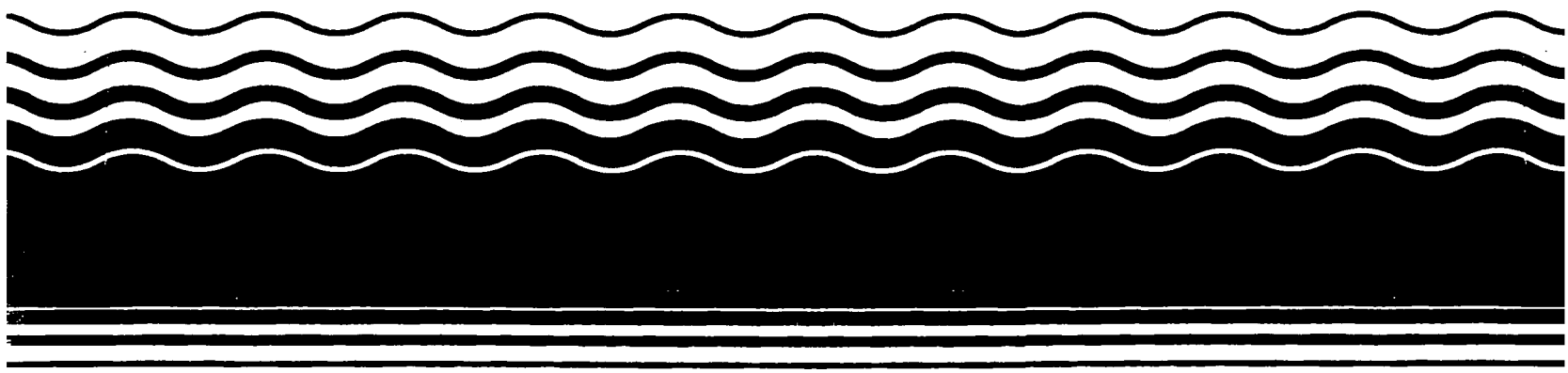


**PB97-964404  
EPA/541/R-97/194  
January 1998**

**EPA Superfund  
Record of Decision:**

**F E Warren Air Force Base, OU 2  
Cheyenne, WY  
9/30/1997**



**I. RECORD OF DECISION DECLARATION  
INTERIM REMEDIAL ACTION  
OPERABLE UNIT 2,  
Shallow Groundwater at Spill Site 7  
F.E. WARREN AIR FORCE BASE**

**1.0 SITE NAME AND LOCATION**

The site name is F.E. Warren Air Force Base (FEW), and it is located in Cheyenne, Wyoming. This site was placed on the National Priorities List (NPL) in February 1990. This Record of Decision (ROD) addresses the interim remedial action (IRA) at Operable Unit (OU) 2. Shallow groundwater. The only portion of OU2 addressed by this IRA ROD is the shallow groundwater located within the upper 15 feet of the aquifer contaminated from Spill Site 7 (SS7). The only contaminants addressed by this IRA ROD are trichloroethene (TCE), vinyl chloride, cis 1,2-dichloroethene, trans 1,2-dichloroethene, and total 1,2-dichloroethene.

**2.0 STATEMENT OF BASIS AND PURPOSE**

This decision document presents the selected IRA for the top 15 feet of groundwater beneath SS7 at FEW. This IRA was chosen in accordance with Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for this site.

The selected IRA for OU2 at SS7 includes an IN SITU PASSIVE TREATMENT WALL. This IRA addresses only TCE, vinyl chloride, trans-1,2-DCE, cis-1,2-DCE, and total 1,2-DCE in the upper 15 feet of groundwater at SS7, which, in turn, should minimize flow of these contaminants from SS7 into Diamond Creek. The United States Environmental Protection Agency (EPA) and State of Wyoming Department of Environmental Quality (WDEQ), as oversight agencies, concur with the selected IRA. The United States Air Force (USAF) is the lead agency for the site.

The in situ passive treatment wall will not address all of the contamination at OU2 SS7. The selected IRA addresses only TCE and other volatile organic compounds (VOCs) in the top 15 feet of groundwater beneath SS7. Other site contaminants detected at SS7 in shallow groundwater, other environmental media, and the deeper portions of the aquifer, are not addressed by the selected IRA. Alternatives for a final remedy will be proposed in a feasibility study after all RI data are available and evaluated. The selected IRA will not affect or interfere with other IRAs currently planned at FEW, and it will be consistent with any future actions, to the extent possible.

**3.0 ASSESSMENT OF THE SITE**

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

#### **4.0 DESCRIPTION OF THE SELECTED IRA**

The selected IRA for the top 15 feet of groundwater at SS7 is an IN SITU PASSIVE TREATMENT WALL. OU2 is one of 10 OUs that will be investigated under terms of the Federal Facility Agreement (FFA). The IN SITU PASSIVE TREATMENT WALL will address SS7 contaminants in groundwater at and downgradient of SS7 using an iron filings passive treatment wall technology. Groundwater beneath SS7 is only a portion of the groundwater identified for OU2. OU2 also includes facility groundwater beneath other sites included in OU1 and also beneath sites in OUs 4, 5, 9 and 10. Groundwater beneath these OUs will be addressed by the final OU2 remedial action.

The function of the IRA is to reduce groundwater contamination in the top 15 feet of the aquifer beneath the SS7 site, and thereby, reduce the risks associated with exposure to contaminated groundwater. Groundwater contaminants addressed by the IRA include trichloroethene (TCE), vinyl chloride, 1,2-dichloroethene (total) (1,2-DCE), trans 1,2-DCE and cis-1,2-DCE. While the IRA addresses one of the principal threats at the site (i.e., indicator contaminants of concern [ICOCs] in the top 15 feet of groundwater) the final remedial alternative will address remediation of other environmental media, in addition to the remainder of groundwater, and other types of contaminants that pose an unacceptable risk at the site.

The selected IRA will meet the remedial action objectives by directing groundwater through the in-situ passive treatment wall. Although the selected IRA is an innovative technology, it is expected to degrade the target contaminants to acceptable levels. The in-situ passive treatment wall is constructed of a treatment medium that degrades ICOCs and other volatile organic compounds (VOCs) to nontoxic by-products. ICOCs identified as posing an unacceptable risk in the top 15 feet of groundwater are TCE, vinyl chloride, total 1,2-DCE, cis-1,2-DCE, and trans 1,2-DCE. Concentrations of ICOCs will be permanently reduced to Safe Drinking Water Act (SDWA) maximum contaminant levels (MCLs). Thus, groundwater contaminant concentrations are permanently reduced to acceptable levels, there are minimal impacts to the site after construction, there are no treatment residuals, and the selected IRA is consistent with future remedial actions planned for the remainder of OU1 and OU2.

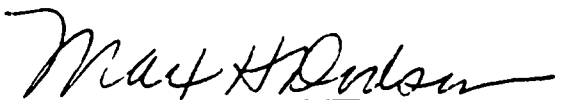
#### **5.0 STATUTORY DETERMINATIONS**

USAF has determined, with the concurrence of EPA and WDEQ, that this IRA is protective of human health and the environment, complies with federal and state applicable or relevant and appropriate requirements (ARARs) directly associated with this action, satisfies the requirements for an interim measures waiver of any standards that are not addressed by this remedy and is cost effective. For the scope of this IRA, the statutory mandate for permanence and treatment to the maximum extent practicable is met because this IRA does use treatment and thus is in furtherance of that statutory mandate. Because this IRA does not constitute the final remedy for OU1, SS7 or OU2, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element (although partially addressed for groundwater contaminants) will be addressed by the final action. Subsequent actions are planned to fully address the principal threats posed by current conditions at OU1, SS7 and the remainder of OU2.

CERCLA Section 121(c), 42 U.S.C. Section 9621(c), requires five-year reviews in the event that hazardous substances, pollutants, or contaminants remain on site. USAF will conduct reviews every 5 years after commencement of the remedial action to ensure that the IRA continues to provide protection of human health and the environment. Because this is an IRA ROD, review of this site and of this IRA will be ongoing as USAF continues to develop final remedial alternatives for OU1 and OU2.

**6.0 SIGNATURE OF AGENCY ACCEPTANCE OF REMEDY (EPA)**

The undersigned representative concurs with the Record of Decision for the Interim Remedial Action.  
Operable Unit 2: Shallow groundwater beneath Spill Site 7 at F.E. Warren Air Force Base, Wyoming.



MAX H. DODSON

ASSISTANT REGIONAL ADMINISTRATOR

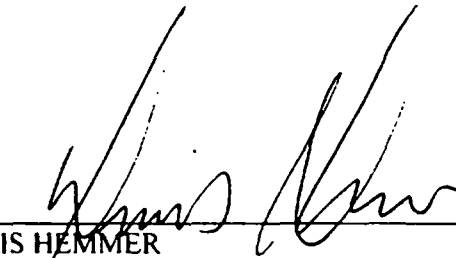
ECOSYSTEMS PROTECTION AND REMEDIATION

U.S. ENVIRONMENTAL PROTECTION AGENCY - REGION 8

9/30/97  
DATE

**6.0 SIGNATURE OF AGENCY ACCEPTANCE OF REMEDY (WDEQ)**

The undersigned representative concurs with the Record of Decision for the Interim Remedial Action.  
Operable Unit 2: Shallow groundwater beneath Spill Site 7 at F.E. Warren Air Force Base, Wyoming.

  
\_\_\_\_\_  
DENNIS HEMMER  
DIRECTOR, WYOMING DEPARTMENT  
OF ENVIRONMENTAL QUALITY

10-10-97  
DATE

**6.0 SIGNATURE OF AGENCY ACCEPTANCE OF REMEDY (USAF)**

The undersigned representative concurs with the Record of Decision for the Interim Remedial Action.  
Operable Unit 2: Shallow groundwater beneath Spill Site 7 at F.E. Warren Air Force Base, Wyoming.

A handwritten signature in black ink, appearing to read "Lance W. Lord", written over a horizontal line.

LANCE W. LORD, LIEUTENANT GENERAL  
VICE COMMANDER  
AIR FORCE SPACE COMMAND

23 September 1997  
DATE

## **II. DECISION SUMMARY FOR THE RECORD OF DECISION INTERIM REMEDIAL ACTION AT OPERABLE UNIT 2, Shallow Groundwater at Spill Site 7 F. E. WARREN AIR FORCE BASE**

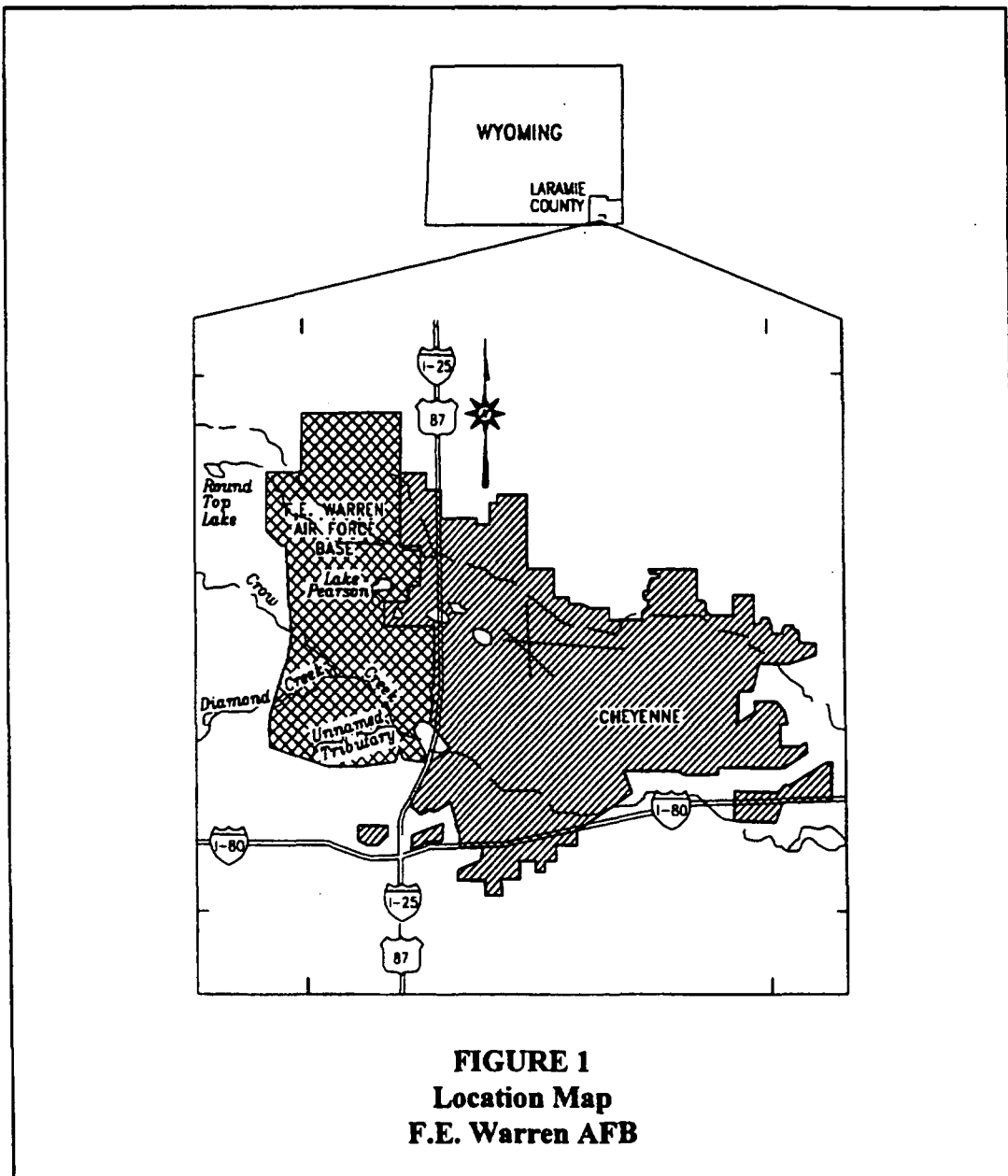
### **1.0 SITE NAME, LOCATION, AND DESCRIPTION**

FEW occupies 5,866 acres immediately adjacent to and hydrogeologically upgradient of the west side of the City of Cheyenne, Wyoming (Figure 1). FEW was placed on the National Priorities List on February 21, 1990. Historically, FEW has served a number of military functions, including cavalry outpost, quartermaster depot, and intercontinental ballistic missile (ICBM) operations base. Operations began at the U.S. Army outpost named Fort D.A. Russell in 1867. The name was changed to Fort F.E. Warren in 1930. The Fort was a major training facility during and after World War II. Fort F.E. Warren was transferred to the newly formed U.S. Air Force in 1947. FEW underwent extensive renovation after World War II. The majority of the Army training facilities were torn down and not replaced. Construction since that time has centered on facilities for USAF operations. Beginning in 1958, FEW became a Strategic Air Command base. Since then, FEW has served as an operations center for (1) the Atlas ICBM, (2) the Minuteman I and III, and (3) the Peacekeeper (MX) ICBMs. FEW was part of Air Combat Command from 1992 to 1993, and in July 1993, became part of Space Command.

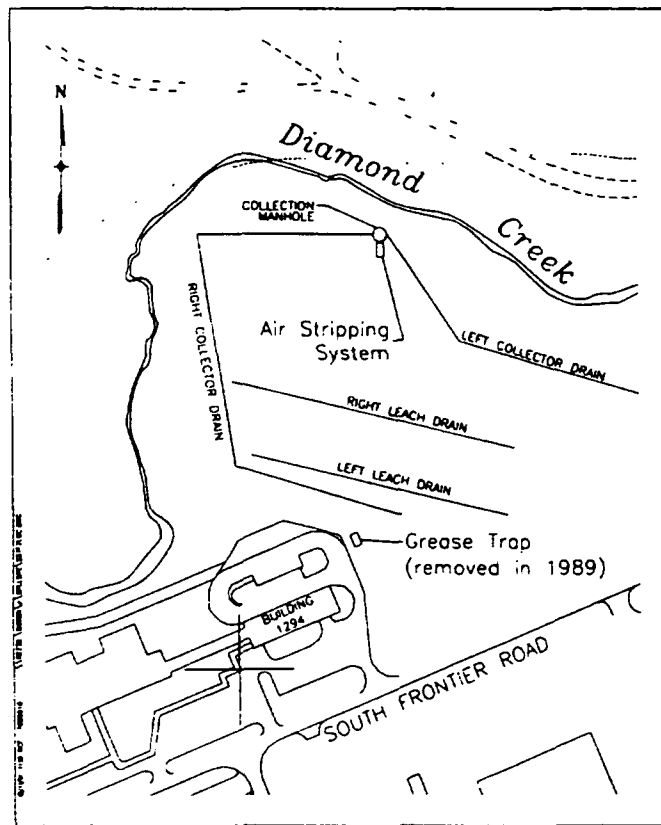
FEW is bordered by agricultural land and rural or suburban residential areas. FEW contains 831 residential housing units and several unaccompanied personnel housing units (barracks), along with the services required by residents. The nearest residences to SS7 are off-base, approximately 0.5 miles to the west, upgradient from the site. SS7 is in an area of gently rolling terrain overlooking a relatively sharp drop in elevation to Diamond Creek. SS7 is located within a stream meander, and the terrain generally slopes to the northeast toward Diamond Creek. Building 1294 is at the topographic high point at the site. The location of SS7 is shown on Figure 2.

### **2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES**

On September 26, 1991, a Federal Facility Agreement (FFA) was signed among USAF, EPA, and WDEQ. The FFA is required by Section 120 of CERCLA. The FFA provides the framework for EPA and WDEQ oversight of continuing remedial investigations at FEW and further identifies USAF investigation activities and schedules. USAF provides documents to EPA and WDEQ for review and concurrence, in accordance with the FFA. USAF is the lead agency for implementing CERCLA requirements at FEW.







**FIGURE 2**  
**Operable Unit 2**  
**Spill Site No. 7**

In April 1995, USAF implemented a treatability study at SS7. The treatability study was designed to remove TCE and its degradation products from groundwater through the use of a collection and treatment system. The collection system consisted of horizontal drains installed below the ground surface; air-stripping towers to remove TCE and its degradation products from the groundwater; and a granular-activated-carbon filter to treat the gases from the air stripping towers. The treated groundwater was reinjected into the aquifer upgradient of the collection drains. The treatability study was operated for a period of 12 months. Although TCE concentrations in some monitor wells within the influence of the treatability study showed decreases, TCE concentrations between the collector drains and Diamond Creek remained elevated and actually increased. Additionally, contaminated groundwater was bypassing the collector drains and reaching Diamond Creek.

OU2 groundwater beneath and downgradient of SS7 contains significant concentrations of TCE and its degradation products. Through the results of the completed remedial investigation (RI) activities, USAF has determined the grease trap at SS7 was a source of the TCE groundwater contamination. To control TCE contamination in shallow groundwater beneath and downgradient of SS7, an IRA has been selected. As remedial investigations are completed, remedies will be selected for contaminated groundwater at F.E. Warren Air Force Base.

### **3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION**

USAF has prepared and implemented a community relations plan (CRP) in accordance with CERCLA requirements and the FFA. The CRP describes community involvement activities that USAF will undertake during remedial activities at FEW. USAF has followed the requirements of the CRP, including issuing periodic fact sheets, holding public meetings, and providing the opportunity for public comment throughout the IRA process.

The Administrative Record has been filed at two locations: FEW and the Laramie County Public Library. USAF has prepared and distributed fact sheets to all persons or groups identified on the CRP mailing list. Currently, the mailing list has approximately 550 listings.

The announcement of commencement of the public comment period and public meeting for this ROD was made on July 13, 1997 through notices in the *Wyoming Tribune-Eagle* and in the *Casper Star-Tribune*. The original public comment period was July 26, 1997 through August 25, 1997. A public meeting to discuss this ROD was held in Cheyenne, Wyoming on August 19, 1997.

Due to a delay in distribution of the Proposed Plan to persons or groups on the mailing list, USAF extended the closure of the original public comment period from August 25, 1997 to September 9, 1997. An additional public meeting was held in Cheyenne, Wyoming on September 4, 1997. The extension of the public comment period and the additional public meeting were announced on August 24, 1997 through notices in the *Wyoming Tribune-Eagle* and in the *Casper Star-Tribune*. Moreover, a notice was mailed to persons or groups on the mailing list in order to announce the extension of the public comment period and the additional public meeting.

In addition to the newspaper notices, USAF issued press releases, and an article appeared in the FEW *Sentinel* newspaper on August 29, 1997. An article describing the original public meeting was published in the *Casper Star-Tribune* on August 20, 1997.

Official transcripts of the public meetings were prepared and placed in the Administrative Record. Responses to all comments on the Proposed Plan are presented in the Responsiveness Summary of this ROD.

#### **4.0 SCOPE AND ROLE OF OPERABLE UNIT**

Groundwater contamination from SS7 will be addressed under OU2. The selected IRA for OU2 at SS7 is an action to treat contaminated groundwater by installing an in situ passive treatment wall. OU2 is one of ten operable units that will be addressed under the terms of the FFA. The operable units identified at FEW are:

- OU1 Spill Sites 1 through 7
- OU2 Facility Groundwater, with the exception of groundwater at OUs 3, 6, 7, and 8
- OU3 Landfills 3 and 6
- OU4 Acid Dry Wells
- OU5 Fire Protection Training Area 2
- OU6 Opening Burning/Open Detonation Area
- OU7 Firing Ranges
- OU8 Landfill 5
- OU9 Landfills 2 and 4
- OU10 Landfill 7 and Fire Protection Training Area No. 1.

The groundwater contamination associated with OUs 3, 6, 7, and 8 will be investigated and remediated as part of those OUs, separate from OU2. All of the investigations are being conducted in accordance with the FFA. It is anticipated that the final remedial action ROD for OU2 will be issued after the RI has been completed for the other OUs.

The in situ passive treatment wall will not address all of the contamination at OU2 or at OU1, SS7. The selected IRA addresses only TCE and other volatile organic compounds (VOCs) in the top 15 feet of groundwater beneath SS7. Other contamination detected at SS7 is not addressed by the selected IRA. Alternatives for a final remedy will be proposed in a feasibility study after all RI data are available and evaluated. The selected IRA will not affect or interfere with other IRAs currently planned at FEW, and it will be consistent with any future actions, to the extent possible.

The purpose of this IRA is to:

- Minimize the potential for ingestion, inhalation, and dermal exposure to groundwater ICOCs by reducing levels to MCLs in the first 15 feet of the water table.
- Minimize contaminant loading to Diamond Creek from the SS7 shallow groundwater by reducing groundwater ICOC levels to MCLs in the first 15 feet of the aquifer.

Descriptions of remedies selected for other FEW sites are described in the Administrative Record.

## 5.0 SITE CHARACTERISTICS

The primary source of groundwater contamination at SS7 is the former grease trap that was located about 150 feet northeast of Building 1294.

Samples of soils, groundwater, and surface water have been collected from the site. Groundwater has been shown to be contaminated by various organic contaminants but predominantly by TCE and cis-1,2-DCE. Groundwater samples from 26 monitor wells at SS7 were collected and analyzed during September and October 1992 and August and September 1993 for the OUI RI. The groundwater samples were analyzed for VOCs, semivolatile organic compounds (SVOCs), and metals. 1,2-Dichloroethene (1,2-DCE) was detected in 1 of 29 samples. TCE was detected in 19 of 29 samples collected at concentrations ranging from 1.0 to 9,900 micrograms per liter ( $\mu\text{g/L}$ ). The highest TCE concentration was detected in a monitor well near the former location of the grease trap. Based on laboratory analytical results, the highest TCE concentration in groundwater at SS7 was detected in MW069 at 12,000  $\mu\text{g/L}$  in August 1993.

Collection and analyses of samples from Spill Site 7 have been conducted on an on-going basis. The results are presented in the *Focused Remedial Investigation for Operable Unit 2: Spill Site 7 at F.E. Warren Air Force Base, Wyoming*; the *Remedial Investigation for Operable Unit 1 at F.E. Warren Air Force Base, Wyoming*; the *Spill Site 7 Final Treatability Study Report, F.E. Warren Air Force Base, Wyoming*; the *Spill Site 7 Shutdown Monitoring* (9/18/96, 10/2/96 and 10/3/96); and the *Spill Site 7 - Field Activities Report Surface Water Sampling* (4/17/97 and 6/16/97). These reports may be found in the Administrative Record.

## 6.0 SUMMARY OF SITE RISKS

A streamlined risk assessment (SRA) was prepared to characterize the potential human health exposure and risks, under baseline conditions, associated with ICOCs in groundwater at SS7. An ecological SRA was not performed for SS7. The following paragraphs describe the SRA calculations and input criteria.

Cancer potency factors (CPFs) have been developed by EPA for the purpose of estimating lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs are expressed in units of  $\text{mg/kg-day}^{-1}$  and are multiplied by the estimated intake of a potential carcinogen (in  $\text{mg/kg-day}$ ) to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. CPFs 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.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs are expressed in  $\text{mg/kg-day}$  and are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (i.e., the amount of a chemical 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 (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

Groundwater ICOCs included in the SS7 SRA were selected by USAF, WDEQ and EPA. Contaminants

selected as ICOCs were the most likely to present unacceptable risks to human health and the environment at present concentrations. The ICOCs for the SS7 SRA included TCE; 1,2-DCE (total); isomers of 1,2-DCE, including cis and trans 1,2-DCE; and vinyl chloride. The only potential exposure pathways characterized by the land-use scenario for future adult and child residents include ingestion and dermal contact with contaminated groundwater and inhalation of volatile chemicals. The exposure scenarios considered in the SRA were the future child and future adult residents. The residential risk assessment scenario is the most conservative risk assessment scenario, and there are no current residential areas or current plans for creation of any residential areas at or near SS7.

Lifetime cancer risks resulting from exposures to contaminants are determined by multiplying the intake level with the CPF. These risks are probabilities that are generally expressed in scientific notation (e.g.,  $1 \times 10^{-6}$  or  $1.0\text{E-}6$ ). An excess lifetime cancer risk of  $1.0\text{E-}6$  indicates that, as a plausible upper bound, an individual has a one in a million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient. The hazard quotient is the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's reference dose. By adding the hazard quotients for all contaminants within the groundwater medium to which a given future population may reasonably be exposed, the hazard index can be generated. The hazard index provides a useful reference point for gauging the potential significance of multiple contaminant exposures to groundwater at SS7.

Contaminant-specific preliminary remediation goals (PRGs) were calculated for groundwater for the future land-use scenario using information from the toxicity assessment and risk characterization calculations. For carcinogenic contaminants, a target risk level of  $1.0\text{E-}6$  was used. For noncarcinogenic contaminants, a total hazard quotient of 1.0 was used. The SRA risk characterization compared the contaminant concentration term for each of the ICOCs with the corresponding groundwater PRGs for each exposure scenario. Carcinogenic risks associated with TCE consistently exceeded the target risk level. Also, hazard indices determined to indicate potential noncarcinogenic health effects were greater than 1.0 for both TCE and 1,2-DCE.

Based on the results of the SRA, USAF determined that SS7 groundwater presents both carcinogenic and noncarcinogenic unacceptable human health risks to future populations living at SS7. TCE presents an unacceptable carcinogenic risk and both total 1,2-DCE and TCE present an unacceptable noncarcinogenic risk. Risk assessment summary tables from the FS have been included as Attachment B to this IRA ROD. To minimize these potential risks until a final remedy is developed for all of OU2, an IRA for groundwater is necessary at SS7. The complete streamlined risk assessment is contained in Appendix E to the *Focused Remedial Investigation for Operable Unit 2: Spill Site 7 at F.E. Warren Air Force Base, Wyoming*. This report is filed with the Administrative Record.

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

## **7.0 DESCRIPTION OF ALTERNATIVES**

Three alternatives have been evaluated for the IRA for OU2 at SS7. The three alternatives are summarized in the following paragraphs. None of these three remedial alternatives are expected to be the final remedy for OU2.

Alternative No. 1 is no action. Evaluation of the no-action alternative is required by the NCP to be used as a baseline comparison for other alternatives. Under Alternative No. 1, USAF would take no action at SS7 to prevent migration or exposure to the TCE contamination.

Alternative No. 2 is an in situ passive treatment wall. This remediation technology includes a permeable treatment wall installed vertically below ground surface and perpendicular to the direction of groundwater flow. Segments of highly permeable material are installed adjacent to the reactive treatment medium. As contaminated groundwater flows through the wall and into the selected treatment medium, the contaminants are degraded to nontoxic by-products. A long-term monitoring program will be implemented to monitor both the effectiveness of the treatment wall and groundwater movement. The treated groundwater is expected to meet the maximum contaminant levels provided in the Safe Drinking Water Act regulations and the Wyoming Water Quality Rules and Regulations for groundwater (Chapter VIII) with respect to ICOCs. Soil spoils from installation of the treatment wall will require characterization to determine if they meet the definition of a hazardous waste. If so, the soil spoils will be managed in accordance with the Wyoming Hazardous Waste Rules and Regulations.

Alternative No. 3 includes modifications to the treatability study. The treatability study was conducted from April, 1995 until March, 1996. The treatability study system consists of horizontal drains that collect contaminated groundwater, an above-ground water treatment system, and injection drains to return the treated groundwater to the aquifer. Alternative No. 3 replaces the horizontal drains with vertical extraction wells and incorporates other modifications to treat larger volumes of groundwater. After the groundwater is extracted, it is treated using air stripping towers that remove TCE and other volatile organic contaminants. A long-term monitoring program will be implemented to monitor both the effectiveness of the collection and treatment systems and groundwater movement. To the extent hazardous waste is extracted from groundwater, air emissions from the air stripper will comply with the requirements of the Resource Conservation and Recovery Act, Clean Air Act and Wyoming air quality standards and regulations. Contaminant levels in treated groundwater are expected to comply with the requirements of the Safe Drinking Water Act and Wyoming water quality rules and regulations for groundwater (Chapter VIII) with respect to ICOCs. If the treated groundwater is discharged to an off-site publicly owned treatment works (POTW), a discharge permit will be required; if it is discharged to on-site surface water, the substantive requirements of a National Pollutant Discharge Elimination System (NPDES) permit will be met.

## **8.0 MONITORING WELL CONSTRUCTION**

The State and USAF disagree on whether USAF is required to obtain permits from the State Engineer's Office pursuant to state law, whether USAF has a federal reserved water right covering groundwater at FEW, and whether Wyoming statutes, rules, and regulations pertaining to groundwater appropriation are ARARs. Despite these disagreements, however, the parties believe that the procedures described below will enable USAF to appropriate water for the required monitor wells, while preserving the parties' legal and jurisdictional positions. By employing these procedures, the parties intend to avoid the necessity for protracted dispute resolution and/or legal action to resolve their legal and jurisdictional differences. The parties do not anticipate that the legal and jurisdictional issues will need to be resolved in the context of this IRA for groundwater cleanup at SS7 or in the context of the CERCLA clean-up at FEW. Consistent with this background, the purpose of these procedures is to effectuate the parties' desire that progress at

SS7 continue, while ensuring that the legal and jurisdictional positions of the State and USAF are preserved in the event of a future dispute relating to appropriation of groundwater at SS7 or other cleanup actions at FEW.

These procedures, and the reservation of jurisdictional and legal arguments, are only applicable within the context of water appropriation incident to construction, operation, and abandonment of monitor wells at FEW for USAF's on-base CERCLA cleanup activities. The procedures set forth herein shall not be relied upon as precedent for any activities or water use or development outside the narrow context of the USAF's CERCLA cleanup, unless otherwise agreed to in writing by the parties.

By employing these procedures, the parties are not waiving any arguments they may raise concerning the legal applicability of State law permitting requirements, or the designation of State law requirements as ARARs. In particular, but not by way of limitation, the parties each preserve their legal positions concerning: (1) whether USAF has a federal reserved water right covering use of water at FEW; (2) whether Wyoming Statutes and the Regulations and Instructions of the State Engineer's Office are ARARs; and (3) whether the permitting exemption contained in Section 9621(e)(1) of CERCLA applies to State permits for the appropriation of groundwater. In the event that a dispute or disagreement arises between the parties in the implementation of the procedures described herein, the parties expressly agree that any and all legal arguments and/or defenses are fully preserved and may be raised in any proceeding relating to the disputed issue.

USAF and the State agree to the following procedures relating to the appropriation of groundwater incident to the construction, operation, and abandonment of monitor wells at FEW during the CERCLA cleanup:

- A. Prior to the construction of any wells, USAF will complete and submit to the State Engineer's Office, the State's standard form, "Application for Permit to Appropriate Groundwater."
- B. USAF will comply with all requirements for appropriating groundwater contained in Wyoming Statutes and Parts 2 and 3 of the Regulations and Instructions of the State Engineer. USAF further agrees to submit a "Statement of Completion" on the standard State form, providing the information required therein.
- C. USAF maintains that in providing information to the State on the State's forms and complying with State law procedures that it is not making application for a permit under State law, and further, that it is not required to follow State law for the appropriation of federally reserved groundwater. It is USAF's position that it is only providing information to the State in the most usable and efficient format to enable the State to properly maintain its water records system, and cooperating with the State as a matter of comity. As provided above, by submitting information on the State's forms and otherwise complying with State law, USAF does not waive its right to claim that no State permit is necessary or that USAF is not bound to follow State law in appropriating groundwater for the CERCLA cleanup at FEW.
- D. The State Engineer will treat the forms and information received from USAF as a permit application, and will issue permits in the name of USAF. The State Engineer will, in all respects, and in the same manner as for any private water appropriator, maintain its records and administer the permits in accordance with all applicable State law. As provided above, by following these procedures, the State does not waive its right to claim that USAF is required to obtain State permits and follow State law in the appropriation of groundwater at FEW.

- E. The parties agree to work in good faith to resolve any disputes or disagreements that may arise in the implementation of these procedures.

In the event that a dispute or disagreement arises from these procedures, and the parties are unable to resolve the matter through informal negotiation, the parties agree that an action to resolve the underlying jurisdictional and legal issues pertinent to appropriations of groundwater at SS7 may be maintained pursuant to the FFA, Section 9621(e)(2) of CERCLA, or through any other applicable remedy provided for by law.

## 9.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

Alternative Nos. 1, 2, and 3 were compared with the nine EPA criteria established to evaluate remedial alternatives. The following paragraphs describe this evaluation.

1. **Overall Protection of Human Health and the Environment.** Alternative No. 1 provides no mechanism for reducing or monitoring aquifer contaminant levels. Human health and the environment are not protected. Alternatives No. 2 and 3 provide adequate protection by reducing contaminant levels in groundwater to below MCLs. Alternative No. 3 requires additional monitoring of treatment residuals before they are discharged to the Publicly Owned Treatment Works (POTW) or Diamond Creek and the atmosphere.

No unacceptable short-term or cross-media impacts are expected for Alternative No. 2. Treatment would be required to mitigate any potential cross-media impacts of Alternative No. 3. No unacceptable short-term impacts are expected for Alternative No. 3.

2. **Compliance with ARARs.** Alternative No. 1, No Action, does not comply with ARARs. Contaminants in groundwater at SS7 will not be reduced or remediated.

Treated groundwater resulting from Alternatives No. 2 and 3 would comply with the Safe Drinking Water Act regulations and Wyoming Water Quality Rules and Regulations, Chapter VIII for ICOCs. Soil spoils from installation of the Alternative No. 2 treatment wall will require characterization, as will soil spoils generated during well installation associated with Alternative No. 3, to determine if they meet the definition of a hazardous waste. If so, the soil spoils will be managed in accordance with Wyoming Hazardous Waste Rules and Regulations.

Alternative No. 3 would require a discharge permit if treated groundwater is discharged to an off-site publicly owned treatment works (POTW), or the substantive requirements of an NPDES permit will be met if treated groundwater is discharged to surface water. Alternative No. 2 does not generate effluent that requires discharge to a POTW or the environment. Alternative No. 3 would generate air emissions from the air stripper that will comply with requirements of 40 CFR Part 264, Subpart AA, Process Vents, the Clean Air Act, and Wyoming Air Quality Standards and Regulations, Section 21. The complete list of ARARs for the IRA at SS7 is included as Attachment A.

3. **Long-Term Effectiveness and Permanence.** Alternative No. 1 does not provide an effective long-term remedy for groundwater, because it does not manage or reduce risk to groundwater. Alternatives No. 2 and 3 meet remedial action objectives and use adequate and reliable controls to evaluate the system performance. Alternative No. 2 does not produce treatment residuals. No operation and maintenance activities other than periodic groundwater and surface water monitoring would be required for Alternative No. 2. Alternative No. 3 would require routine monitoring to ensure compliance with discharge permits or substantive NPDES requirements.



Alternative No. 3 would further require extensive operation and maintenance activities. Controls and wall width would be used to manage the treatment residuals and untreated waste from Alternative No. 2. The effluent water on the downgradient side of the treatment wall would be sampled regularly to ensure that contaminant concentrations remain at or below MCLs.

Alternatives No. 2 and No. 3 provide an effective and permanent long-term remedial action.

4. **Reduction of Toxicity, Mobility, and Volume through Treatment.** Alternative No. 1 would not reduce toxicity, mobility, and volume of contaminants in groundwater at SS7. Given sufficient time, both Alternatives No. 2 and 3 could reduce ICOC levels to their respective MCLs. Degradation products may be present downgradient of Alternative No. 2, but are anticipated to be at concentrations below regulatory limits. Degradation products resulting from Alternative No. 2 would not pose an unacceptable risk to human health and the environment. The chemical treatment process associated with Alternative No. 2 uses destructive techniques to reduce contaminant concentrations, and the reductions are permanent. Alternative No. 3 uses physical separation techniques to reduce contaminants, and therefore, treatment residuals are produced. Treatment residuals from Alternative No. 3 would require additional management and disposal, in accordance with regulatory requirements.

Alternative No. 2 reduces mobility, toxicity, and volume of contaminants. Alternative No. 3 would reduce mobility and volume but not toxicity of contaminants. Alternative No. 2 provides the most effective treatment for SS7 ICOCs in the upper 15 feet of the groundwater aquifer.

5. **Short-Term Effectiveness.** Alternative No. 1 is not effective in the short-term because no action would be taken. Alternatives 2 and 3 will be effective immediately upon completion of construction in that they will begin to reduce contamination in groundwater and reduce the flow of contaminated groundwater from the site. Alternative No. 2 would require approximately 39 years to meet the remedial action objective cleanup goals. Alternative No. 3 would require approximately 30 years to meet the remedial action objective cleanup goals.

Alternatives No. 2 and 3 would pose some potential environmental impacts and worker risks during trench and monitor well installation. No increased risk to workers or the community and no environmental impacts would occur with Alternative No. 2 after construction and implementation. During construction of Alternatives No. 2 and 3, dust may be generated that may pose a minor, but temporary, risk to both workers and the surrounding community. These risks would be minimized by following health and safety procedures. Air monitoring will be used to assess the requirement for temporary control measures during construction. Monitoring would be performed to ensure that treated groundwater meets the cleanup goal. Monitoring would be performed to also ensure that workers are not affected during extensive operation and maintenance activities for Alternative No. 3.

6. **Implementability.** Alternative No. 1 is easily implemented because no action is taken. Alternatives 2 and 3 would be easily implemented because traditional and proven construction technologies would be used. Neither Alternative 2 nor 3 is anticipated to be inconsistent with or preclude implementation of subsequent remedies. The equipment, specialists, and services required to implement a long-term monitoring program are available, and monitoring is easily performed to measure system performance. The operation and maintenance activities necessary for Alternative No. 3 are extensive in comparison to Alternative No. 2.

Administrative implementability concerns for Alternative No. 2 are expected to be minimal and

consist of coordination of the FEW engineering department and the regulatory approval of the long-term monitoring program. Alternative No. 3 requires a POTW discharge permit or compliance with the substantive portions of the NPDES permit regulations. There may be administrative difficulties with obtaining a POTW discharge permit based on past performance.

Alternative No. 2 and No. 3 can be implemented at SS7 using common construction and engineering practices. Because Alternative No. 3 may require a permit for off-site discharge of treated water, Alternative No. 2 provides the most easily implemented remedy.

7. **Cost.** The cost to implement Alternative No. 1 is \$0. The capital cost for Alternative No. 2 is \$1,619,000. The capital cost for Alternative No. 3 is \$375,000. Long-term monitoring is the only operation and maintenance cost required for Alternative No. 2 and is expected to be \$85,000 for the first year. Operation and maintenance costs for Alternative No. 3 are estimated to be \$247,000 for the first year. The total 30-year present worth for Alternative No. 2 is \$2,131,000. The total 30-year present worth for Alternative No. 3 is \$2,639,000. Because of fewer operation and maintenance requirements, Alternative No. 2, compared with Alternative No. 3 (which achieves the same cleanup standard), has the lowest 30-year cost.
8. **State/Support Agency Acceptance.** EPA concurs with the selection of Alternative No. 2 for the groundwater IRA at SS7. The State of Wyoming, Department of Environmental Quality agrees with the Air Force's selection of the iron filings wall as the preferred alternative to be used for shallow groundwater treatment at Spill Site 7. The agency has expressed some concerns regarding the proposed configuration for the wall and its ability to treat shallow groundwater contamination across the site, particularly groundwater associated with the source area for much of the contamination noted at the site. It is the state's position that groundwater flow at the site, especially relative to the area where the grease trap was located, has not been well characterized and appears to be moving in a radial direction which would result in incomplete interception by the treatment wall. The wall is planned to be located on the northern portion of the site, as proposed in the FS. Additionally, the state would like to see, as an immediate benefit of the wall's installation, a decrease of discharge of contaminants to the creek such that water quality criteria for TCE and related contaminants are met. However, it is not known at this time whether the wall will intercept an adequate zone of groundwater to accomplish this. Additionally, data collected to date suggests that the greater mass of contamination at the site is located deeper in the aquifer than the wall will extend. The construction of the preferred alternative will not preclude the incorporation, at a later date, of a remedy designed to address deeper zone contamination. The state has agreed to the preferred alternative with the understanding that the performance of the remedial action will be monitored to determine both the horizontal and vertical extent of contaminant reduction resulting from the implementation of the remedy.
9. **Community Acceptance.** Both oral and written comments were received from the community during the public comment period and public meeting described in Section 3.0. Based on these comments, the general community consisting of the residents of the City of Cheyenne, Laramie County, and FEW have not expressed any comments or concerns about the technical aspects of the selected alternative.

## 10.0 THE SELECTED INTERIM REMEDIAL ACTION

Based on consideration of the requirements of CERCLA, the detailed analysis of the three remedial alternatives, agency comments, and public comments, USAF has determined that Alternative No. 2: INSITU PASSIVE TREATMENT WALL is the most appropriate IRA for OU2 groundwater at SS7. The purpose of this response action is to control unacceptable carcinogenic and noncarcinogenic risks posed

by the upper 15 feet of the groundwater aquifer from TCE, total 1,2-DCE, trans 1,2-DCE, cis 1,2-DCE, and vinyl chloride and minimize contaminant loading from SS7 to Diamond Creek. This IRA does not address the remainder of groundwater, other environmental media, or other site contaminants. The final remedy will address all of the contaminants detected above the target risk levels. Performance standards for the ICOCs are based on the National Primary Drinking Water Regulations that identify MCLs. The groundwater will be treated by an iron filings passive treatment wall technology described in the Focused FS. Based on the comparative analysis presented in Section 9.0 above, Alternative No. 2 will provide the greatest benefits when evaluated against the nine criteria. Alternative No. 2 was selected as the IRA at SS7 because of the following advantages:

- Low operation and maintenance requirements
- Minimal impacts to the site after construction
- No effluent, therefore no effluent discharge permits or requirements
- No treatment residuals to recycle and dispose
- Cost effectiveness.

In situ passive treatment wall technology is considered innovative; a patent for this technology has been issued to EnviroMetals Technologies, Inc. for the reductive dechlorination of chlorinated aliphatic hydrocarbons by zero-valent iron. Implementation of this alternative will require registration, notification, conceptual design approval, and payment of fees to EnviroMetals Technologies, Inc. These costs are included in the capital cost presented in Section 9.0. During the design process, the actual length, width, and depth of the wall will be designed to optimize the treatment potential. The treatment wall is composed of more permeable materials than the surrounding groundwater aquifer. Contaminants passing beneath the treatment wall will not be treated.

The long-term monitoring program would assess the effectiveness of the performance of Alternative No. 2. Alternatives No. 1, 2, and 3 are described in detail in the Focused Feasibility Study. This report is filed in the Administrative Record.

The point of compliance, to determine if the selected interim remedial action is meeting its remedial action objectives, is established to be between Diamond Creek and the iron filings wall. Monitor wells will be used as the point of compliance. The monitor wells will be screened to approximately between 2 feet above the water table and 2 to 2.5 feet above the base of the wall. The monitor wells will be located downgradient of Manhole 0+00, one near either end of the wall and at intermediate locations along the length of the wall, due to heterogeneity of the aquifer. Exact locations will be determined by joint agreement of the EPA, WDEQ, and USAF during the design of the remedial alternative and will be identified in a compliance monitoring plan.

Compliance monitoring will begin thirty days after installation of the iron filings wall. However, due to the uncertainty of groundwater velocity between the iron filings wall and monitoring wells, regulatory compliance will not be determined until stabilization of ICOC concentrations have been established through agreement among EPA, WDEQ, and USAF.

Alternative No. 2 will reduce TCE, vinyl chloride, total 1,2-DCE, trans 1,2-DCE, and cis-1,2-DCE to concentrations below the corresponding regulatory limits. These limits are presented in Table 1. Limits for the contaminants listed in Table 1 are based on MCLs set forth in the National Primary Drinking Water Regulations, 40 CFR Part 141 for public drinking water systems. Although the total present worth costs are comparable for Alternatives No. 2 and 3, Alternative No. 2 requires lower operation and maintenance costs. Figure 3 shows the proposed location of the treatment wall.

**TABLE 1**  
**Performance Standards For ICOCs**  
**Spill Site 7 Groundwater**

ICOC	Maximum Concentration Detected	Regulatory Limit (µg/L)
TCE	12,000	5
total 1,2-DCE	See 1 below	300 <sup>2</sup>
trans 1,2-DCE	440	100
cis-1,2-DCE	610	70
vinyl chloride	ND	2

**Notes:**

Regulatory Limits are Maximum Contaminant Levels found in 40 CFR Part 141.  
The reported maximum concentrations detected are based on laboratory analytical results.

<sup>1</sup>Total 1,2-DCE was not included in groundwater analyses. Total 1,2-DCE is comprised of trans and cis 1,2-DCE.

<sup>2</sup>WDEQ standard for mixed isomers of 1,2-DCE.

µg/L = Micrograms per Liter

## **11.0 STATUTORY DETERMINATIONS**

USAF's selected IRA for Operable Unit 2, SS7 is Alternative No. 2. The selected IRA meets the statutory requirements of Section 121 of CERCLA, as amended by SARA. These statutory requirements include protecting human health and the environment, complying with ARARs, assuring cost effectiveness, using permanent solutions and alternative treatment technologies to the maximum extent practicable, and assuring preference for treatment as a principal element. The selected IRA uses permanent solutions and treatment technologies to the maximum extent practicable. This IRA is not designed or expected to be the final remedy for OU2; however, the selected IRA represents the best balance of trade offs among the two remedial alternatives with respect to pertinent criteria given the limited scope of the action.

The selected IRA will reduce TCE and other ICOCs and VOCs in SS7 groundwater. The in situ passive treatment wall results in permanent destruction of TCE and related compounds to allowable concentrations. Alternative No. 2 reduces the potential for exposure to site contaminants. Installation of the system components will cause minimal short-term effects to the community. There will be no cross-media impacts from the installation or operation of the in situ passive treatment wall. As discussed in Section 9.0, the selected IRA for SS7 will comply with ARARs.

The following paragraphs summarize how the selected IRA meets the statutory requirements.

### **Protection of Human Health and the Environment**

Alternative No. 2 protects human health and the environment by passively treating the contaminated groundwater in place via reductive dehalogenation processes as groundwater flows through the wall. The IRA will reduce ICOC concentrations in groundwater to MCLs as groundwater flows through the wall. Currently, groundwater at SS7 is not being used. There will be minimal risk to human health and the environment during construction, operation, and maintenance of the treatment wall. Strict adherence to health and safety protocols and monitoring will minimize risk from VOCs, dust, and noise. Erosion control barriers will be used to prevent surface run-off to Diamond Creek.

### **Compliance with ARARs**

The in situ passive treatment wall will comply with all potential action-specific and location-specific ARARs. The treated groundwater is expected to meet MCLs set forth in the National Primary Drinking Water Regulations for ICOCs that pose an unacceptable risk in groundwater in the upper 15 feet of the groundwater aquifer. Pursuant to the remedial action objectives, ARARs will not be met for groundwater located beneath the upper 15 feet of the aquifer or for contaminants other than TCE, total 1,2-DCE, trans 1,2-DCE, cis 1,2-DCE, and vinyl chloride. Soil spoils classified as hazardous waste will be managed in accordance with the Wyoming Hazardous Waste Rules and Regulations.

### **Cost Effectiveness**

The cost for Alternative No. 2 is slightly lower for the total 30-year present worth. The capital cost for Alternative No. 2 is \$1,619,000 and \$375,000 for Alternative No. 3. Long-term monitoring is the only operation and maintenance cost required for Alternative No. 2 and would result in a cost of \$85,000 for the first year. The operation and maintenance cost for Alternative No. 3, including long-term monitoring, filter replacement, and GAC regeneration would be \$247,000 for the first year. The total 30-year present worth for Alternative No. 2 is \$2,131,000 and \$2,639,000 for Alternative No. 3. Alternative No. 2 achieves the same performance standards as Alternative No. 3, with the lowest overall cost.

### **Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable**

USAF has determined that the selected IRA represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the interim source control action for site-specific ICOCs in the upper 15 feet of the aquifer. Alternatives 2 and 3 are protective of human health and the environment and comply with ARARs. USAF has determined that Alternative No. 2 fulfills the remaining criteria (described in Section 9) better than Alternative No. 3.

The relative benefits of the selected remedy are lower operations and maintenance requirements, fewer administrative requirements, and permanent destruction of ICOCs. The selected remedy can be implemented using common engineering and construction practices and readily available materials. The in situ passive treatment wall technology is considered to be innovative. Information obtained from monitoring during operation will be used to assess the effectiveness of the selected remedy.

### **Preference for Treatment as a Principal Element**

The selected remedy treats contaminated groundwater by dechlorinating volatile halogenated contaminants. Therefore, the statutory preference for remedies that employ treatment as a principal element is satisfied.

## **12.0 EXPLANATION OF SIGNIFICANT CHANGES**

The Proposed Plan for the ROD was released for public comment in July 1997. The preferred alternative identified in the Proposed Plan was an in situ passive treatment wall, which was determined to be protective of human health and the environment. USAF, EPA, and WDEQ reviewed all written and verbal comments submitted during the public comment period. There were no significant changes to the preferred alternative.

### **III. RESPONSIVENESS SUMMARY FOR THE RECORD OF DECISION INTERIM REMEDIAL ACTION AT OPERABLE UNIT 2, Shallow Groundwater at Spill Site 7 F.E. WARREN AIR FORCE BASE**

#### **INTRODUCTION**

The responsiveness summary for the ROD is organized into sections as follows:

- A. Overview
- B. Background on Community Involvement
- C. Summary of Comments Received
- D. State Concerns
- E. Community Relations

#### **A. OVERVIEW**

At the time of the ROD public comment period, the preferred alternative for the IRA at OU2, SS7 had been selected by USAF, with EPA and WDEQ concurrence. The preferred IRA, IN SITU PASSIVE TREATMENT WALL, was presented in the Proposed Plan. Based on the public's response and comments received during the public comment period for the ROD, there were no significant objections to the preferred alternative as presented.

#### **B. BACKGROUND ON COMMUNITY INVOLVEMENT**

Community interest in CERCLA and Installation Restoration Program (IRP) activities at FEW has fluctuated over the years since the initial record search and personnel interviews conducted for USAF in September 1985. No specific individuals or organizations have been consistently involved over this period, although many groups and individuals have been involved during the life of the project. There were no concerns expressed during the SS7 RI or on the Focused Feasibility Study before the public comment period for the ROD.

#### **C. SUMMARY OF COMMENTS RECEIVED**

The public comment period on the Proposed Plan for the OU2, SS7 IRA at FEW was held from July 26 to September 9, 1997. Comments received during the public comment period are summarized below. Similar comments have been combined where possible to prevent duplication of responses.

1. Is the selected interim remedial alternative the best technology available to address specific SS7 issues at the present time?

**Response.** The iron filings wall is considered an innovative and relatively new technology. This technology is well suited to the type of contaminants to be addressed by the interim remedial action at SS7. The iron filings wall technology is designed to reduce concentrations of chlorinated hydrocarbons found in groundwater in the upper 15 feet of the aquifer below the SS7 area. Based on current research and field tests, the technology appears to be very appropriate and

very promising in reducing contaminants of concern at SS7. In addition, the technology is not the final remedy for the site.

2. Will the construction of the iron filings wall create more pollution than it is designed to correct?

**Response.** Although there will be some additional potential for dust, noise, and traffic during the construction phase, measures will be taken to keep these nuisances to a minimum. Construction will be completed only during certain hours of the day, and dust control measures will be implemented in accordance with federal, state, and United States Air Force (USAF) regulations. The trench for the iron filings wall will require common construction equipment, such as track-mounted backhoes. If no action is taken to reduce contaminant concentrations in the upper 15 feet of the groundwater aquifer at SS7, the contaminants will continue to migrate toward Diamond Creek. Based on the results of the streamlined risk assessment, this unchecked release may affect any future populations living in the SS7 area.

3. How did USAF determine that the interim remedial action at SS7 will only address the upper 15 feet of the groundwater aquifer?

**Response.** The depth of 15 feet was based on initial studies indicating that the majority of the TCE contaminated groundwater beneath SS7 is between 0 and 15 feet below the groundwater surface. Because these studies have not been completed, USAF, EPA, and WDEQ agreed to use this depth to implement an interim remedial action at SS7. Once the studies have been completed and more information about the characteristics of the site is known, a final remedy will be selected to address any additional contaminants of concern in groundwater at depths greater than 15 feet and contaminants of concern in other environmental media.

4. Based on initial studies at the site, have the concentrations of TCE been increasing, and if so, why?

**Response.** The source of the TCE, a grease trap associated with Building 1294, has been removed; therefore, the potential for additional contamination of the groundwater by this source has been removed. Although higher concentrations of TCE were noted during the treatability study in downgradient monitor wells, subsequent sampling events indicate the TCE concentrations are not increasing.

5. How much heat does it take to chemically break down TCE?

**Response.** The reductive dechlorination of TCE does not require an outside energy source. The breakdown of TCE is caused by an electron transfer process.



## D. STATE CONCERNS

The State of Wyoming, Department of Environmental Quality agrees with the Air Force's selection of the iron filings wall as the preferred alternative to be used for shallow groundwater treatment at Spill Site 7. The agency has expressed some concerns regarding the proposed configuration for the wall and its ability to treat shallow groundwater contamination across the site, particularly groundwater associated with the source area for much of the contamination noted at the site. It is the state's position that groundwater flow at the site, especially relative to the area where the grease trap was located, has not been well characterized and appears to be moving in a radial direction which would result in incomplete interception by the treatment wall. The wall is planned to be located on the northern portion of the site, as proposed in the FS. Additionally, the state would like to see, as an immediate benefit of the wall's installation, a decrease of discharge of contaminants to the creek such that water quality criteria for TCE and related contaminants are met. However, it is not known at this time whether the wall will intercept an adequate zone of groundwater to accomplish this. Additionally, data collected to date suggests that the greater mass of contamination at the site is located deeper in the aquifer than the wall will extend. The construction of the preferred alternative will not preclude the incorporation, at a later date, of a remedy designed to address deeper zone contamination. The state has agreed to the preferred alternative with the understanding that the performance of the remedial action will be monitored to determine both the horizontal and vertical extent of contaminant reduction resulting from the implementation of the remedy.

The state does not agree with the methods used to estimate the length of time needed for Alternatives 2 and 3 to achieve the objectives of this interim action. Estimates suggest that cleanup may be achieved more quickly with Alternative No. 3 than Alternative No. 2; however, there is considerable difficulty in accurately predicting the length of time until cleanup is achieved for either option and the potential margin of error is not necessarily consistent for both alternatives.

## E. COMMUNITY RELATIONS

The Proposed Plan for the ROD was published in July 1997. Display advertisement providing notice of the Proposed Plan and the public meeting were published on July 13, 1997 in the *Wyoming Tribune-Eagle* and in the *Casper Star-Tribune*. A copy of the Proposed Plan was placed in the Administrative Record on July 24, 1997. The Administrative Record locations are:

Laramie County Library	90 CES\CEVR
Reference Section	Environmental Restoration Section
2800 Central Avenue	6203 15 <sup>th</sup> Cavalry Avenue, Building 367
Cheyenne, WY 82001	F.E. Warren AFB, WY 82005-2788
Phone: (307) 634-3561	Phone: (307) 773-3468

Due to a delay in distribution of the Proposed Plan to persons or groups on the mailing list, USAF extended the closure of the original public comment period and held an additional public meeting. The extension of the public comment period and the additional public meeting were announced on August 24, 1997 through notices in the *Wyoming Tribune-Eagle* and in the *Casper Star-Tribune*. A copy of the Proposed Plan was sent to all persons or groups on the mailing list.

All of the newspaper advertisements and mailings were coordinated among USAF, EPA, and WDEQ before publication or distribution. In addition to the paid advertisements, USAF issued press releases. An article describing the public meeting was published in the *Casper Star-Tribune* on August 20, 1997, and an article appeared in the *FEW Sentinel* newspaper on August 29, 1997.

**ATTACHMENT A**

**APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS**

**INTERIM REMEDIAL ACTION**

**OPERABLE UNIT 2**

**Shallow groundwater at Spill Site 7**

**F.E. WARREN AIR FORCE BASE**

**TABLE A-1**  
**Chemical-Specific ARARs**  
**Operable Unit 2, Spill Site 7**

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant/Not Appropriate	Comments
<b>FEDERAL</b>				
<b>SAFE DRINKING WATER ACT</b>	42 USC Sec. 300G	--	--	--
National Primary Drinking Water Regulations	40 CFR 141, Subparts B and G	Establish health-based standards for the public water systems (maximum contaminant levels)	No/Yes	Groundwater is a potential or actual source of drinking water. This IRA is due to groundwater contamination from particular ICOCs. MCLs for these ICOCs and contaminants or constituents that are specifically attributable to the remedial action alternatives are relevant and appropriate at the agreed point of compliance.
Maximum Contaminant Level Goals	40 CFR 141, Subpart F	Establish drinking water quality goals set at levels of no known or anticipated adverse health affects, with an adequate margin of safety.	No/Yes	Groundwater is a potential or actual source of drinking water. This IRA is due to groundwater contamination. However, there are no MCLGs that are relevant for the ICOCs in this IRA.
<b>CLEAN AIR ACT</b>	42 USC Sec. 7401-7642	--	--	--
National Emission Standards for Hazardous Air Pollutants	40 CFR 60 and 61, Subpart A	Establish regulatory standards for specific hazardous air pollutants	No/Yes	Relevant and appropriate during construction or maintenance of the selected IRA and operation of Alternative No. 3, if it is the selected remedial alternative. Applicable under those circumstances if the source meets the definition of a major source of hazardous air pollutants.
<b>STATE OF WYOMING</b>				
<b>WYOMING ENVIRONMENTAL QUALITY ACT</b>	W.S. 35-11-101 to 35-11-1428	--	--	--
	Article 2, W.S. 35-11-201	Addresses discharge or emission of air contaminants	Yes/NA	Compliance with state air quality numeric and other substantive requirements identified as ARARs satisfies all requirements of this provision.
	Article 3, W.S. 35-11-301	Prohibits certain acts without a permit	Yes/NA	Compliance with state water quality substantive requirements (permits are not required) identified as ARARs satisfies all requirements of this provision.

**TABLE A-1 (Continued)**  
**Chemical-Specific ARARs**  
**Operable Unit 2, Spill Site 7**

Standard, Requirement, Criteria, or Limitation	Citations	Description	Applicable/Relevant and Appropriate	Comments
<b>WYOMING WATER QUALITY RULES AND REGULATIONS</b>	Chapter I, Section 13	Toxic Materials	Yes/NA	Applicable to those contaminants and/or constituents that are specifically attributable to the selected IRA, but not the ICOCs. Compliance with other state water quality substantive requirements satisfies all requirements of this provision.
	Chapter I, Section 21(a, c)	Protection of aquatic life	Yes/NA	Ammonia is not anticipated and monitoring is not required. Applicable to those contaminants and or constituents that are specifically attributable to the selected IRA.
	Chapter I, Section 22	Radioactive Material	Yes/NA	Radioactive materials are not anticipated and monitoring is not required. Applicable to contaminants and or constituents that are specifically attributable to the selected IRA.
	Chapter I, Section 24	Dissolved Oxygen	Yes/NA	Not applicable unless affected waters upgraded to class 2.
	Chapter I, Section 26	pH	Yes/NA	
	Chapter I, Section 29	Oil and grease	Yes/NA	Primarily applicable during construction. Although discharges are not anticipated, may be applicable during any maintenance.
	Chapter VIII	Quality Standards for Wyoming Groundwaters	Yes/NA	Groundwater is a potential or actual source of drinking water. This IRA is due to groundwater contamination. Regarding Section I, compliance with other state water quality substantive requirements (permits are not required) identified as ARARs satisfies all requirements of this provision. Applicable to those contaminants and or constituents that are specifically attributable to the selected IRA and the ICOCs at the agreed point of compliance.
	Chapter XVII, Appendix A, Sections III, IX	Establishes standards for LUST remediation actions	No/Yes	This IRA is being conducted as a result of groundwater contamination. Compliance with Federal Safe Drinking Water Program Maximum Contaminant Levels for ICOCs satisfies relevant and appropriate requirements of these provisions.

**TABLE A-1 (Continued)**  
**Chemical-Specific ARARs**  
**Operable Unit 2, Spill Site 7**

Standard, Requirement, Criteria, or Limitation	Citations	Description	Applicable, Relevant, and Appropriate	Comments
WYOMING HAZARDOUS WASTE RULES AND REGULATIONS	Chapter 1	Overview and definitions	Yes/NA	If hazardous waste is generated, this chapter would apply. Applicable as necessary to implement other substantive requirements.
	Chapter 2	Identification and Listing of Hazardous Waste	Yes/NA	If hazardous waste is generated, this chapter would apply. Applicable in identifying listed or characteristic hazardous waste subject to other substantive requirements.

**Notes:**

ARARs = Applicable or relevant and appropriate requirements  
CFR = Code of Federal Regulations  
EPA = U.S. Environmental Protection Agency  
ICOC = Indicator contaminants of concern  
LUST = Leaking Underground Storage Tank  
MCL = Maximum contaminant level  
MCLGs = Maximum contaminant level goals  
NA = Not applicable  
Sec. = Section  
USC = U.S. Code  
W.S. = Wyoming Statute

**TABLE A-2**  
**Chemical-Specific ARAR Standards**  
**Operable Unit 2, Spill Site 7**

Analyte	Federal MCL (mg/L)	WDEQ C-MCL (mg/L)
Trichloroethylene <sup>1</sup>	5.0	5.0
1,2-dichloroethene (total) <sup>1</sup>	5.0	5.0
<i>cis</i> 1,2-dichloroethene <sup>1</sup>	70.0	70.0
<i>trans</i> 1,2-dichloroethene <sup>1</sup>	100.0	100.0
Vinyl Chloride <sup>1</sup>	2.0	2.0

**Notes:**

WDEQ Drinking Water Equivalent Level standards have not been listed because all analytes listed above hold a respective federal MCL that takes precedence (as per WDEQ Chapter XVII, Appendix I).

<sup>1</sup> Contaminants listed are considered indicator contaminants of concern in the OU2, SS7 Focused Remedial Investigation, 1996.

-- = None listed  
MCL = Maximum contaminant level  
mg/L = Milligrams per liter  
WDEQ = Wyoming Department of Environmental Quality

**TABLE A-3**  
**Action-Specific ARARs**  
**Operable Unit 2, Spill Site 7**

Requirement, Criteria, or Limitation	Citations	Description	Applicable, Relevant, and Appropriate	Comments
<b>FEDERAL</b>				
<b>CLEAN WATER ACT</b>	33 USC Sec.1251-1376	--	--	--
NPDES Storm Water Regulations	40 CFR Part 122	Establishes requirements for discharge of storm waters	Yes/NA	Storm water may occur from the site making substantive requirements applicable.
Criteria and Standards for the National Pollutant Discharge System	40 CFR Part 125	Provides discharge criteria, chemical standards, and permit forms for existing industrial operations	Yes/NA	Although permits are not required, substantive provisions are applicable to remedial actions (Alternative No. 3) that cause discharge to waters of the U.S.
National Pretreatment Standards: Prohibited Discharges	40 CFR 403.5	Establishes National Pretreatment Standards to control pollutants that pass through POTWs	Yes/NA	Applicable if Alternative No. 3 is selected and the option to discharge treated water to the POTW is selected.
<b>CLEAN AIR ACT</b>	42 USC 7401-7642	--	--	--
National Emissions Standards for Hazardous Air Pollutants	40 CFR Part 60 and 61, Subpart A	Establishes emissions standards for specific hazardous air pollutants	No/Yes	Relevant and appropriate during construction or maintenance of the selected IRA and operation of Alternative No. 3, if it is the selected IRA. Applicable under those circumstances if the source meets the definition of a major source of hazardous air pollutants.
National Primary and Secondary Ambient Air Quality Standards	40 CFR Part 50	Establishes standards for ambient air quality to protect public health and welfare (including standards for particulate matter and lead)	Yes/NA	Emissions from IRA process will be subject to NAAQS unless state standards are more stringent.
<b>RESOURCE CONSERVATION AND RECOVERY ACT</b>	42 USC Sec. 6901, et. seq.	--	--	--
Air Emissions Standards for Process Vents	40 CFR 264, Subpart AA	Establishes air emission requirements for process units	No/Yes	Relevant and appropriate if Alternative No. 3 is selected. Although hazardous waste is not anticipated to exceed the threshold, applicable if air stripping operations treat hazardous wastes that have a total organics concentration of 10 parts per million by weight or greater.
<b>STATE OF WYOMING</b>				
<b>WYOMING ENVIRONMENTAL QUALITY ACT</b>	Article 2, W.S. 35-11-201 to 35-11-212	Discharge or emission of air contaminants	Yes/NA	Compliance with state air quality numeric and other substantive requirements identified as ARARs satisfies all requirements of this provision.

**TABLE A-3 (Continued)**  
**Action-Specific ARARs**  
**Operable Unit 2, Spill Site 7**

Standard, Requirement, Criteria, or Limitation	Citations	Description	Applicable/Relevant and Appropriate	Comments
	Article 3, W.S. 35-11-301	Prohibits certain acts without a permit.	Yes/NA	Compliance with state water quality substantive requirements (permits are not required) identified as ARARs satisfies all requirements of this provision.
<b>WYOMING WATER QUALITY RULES AND REGULATIONS</b>	Chapter I, Section 10	Testing Procedures	Yes/NA	However, where standard methods of testing have not been established, the suitability of testing procedures shall be determined by USAF in consultation with WDEQ and EPA using defensible scientific methods.
	Chapter I, Section 11(a, b)	Flow conditions	Yes/NA	
	Chapter I, Section 12	Protection of Wetlands	Yes/NA	An authorized wetlands mitigation process includes any process under Section 404 of the Federal Clean Water Act or under U.S. Army Corps of Engineers wetlands regulations.
	Chapter I, Section 14	Dead animals and solid waste	Yes/NA	Primarily applicable during construction and any maintenance of the selected IRA.
	Chapter I, Sections 15, 16, 17(a-c)	Settleable solids; floating and suspended solids; and taste, odor and color.	Yes/NA	Primarily applicable during construction of the IRA, and although discharges are not anticipated, may be applicable during any maintenance.
	Chapter I, Section 23(a, b)	Turbidity	Yes/NA	Section 23(a) is not applicable unless affected waters are upgraded to Class 2.
	Chapter I, Section 28	Undesirable aquatic life	Yes/NA	If undesirable aquatic life is specifically attributable to the selected IRA, this section is applicable.
	Chapter III, Section 4(e), 6(d), 7(c), 8(a-f)	Construction, installation or modification of facilities capable of causing or contributing to pollution	Yes/NA	Substantive provisions apply, but no permits are required.
	Chapter IV, Sections 4(a) (i, iii), (b-c), 5, 7, 8	Releases of oil and hazardous substances	Yes/NA	Compliance with other water quality substantive requirements identified as ARARs satisfies all requirements of Section 5.
	Chapter VIII	Water Quality Standards for Wyoming Groundwater.	Yes/NA	Groundwater is a potential or actual source of drinking water. Applicable to those contaminants and or constituents that are specifically attributable to the selected IRA and the ICOCs at the agreed point of compliance.
	Chapter XI, Part G	Standards for the Design and Construction and for the Abandonment of Monitor Wells	Yes/NA	Substantive requirements apply (permits are not required) if monitor wells are constructed or abandoned.



**TABLE A-3 (Continued)**  
**Action-Specific ARARs**  
**Operable Unit 2, Spill Site 7**

Standard, Requirement, Criteria, or Limitation	Citations	Description	Applicable/Relevant and Appropriate	Comments
<b>WYOMING AIR QUALITY STANDARDS AND REGULATIONS</b>	Section 14	Control of particulate emissions	Yes/NA	Primarily applicable during construction and any maintenance of IRA.
	Section 16(a), (c)	Odors	Yes/NA	Applicable if Alternative No. 3 is selected. No monitoring is required.
	Section 19	Abnormal conditions and equipment malfunctions	Yes/NA	Primarily applicable during construction and any maintenance of IRA.
	Section 21(c)(v) and (j)	Requirements for construction, modification, and operations	Yes/NA	
<b>WYOMING HAZARDOUS WASTE RULES AND REGULATIONS</b>	Chapter 1	Overview and Definitions	Yes/NA	If hazardous waste is generated, this chapter would apply. Applicable as necessary to implement other substantive requirements.
	Chapter 8	Standards for Generators of Hazardous Waste	Yes/NA	If hazardous waste is generated, this chapter would apply.
	Chapter 9	Standards for Transporters of Hazardous Waste	Yes/NA	If hazardous waste is generated, this chapter would apply.
	Chapter 10	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	Yes/NA	Applicable if hazardous waste is treated on site, except when treated in a container, or if hazardous waste is accumulated on site for more than 90 days. Storage of hazardous waste longer than 90 days is not anticipated.
	Chapter 11, Sections 4(g), 5, 6, 9(b) and (e), 10, 11 (except (h)(iii) and (k), 24, 31	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	Yes/NA	If hazardous waste is generated, these provisions would apply. Chapter 8, Section 3(e) refers to these requirements for a generator that accumulates hazardous waste on site for 90 days or less.
	Chapter 13	Land Disposal Restrictions	Yes/NA	If hazardous waste is generated, these provisions would apply.

**TABLE A-3 (Continued)**  
**Action-Specific ARARs**  
**Operable Unit 2, Spill Site 7**

Standard, Requirement, Criteria, or Limitation	Citations	Description	Applicable/Relevant and Appropriate	Comments
<b>LOCAL</b>				
<b>ORDINANCES RELATED TO THE DISCHARGE OF UNSANITARY OR CONTAMINATED WASTES</b>	City of Cheyenne Code, Chapter 45	Discharge of effluent water	Yes/NA	If Alternative No. 3 is selected and wastewater is discharged to the CBPU POTW, local pretreatment standards and requirements will be applicable.

**Notes:**

ARARs = Applicable or relevant and appropriate requirements  
 BACT = Best available control technology  
 CAMU = Corrective action management unit  
 CFR = Code of Federal Regulations  
 EPA = U.S. Environmental Protection Agency  
 FR = Federal regulation  
 GAC = Granular activated carbon  
 ICOCs = Indicator contaminants of concern  
 NA = Not applicable  
 NESHAPS = National Emission Standards for Hazardous Air Pollutants  
 NPDES = National Pollution Discharge Elimination System  
 POTW = Publicly Owned Treatment Works  
 RCRA = Resource Conservation and Recovery Act  
 Stat = Statute  
 USC = U.S. Code  
 UST = Underground Storage Tank  
 W.S. = Wyoming Statute

**Table A-4  
Location-Specific ARARs  
Operable Unit 2, Spill Site 7**

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable, Relevant and Appropriate	Comments
<b>FEDERAL—NA</b>				
<b>STATE OF WYOMING</b>				
<b>WYOMING WATER QUALITY RULES AND REGULATIONS</b>	Chapter I, Appendix A	Classifications for Diamond and Crow Creek	Yes/NA	If affected waters are upgraded, ARARs as listed herein for the upgraded stream classifications would be applicable to those contaminants and/or constituents that are specifically attributable to the selected IRA, but not the ICOCs.
	Chapter VIII	Quality Standards for Wyoming Groundwaters	Yes/NA	Groundwater is a potential or actual source of drinking water. Applicable to those contaminants and or constituents that are specifically attributable to the selected IRA and the ICOCs at the agreed point of compliance.

**Notes:**

ARARS = Applicable or relevant and appropriate requirements  
ICOCs = Indicator contaminants of concern  
NA = Not applicable

**TABLE A-5**  
**Temporarily Waived Federal and Wyoming State ARARs**  
**Operable Unit 2, Spill Site 7**

Standard, Requirement, Criteria, or Limitation	Citation	Description	Rationale for Waiver
<b>FEDERAL</b>			
<b>SAFE DRINKING WATER ACT</b>	42 USC, Section 300G		
National Primary Drinking Water Regulations	40 CFR 141, Subparts B and G	Maximum Contaminant Levels	Interim measures waiver for contaminants and/or constituents that are not specifically attributable to the remedial alternatives and are not ICOCs.
Maximum Contaminant Level Goals	40 CFR 141, Subpart F	Establish drinking water quality goals	Interim waiver for contaminants and/or constituents that are not specifically attributable to the remedial alternatives and are not ICOCs.
<b>STATE OF WYOMING</b>			
<b>WYOMING WATER QUALITY RULES AND REGULATIONS</b>	Chapter I, Section 13	Toxic Materials	Interim waiver for those contaminants or constituents that are not specifically attributable to the selected IRA and the ICOCs.
	Chapter I, Section 18	Human Health	Not applicable unless the affected waters are upgraded to Class 2.
	Chapter I, Section 21(a-c)	Protection of Aquatic Life	Interim waiver for those contaminants and/or constituents that are not specifically attributable to the selected IRA and the ICOCs.
	Chapter I, Section 22	Radioactive Material	Although radioactive materials are not anticipated and monitoring is not required, an interim waiver applies for those contaminants and/or constituents that are not specifically attributable to the selected IRA.
	Chapter VIII	Water Quality Standards for Wyoming Groundwater	Interim waiver for those contaminants or constituents that are not specifically attributable to the selected IRA.

**Notes:**

ARARS = Applicable or relevant and appropriate requirements  
ICOCs = Indicator contaminants of concern

**ATTACHMENT B**

**RISK ASSESSMENT SUMMARY TABLES  
INTERIM REMEDIAL ACTION  
OPERABLE UNIT 2  
Shallow Groundwater at Spill Site 7  
F.E. WARREN AIR FORCE BASE**

**TABLE B-1**  
**Groundwater Preliminary Remediation Goals**  
**Operable Unit 2, Spill Site 7**

Indicator Contaminant of Concern	Remediation	
	RME	Mid-Range
<b>Carcinogenic Effect</b>		
Trichloroethene	1.54 µg/L	13.7 µg/L
<b>Noncarcinogenic Effect</b>		
1,2-dichloroethene (total)	328 µg/L	1,820 µg/L
Trichloroethene	210 µg/L	1,210 µg/L

**Notes:**

RME = Reasonable Maximum Exposure  
 µg/L = Micrograms per Liter

Source: USAF 1996a.

**TABLE B-2**  
**Carcinogenic Risk Analysis Summary**  
**Operable Unit 2, Spill Site 7**

Well Number	Indicator Contaminant of Concern	Indicator Contaminant of Concern Concentration (µg/L)	Min & Max Residential Risk	RME Residential Risk
GW-129	Trichloroethene	1.6	1.2E-07	1.0E-06
GW-171A	Trichloroethene	4.5	3.3E-07	2.9E-06
GW-171B	Trichloroethene	380.0	2.8E-05	2.5E-04
GW-172C	Trichloroethene	86.0	6.3E-06	5.5E-05
GW-173A	Trichloroethene	74.0	5.4E-06	4.8E-05
GW-173A-A	Trichloroethene	71.0	5.2E-06	4.6E-05
GW-173B	Trichloroethene	750.0	5.5E-05	4.8E-04
GW-173SS	Trichloroethene	1,000.0	7.3E-05	6.5E-04
GW-174	Trichloroethene	1.0	7.3E-08	6.5E-07
GW-174A	Trichloroethene	2.0	1.5E-07	1.3E-06
GW-174C	Trichloroethene	310.0	2.3E-05	2.0E-04
GW-27	Trichloroethene	180.0	1.3E-05	1.2E-04
GW-43	Trichloroethene	5.3	3.9E-07	3.4E-06
GW-67	Trichloroethene	76.0	5.5E-06	4.9E-05
GW-68	Trichloroethene	9,900.0	7.2E-04	6.4E-03
GW-69	Trichloroethene	9,700.0	7.1E-04	6.3E-03

**Notes:**

µg/L = Micrograms per Liter  
RME = Reasonable Maximum Exposure

Source: USAF 1996a

**TABLE B-3**  
**Noncarcinogenic Hazard Analysis Summary**  
**Operable Unit 2, Spill Site 7**

Well Number	Indicator Contaminant of Concern	Indicator Contaminant of Concern Concentration (µg/L)	Maximum Residual Hazard	RME Residual Hazard
GW-129	Trichloroethene	1.6	0.0013	0.0073
GW-171A	Trichloroethene	4.5	0.0037	0.021
GW-171B	1,2-dichloroethene (total)	8.6	0.0047	0.026
	Trichloroethene	380.0	0.31	1.7
	Cumulative hazard for well 171B		0.32	1.8
GW-172C	1,2-dichloroethene (total)	73.0	0.04	0.22
	Trichloroethene	86.0	0.07	0.39
	Cumulative hazard for well 172C		0.11	0.62
GW-173SS	Trichloroethene	1,000.0	0.82	4.6
GW-174	Trichloroethene	1.0	0.00082	0.0046
GW-174A	Trichloroethene	2.0	0.0016	0.0091
GW-174C	Trichloroethene	310.0	0.25	1.4
GW-27	1,2-dichloroethene	28.0	0.015	0.085
	Trichloroethene	180.0	0.15	0.82
	Cumulative hazard for well 27		0.16	0.91
GW-43	1,2-dichloroethene (total)	1.8	0.00099	0.0055
	Trichloroethene	5.3	0.0043	0.024
	Cumulative hazard for well 43		0.0053	0.03
GW-67	Trichloroethene	76.0	0.062	0.35
GW-68	Trichloroethene	9,900.0	8.1	45.0
GW-69	1,2-dichloroethene	400.0	0.22	1.2
	Trichloroethene	9,700.0	8.0	44.0
	Cumulative hazard for well GW-69		8.22	45.2

**Notes:**

µg/L = Micrograms per Liter  
RME = Reasonable Maximum Exposure

Source: USAF 1996a.