where operations were conducted, where solvents were spilled on the ground associated with those.

20:14:00

MS. BON: Were those part of this cleanup?

MR. ELLIOTT: Yes, we have an extensive schedule with the EPA. We have an agreement with EPA and the State Department of Environmental Quality to address each one of these sites. They are all tracking on a different schedule than Operable Unit 2. Operable Unit 4 has already -- is 20:14:30 currently -- they are currently signing the Record of Decision for that. It is at EPA. That public meeting was held last year.

Operable Unit 2 is next on the list. So, there is all of these sites tracking on a different schedule. That has been a function of how much -- or when we found the sites or found the contamination, I should say, and how fast we have been able to investigate it.

MS. BON: Thank you.

20:15:00 COLONEL EMORY: We have meetings on a regular basis out at Hill Air Force Base with people throughout the community, but primarily all of the agencies involved in this remediation effort -- EPA, Water Conservancy Districts, all that sort of business -- on a quarterly basis where we brief all of these simultaneously, current status and so forth.

MR. ELLIOTT: We also meet with each of the city councils on a semiannual basis and brief them on our 20:15:30 progress and what we are doing. You could contact your City Council, or if you are interested in meeting with us --

MS. BON: I only knew about this meeting because I happened to buy a paper one day when it happened to be in the newspaper. How do you know these things are happening?

20:16:00 MR. STITES: Rob Stites. You can get placed on the mailing list and you would have been mailed a copy of the Proposed Plan. Also, you would be getting copies of our fact sheets and news updates that Hill puts out as it comes out.

MR. ELLIOTT: If they have signed up back here, won't they automatically be put on the mailing list?

MS. BREWER: Right.

MR. ELLIOTT: If you sign up and put your name on the list at the back, you will be put on the mailing list.

MR. KIRCHNER: What we did for this Operable Unit is, we tried to identify the people that lived in the vicinity the best we could.

20:16:30 MS. JONES: It is on our agenda. It is posted at our meetings in the City Office.

20:17:00 MR. ELLIOTT: Let me also make sure that we -- we have answered a lot of questions, and that is terrific that the people have these questions. I think it is important that this is also a forum where you can voice concerns or make a public comment, and then it will go into the record. If you don't want to write a written comment, this is a forum where it goes into the permanent record associated with this site.

I want to make sure -- I don't want to get lost in answering questions. I want to make sure that, if you have concerns associated with this project, that you realize that this will, if you do make a statement here, go into the public record.

20:17:30 MR. PEEK: Question for Mr. Elliot. Last year when we had this other meeting, I gave you my name and address to have some ground water that was coming off the hill tested, and I have not been contacted at any point. You mentioned that you would get with us and test this water, because -- and that brings up another question about the Weber-Davis Canal. How can they say that this does not

20:18:00 contribute to the ground water problem unless you have gone up and inspected that canal when it is empty? This spring runs very well when that canal is full. When it is down, it tends to dry up.

MR. KIRCHNER: When I mentioned earlier that it didn't contribute to the problem, the contamination does not go into the canal. However, the canal, as all concrete canals that age and the type of construction, they leak.

20:18:30 The canal, by leaking, actually spreads that contamination farther.

MR. PEEK: That makes better --

MR. KIRCHNER: The canal doesn't impact our contamination.

MR. PEEK: The other way around.

MR. ELLIOTT: Let me address the first question.

I apologize for that, if we haven't taken care of that. If you get together with me, we will take care of that sampling you want.

MR. PEEK: They mentioned the plume was going more westward toward Darren Cutler's home. I'm from Operable Unit 4. They mentioned that it was going more that way.

20:19:00 But just to be safe, because the state has piped that ground water and it runs over into our agricultural drain across the road. So now, we are being exposed to that. If there is not a problem, great.

MR. ELLIOTT: We would very much like to do that, because that is our goal is to make sure we understand where all this ground water is going. We want to control that.

20:19:30 We'll get out there and take care of it.

MR. PEEK: Thank you.

COLONEL EMORY: Make sure you put that on the sheet that you have, your name, number, location and your concern, so we can get this to hang onto to track.

MR. RAY: Ivan Ray. One more question and I'll shut up. According to the study I read, CHM Hill, 21 December 93 -- I know many of the people here are affiliated with that. It cited that there were both upper and lower

20:20:00 hill sliding, and that there were wet spots on the hill. And in lieu of the fact that there has been on-site inspections on the surface of the hill movements, yellow green sludge and odors and, I'm sure, chemicals, both above the Davis-Weber Canal and below the Davis-Weber Canal above the Bamberg Irrigation Company canal, what effect is this hill movement and sliding having on the 40 or 50 foot aquifer underneath? Is it possible that aquifer is leaching some of it out both above and below the canals as the result of the hill movement? Is there any studies? I know, in the report, there is going to be some testing, drilling of, I guess, test holes 150 feet into the hillside. I don't know. That was proposed, but I don't know where it went.

20:20:30

MR. KIRCHNER: I think the area that we're talking about is outside Operable Unit 2. I think that is more to the southeast, closer to the hill cut, probably down in this area here. So, I don't know all the answers to that.

20:21:00

At Operable Unit 2, we did drill a several-hundred-foot boring down into the clays. We installed what is called an inclinometer. That is a pipe with grooves on it. It is almost like a compass, a gyroscope, so you can tell if that hillside is moving. This summer, this spring, we installed one of those inclinometers at Operable Unit 2. I think that is outside of the area that you're talking about. I don't know.

20:21:30

MR. RAY: There is no updated information on that?

COLONEL EMORY: How about going ahead and putting that question down as a matter of record on there and then our experts working in the other Operable Unit can give you the detailed answer.

MR. RAY: I appreciate that.

MR. ELLIOTT: I might just mention, because it was 20:22:00 mentioned about the Davis-Weber Canal, the goal is to reline the canal. They are putting drains underneath that to catch and collect and divert the water to central areas. However, in the winter months, water comes in off the hillside, off UDOT state road, goes into the canal, breaks under the concrete in the bottom. There is a problem of surface water 20:22:30 coming into the canal that has broken the floor of the canal. There is -- they are all working on that and there is cooperation with Hill Air Force Base on some stretches that we have been working on.

MR. KIRCHNER: Yeah, we'll work on -- in the areas that have contamination, we will be glad to work jointly with collecting that. That helps everybody. If we can contribute this to collect contaminated ground water for our purposes and meet your purposes, it is all the better.

20:23:00 I thank you for participating in the public meeting. Again, the comment period is open until June 11th. So, if you can think of anything else, please submit those. You can call me, write me. I think my name is on the Proposed Plan. Also, Rob Stites, EPA, and --

20:23:30 MR. COY: My name is Lynn Coy. What effect does this have on vegetation or livestock and food consumption in those areas? Has testing been done to see if that is safe for consumption, or is it something we should discontinue, and can it continue to be used for agricultural purposes?

MR. KIRCHNER: When I showed that risk table that shows the current use, vegetative uptake was considered in 20:24:00 those scenarios or pathways for that. Under the current situation at Operable Unit 2, since we are not spraying any shallow ground water up on those crops at this point, there is no reason to be concerned.

MR. COY: What system -- do those crops or food sources bring those contaminants to the surface in the vegetation?

20:24:30 MR. ELLIOTT: Bob Elliot. The agricultural community, in conjunction with the environmental engineering community and environmental science community, has looked a lot at that whole process. Because the chemicals that Kyle is talking about are volatile, they tend to evaporate very easily. They are kind of like gasoline. If you were to put them in a pan and came back in the afternoon, it would be 20:25:00 gone. They evaporate very quickly. If you were to spray that water on something, those chemicals just evaporate into the air. So, that's not a problem.

From pulling the ground water out of the ground, 20:25:30 the scientific community, because of the type and nature of the chemical, does not see that as being a concern. These are not the types of chemicals that the plants take up into their system and then are accumulated in the plants.

MR. COY: So, you are saying that it is safe to continue to use that for agricultural use for both human consumption and animal consumption?

MR. ELLIOTT: I think the key would be -- I guess I'm not sure that there would be a problem with you growing 20:26:00 alfalfa and feeding it to a cow. There is no indication that there would be uptake. In vegetables, we don't think there is any uptake either. The problem is, there is no real good data out there to say, look, we've looked at this and it doesn't occur. But the scientific theories say that it won't occur. We can't say, here is a study and it says it won't happen. We are currently working on doing a study 20:26:30 like that to demonstrate that.

I guess I was hedging because I think, if we wait for six to nine months, we'll have some information and we can definitively come out and say this isn't a problem. But the scientific community has sort of said it is not a problem because of the type of chemical. But that doesn't help you, because there is no real data out there to say it doesn't happen.

COLONEL EMORY: I think we've actually done tests on fruits and vegetables at one or more of our Operable Units, right? And it essentially revealed only trace levels, if -- in fact, I don't even know if those showed up.

MR. ELLIOTT: We didn't even see trace levels.

COLONEL EMORY: It isn't just all out of a book. We have actually analyzed the vegetation stuff. We have been in actual Operable Units like that. I don't know if we have done it on Operable Unit 2, but we have conducted some tests and we haven't found anything, yet, in fruits and vegetables.

MR. COY: Are you recommending I can continue to use it for agricultural use, or discontinue that? I'm currently doing that. If I am creating a potential health hazard for someone, I would like to discontinue that. I am currently using that for some of the produce for human consumption.

COLONEL EMORY: Why don't we take a hard look at the official Environmental Risk Assessment on that.

MR. KIRCHNER: I will look at that. There is an exposure scenario that had some vegetative conditions. There is a big spreadsheet on those pathways, that you may have alfalfa growing and feed that to a cow and you eat that cow directly, or if you are growing a vegetable and you are eating that directly. So, without looking at that table and knowing which ones they have specifically identified -- I do know, I saw a summary of that and there was a vegetable pathway in there that was considered the current scenario. It showed it as the levels that were below. So, there is no risk, no worry right now. If conditions are changing, I think that is an important point that we be aware of. I think we are talking about asparagus.

COLONEL EMORY: We need to get with the Environmental Protection Agency folks and make sure we have the right standards and the right words to clearly tell you what the level of risk is, or the lack of.

MR. KIRCHNER: We can take a sample and specifically address this issue for that concern, if that is what you would like to see happen.

MR. STITES: At present, we have got nothing to suggest that you are causing anybody a problem or that you should stop. Is that specific enough for you?

MR. COY: Yes.

MR. STITES: We came from one segment and another, and I don't think we hit the question you were asking.

MS. JONES: Pam Jones. Can they take a sample of his harvest now and do a test to let him know if he is endangering his family? Instead of waiting nine months, can they do that now?

MR. KIRCHNER: We can collect that sample now.

COLONEL EMORY: Any idea, rough order of time span, for what it takes to do a test and get it back?

MR. ELLIOTT: I understand your -- it is not just as simple as going out and taking -- pulling a carrot out of the ground and grinding it up, because these are volatile chemicals. If they are in this carrot and you grind it up in a blender so you can analyze it, you can imagine what happens to that. It goes into the air. So, there are some limitations on how much we can do.

We can certainly test that vegetable or type of vegetable and look at it and see if we see any contaminants. The study that I referred to is a very detailed study that will really track a chemical, track TCE, which is the chemical we are primarily talking about here. It will track that through radio labeling and follow it and see where it ends up, see if it actually goes into the soil, into the system and into the vegetable. We can quantify exactly where that ends up.

So, it is not just as simple as just going out tomorrow and getting a vegetable, to understand that process. It is a very, very difficult scientific problem. That is why we are looking at this detailed study. But we can look at what is there now and see whatever level, if there is any contaminants there. Did I help answer that question?

20:32:00 20:32:30 20:33:00

MR. STITES: I would like to add one brief elaboration. Rob Stites. At some of the other Operable Units, we do have situations where gardens are being watered with TCE-contaminated water and we have gathered samples of fruits and vegetables from those gardens and have not detected anything. Those were higher concentrations than are existing on the outer fringe of the unit.

MR. KIRCHNER: We can still address that issue, if you want to. The test that he is talking about is very exact. We can do it more gross scale than trying to grind up a carrot and address it that way.

MS. BREWER: Does anybody else have any more questions or comments. Rob, John?

MR. STITES: I wanted to toss out one last time, does anybody have anything for or against specifically what we are proposing here as the preferred alternative?

MS. BREWER: Think about it. You have your comment sheets. You have all of our names and numbers. There is a contact sheet in each package. If you think of something after, don't hesitate to call or write or contact us in some way. Colonel Emory?

COLONEL EMORY: I would like to say thanks for coming out this evening and helping us with this process. We'll try to, over the long haul, get this site cleaned up. You are all part of the team that we are on, including all of the federal agencies involved, especially the Environmental Protection Agency.

And Hill Air Force Base is recognized nationwide as kind of on the leading edge of applying technologies in the environmental cleanup business. In fact, Hill Air Force Base, as you saw in the local news, won the D.O.D. Environmental Management Award for installations and program management. I think that's because of the great team relationship we have with the community and with the EPA and the state and local agencies involved in this. Because, as opposed, unfortunately, to a number of other places in the nation, we have gotten great support from all of our higher headquarters and agencies to bite off the biggest problems we have got and focus our resources and get on with the cleanup process.

Part of the agony of this thing, as we started this presentation with, it takes a tremendously long time to go through this process, even to really get started on really spading the ground and putting in equipment to initiate the cleanup.

One of those things is, as you saw in this thing, the dollar cost on these things is really high. That comes right out of the federal budget, right out of your wallet. So, we want to -- as best as the technology is today, all of the experts we have out there, we want to make sure, when we spend your dollars to try to clean up your area out here, that we are really right on target on that when we start. 20:35:00 Like I said, there is very little in the environmental business that is cheap nowadays that gives you a fast cleanup. We are trying to use our resources wisely to clean up what we have done to you in the past.

Thank you very much for your time and effort.

(Whereupon proceedings were adjourned at 8:35 p.m)

20:35:30 * * * * *

REPORTER'S CERTIFICATE

STATE OF UTAH)
) ss.
COUNTY OF SALT LAKE)

I, SHIRLYN SHARPE, R.P.R., C.M. and Notary Public in and for the State of Utah, do hereby certify;

That the foregoing transcript of the Public for Proposed Plan for Operable Unit 2 was prepared by me from my stenographic notes taken at the time of the proceedings therein reflected;

That the foregoing transcript represents all proceedings had of record at the time of the meeting;

And I hereby further certify that the foregoing typewritten transcript, as typed by me, is a full, true and correct record of my stenographic notes so taken;

IN WITNESS WHEREOF, I have subscribed my name and affixed my seal this 7th day of June, 1994.

SHIRLYN SHARPE, RPR, CM

Notary Public
SHIRLYN SHARPE
824 South 850 East
Bountiful, Utah [illegible]
My Commission Expires
February 1, [illegible]
State of Utah

Peggy Bon
2485 East 7800 So.
So. Weber, UT 84405

Which operable unit, if any, am I in, & if I am, I'd like to be on the mailing list for that Unit.

Also please put my daughter on the mailing list for Operable Unit 1 (is that the Unit she is in?).

Larry, Heidi Esplin
1271 East 7600 So.
So. Weber

OO-ALC/PAE
7274 Wardleigh Road
Hill AFB UT 85056-5137

June 2, 1994

Ms. Peggy Bon
2485 East 7800 South
South Weber Ut84405

Dear Ms. Bon

As promised at the meeting last week, included is information on the groundwater contamination that is migrating from Hill AFB into the South Weber valley.

Your home is not within the Operable Units at Hill. Although your daughter lives near Mr. Brent Poll, her home is not in an Operable Unit or area of contamination. Mr. Poll owns some land that is over the plume, however, nothing was found at his home near your daughter.

We have added you and your daughter to our mailing list, so you will get information about work being done in the South Weber area, also notices, newsletters, and other information.

Please let me know if you have questions or need more information. I hope you get involved in the cleanup process. We need to hear from you.

Sincerely

GWEN BREWER
Environmental Public Affairs Coordinator

HILL AIR FORCE BASE
PUBLIC MEETING FOR PROPOSED PLAN FOR OPERABLE UNIT 2
SOUTH WEBER ELEMENTARY SCHOOL
7:00 P.M., WEDNESDAY, 25 MAY, 1994

IF YOU WANT TO MAKE A COMMENT AND PREFER NOT TO SPEAK DURING THE OPEN FORUM OR IF YOU THINK OF SOMETHING LATER, PLEASE COMPLETE THIS FORM AND LEAVE IT TONIGHT OR MAIL IT BEFORE JUNE 11, 1994, TO OO-ALC/PAE, ATTN: GWEN BREWER, 7274 WARDLEIGH ROAD, HILL AFB UT 84056-5137.

YOUR NAME	YOUR ADDRESS	YOUR PHONE #
L. Richard Peek	174 W. South Weber Dr.	479-1792

COMMENTS/QUESTIONS:

Please test springs and ground water by my home and my Fathers home Harry L. Peek 120 W. South Weber Dr # 479-5055

Shane Hirschi (OU 4)

5/25/94

Comments Concerning Remedial Action -- OU2

Newspaper articles often cite the awards the HAFB Environmental Directorate has earned concerning its programs to minimize the production of new hazardous wastes, and for resolving problems created before the Base became so responsible in this regard. Our family has worked with these people for almost 30 years as we were apparently the first to notice the off-base migration of pollution from their toxic dump sites. We too agree that the professionals in this Environmental office are now always approachable and seem very capable.

Such expertise suggests that those with property polluted by the Base should have the ideal advocate through which to have their problems remedied. However, this is not the case. Although budgets project that hundreds of millions of dollars are probably needed to treat the problems created by the Base, not one dime has been allocated to alleviate the property devaluations and related problems of the residents hurt by the off-base migration of contaminants. When questioned about this obvious disparity, the highly acclaimed Environmentalists meekly say to file a claim with the HAFB legal office.

No doubt the HAFB legal office is also staffed with able people; but when confronted with such a claim, its role is adversarial. They cite the Federal Torts Claim Act which precludes citizens from obtaining damages except where negligence can be proven on the government's part. Of course, they deny negligence and shift all the burdens of proof onto those who claim injury. Federal legal offices also infer that, as potential claimants, people are unwise to place any trust or share any confidences with the Base's renown Environmentalists. All involvement with them (including sign-in rosters at their meetings) can potentially be used to refute claims or disallow them entirely on a statute-of-limitation technicality.

In summary, we have found that the Base's efforts as a whole in addressing its pollution problems are clearly more self-serving than community oriented. Contrary to its claim, it was negligent in placing most of its toxic wastes on the steep bluffs above South Weber where they could only migrate downward and off-base into communities below. HAFB should appreciate that to ever deserve credibility for its remedial plans, its Environmental and legal offices must work together to find a way to genuinely safeguard its neighbors and rectify the damages it has caused.

Brent Poll
South Weber Landfill Coalition

[signature]