UNITED STATES AIR FORCE
ELMENDORF AIR FORCE BASE, ALASKA

ENVIRONMENTAL RESTORATION PROGRAM

FIVE-YEAR REVIEW
Second Five-Year Review Report

Final Report

NOVEMBER 2003

ERRATA Sheet

After this document was signed by the Air Force, minor errors were identified by the agencies. This errata sheet serves to correct those minor errors.

- New Table 4-9. Table 4-9 in the Five-Year Review does not identify the correct cleanup levels at SD25. The new table below reflects the correct cleanup levels as referenced in the record of decision for Operable Unit 4.

Table 4-9

Cleanup Levels at OU4

Location	Contaminant of Concern	ROD-Established Cleanup Level	Source of Requirements
Groundwater (μg/L)			
FT23	1,1,1-Trichloroethane	200	MCL[1]
	1,1-Dichlororethene	7	MCL[1]
	1,2-Dichloroethane	6	MCL[1]
	Tetrachloroethene	6	MCL[1]
	Trichloroethene	6	MCL[1]
	1,2-Dichloroethene	70	MCL[1]
	Benzene	5	MCL[1]
SD25	Benzene	5	MCL[1]
	Ethylbenzene	700	MCL[1]
	Toluene	1,000	MCL[1]
SD24, SD26, SD27	Benzene	5	MCL[1]
SD28, SD29	Tetrachloroethene	5	MCL[1]
	Trichloroethene	5	MCL[1]
Soil (mg/kg)			
FT23	DRO	2,000	ACM[2]
	GRO	1,000	ACM[2]
SD25	DRO	2,000	ACM[2]
	GRO	1,000	ACM[2]
SS10	DRO	2,000	ACM[2]
	Jet Fuel	2,000	ACM[2]
	Xylene	100	ACM[2]
	GRO	1,000	ACM[2]

[1]40 CFR Part 131, and 18 ACC Chapter 70.010a and d, 70.015 through 70.0110, 18 AAC 80.070.
[2]ACM – Alaska Cleanup Matrix Level D, 18 AAC 78.315.
Note: There are no cleanup levels for soil at SD26, SD27, SD28, and SD29 because contaminant levels were below regulatory standards at the time of the ROD

- New Table 4-22. Table 4-22 in the Five-Year incorrectly described the land use controls at WP14. WP14 is not a landfill or disposal site and there are no "Restricted Use Area" land use controls. The only land use controls at WP14 pertain to groundwater restrictions. In addition, the land use controls for OU1 and SD15 have been clarified.

Table 4-22

Site-Specific Land Use Controls, Elmendorf AFB

OU (Site)	Land Use Control (LUC) Description	Expected Year of LUC Expiration
1	"Restricted Use Area" designated for recreational use and construction of unmanned facilities (such as parking lots, storage buildings, etc.). The construction of manned facilities (such as office buildings or residential structures) is strictly prohibited. Excavation affecting the integrity and function of the landfill caps, or impacting the shallow groundwater table is not allowed.	2033[1]
2 (ST41)	"Restricted Use Area" designated for recreational use of the parcel (such as cross-country skiing, etc.) and construction of unmanned facilities (such as parking lots, storage buildings, or taxiways). The construction of manned facilities (such as office buildings or residential structures) is strictly prohibited. As long as hazardous substances remain on this site at levels that preclude unrestricted use, groundwater development and the use of the groundwater at this site for any purpose including, but not limited to, drinking, irrigation, fire control, dust control or any other activity is prohibited.	2016
3	No site-specific LUCs are in effect at OU3.	
4	"Airfield Use Area" designated for aircraft O&M, which include active and inactive runways, taxiways, and parking aprons for aircraft. The establishment of residential development of the areas is strictly prohibited.	2006
5	No site-specific LUCs are in effect at OU5.	
6 (LF02)	"Restricted Use Area" designated for recreational use of the parcel (such as cross-country skiing, etc.) and construction of unmanned facilities (such as parking lots, storage buildings, or taxiways). The construction of manned facilities (such as office buildings or residential structures) is strictly prohibited. Drilling into the shallow aquifer is restricted by the Base Comprehensive Plan. As a former landfill, this designation will remain indefinitely.	Indefinite

Table 4-22 (Continued)

OU (Site)	Land Use Control (LUC) Description	Expected Year of LUC Expiration
6 (LF03)	"Restricted Use Area" designated for recreational use of the parcel (such as cross-country skiing, etc.) and construction of unmanned facilities (such as parking lots, storage buildings, or taxiways). The construction of any sort of manned facilities (such as office buildings or residential structures) is strictly prohibited. As a former landfill, this designation will remain indefinitely. This site is also permanently included in the "accident potential zone" which further restricts the construction of any above ground facilities at this location.	Indefinite
6 (LF04)	"Restricted Use Area" designated for recreational use of the parcel (such as cross-country skiing, etc.) and construction of unmanned facilities (such as parking lots, storage buildings, or taxiways). The construction of any sort of manned facilities (such as office buildings or residential structures) is strictly prohibited. As a former landfill, this designation will remain indefinitely. The use of contaminated groundwater throughout LF04 for any purpose including, but not limited to, drinking, irrigation, fire control, dust control or any other activity is prohibited. Drilling into the shallow aquifer is also restricted.	Indefinite
6 (SD15)	Land use controls restrict access to contaminated groundwater throughout the site. Installation of wells in the contaminated plume for residential, industrial, or agricultural use will be prohibited until cleanup levels have been achieved.	TBD[2]
6 (WP14)	Land use controls restrict access to contaminated groundwater throughout the site. Installation of wells in the contaminated plume for residential, industrial, or agricultural use will be prohibited until cleanup levels have been achieved.	2011
(SA100)	No site-specific LUCs are in effect at SA100.	

Notes:
[1] OU1 ROD states that land use controls will continue until groundwater clean up goals are reached. Currently at OU1 groundwater clean up goals have been reached at LF05, LF07, LF13 and OT56 and the land use controls at these sites within OU1 will expire once a closure document for these sites are signed. After LF05, LF07, LF13, and OT56 close document is signed, then land use controls will be in effect for LF59 only.

[2] The land use controls at SD15 will continue until groundwater clean up goals are reached. A groundwater model will be completed in FY05 and this model should provide an estimate on how long the land use controls will continue.

LEAD AGENCY ACCEPTANCE
SECOND FIVE-YEAR REVIEW
ELMENDORF AIR FORCE BASE

This signature sheet documents the United States Air Force acceptance of the second Five-Year Review for Elmendorf Air Force Base.

17 Dec 03

JAMES P. STURCH
Colonel, United States Air Force
Vice Commander

DATE

SUPPORT AGENCY ACCEPTANCE
SECOND FIVE-YEAR REVIEW
ELMENDORF AIR FORCE BASE

This signature sheet documents the United States Environmental Protection Agency acceptance of the second Five-Year Review for Elmendorf Air Force Base.

FOR

MICHAEL F. GEARHEARD, Director
Environmental Cleanup Office
Region X
U.S. Environmental Protection Agency

1/27/04
DATE

SUPPORT AGENCY ACCEPTANCE
SECOND FIVE-YEAR REVIEW
ELMENDORF AIR FORCE BASE

The State of Alaska Department of Environmental Conservation concurs with the second Five-Year Review for Elmendorf Air Force Base.

John Halverson

JOHN HALVERSON
DoD Oversight Section Manager
Alaska Department of Environmental Conservation

1/27/04

DATE

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Attachment B Cleanup Levels, Toxicity, and Risk Evaluation
Attachment C Basewide Groundwater Monitoring Program Figures
Attachment D Site Inspection Checklists
Attachment E Interview Documentatio

ACRONYMS AND ABBREVIATIONS

µg/L	micrograms per liter
AAC	Alaska Administrative Code
ACM	Alaska Cleanup Matrix
ADEC	Alaska Department of Environmental Conservation
AFB	Air Force Base
AFCEE	Air Force Center for Environmental Excellence
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and total xylenes
CEB	Community Environmental Board
CES	Civil Engineering Squadron
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	contaminant of concern
COPC	contaminant of potential concern
DRO	diesel range organics
EE/CA	engineering evaluation/cost analysis
EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency
FFA	Federal Facilities Agreement
FTA	fire training area
FY	fiscal year
GRO	gasoline range organics
HVE	high-vacuum extraction
HpCDD	heptachlorodibenzo-p-dioxin
HxCDD	hexachlorodibenzo-p-dioxin
IRA	Interim Remedial Action
LUC	land use control
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
mg/kg/day	milligrams per kilogram per day
NA	not applicable
ND	non-detect (not detected)
NCP	National Contingency Plan
NFA	no further action
NPL	National Priorities List
O&M	operation and maintenance
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PAH	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyl
PeCDD	pentachlorodibenzo-p-dioxin
PeCDF	pentachlorodibenzofuran
POL	petroleum, oils, and lubricants
RAO	remedial action objective
RBC	risk-based concentrations

ACRONYMS AND ABBREVIATIONS (Continued)

RCRA	Resource Conservation and Recovery Act
RRO	residual range organics
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SVE	soil vapor extraction
SWQC	surface water quality criteria
TAH	total aromatic hydrocarbon
TaqH	total aqueous hydrocarbon
TBC	to be considered
TCDD	tetrachlorodibenzo-p-dioxin
TCDF	tetrachlorodibenzofuran
TCE	trichloroethylene (trichloroethene)
TCLP	Toxicity Characteristic Leaching Procedure
TFH	Total Fuel Hydrocarbons
TVH	Total Volatile Hydrocarbons
USAF	U.S. Air Force
UST	underground storage tank
VOC	volatile organic compound
WRS	wetland remediation system

EXECUTIVE SUMMARY

The purpose of this five-year review is to evaluate the implementation and performance of the remedial actions that were selected in Record of Decision (ROD) for each Operable Unit (OU). The contaminant sources at Elmendorf Air Force Base (AFB), Alaska are grouped into six areas including OU1, OU2, OU4, OU5, OU6, and SA100. The remedies vary by site and have included contaminated soil and debris removal, institutional controls, monitored natural attenuation of contaminated groundwater, and operation and monitoring of several active remediation systems such as free-product recovery, high-vacuum extraction (HVE), constructed wetland, and in-situ bioventing. This is the second five-year review for Elmendorf AFB. The trigger for this review was the signing of the first five-year review report on November 4, 1998.

The Five-Year Review Summary Form on the following pages presents the issues that were identified during the review, associated recommendations and follow-up actions, and protectiveness statements for each area.

The assessment of this five-year review found that the remedies were constructed and in general, are operating and functioning as intended by decision documents. For the source areas within OU1, OU2, OU4, and OU6 that have not met groundwater cleanup levels, the remedies are expected to be protective of human health and the environment upon attainment of groundwater cleanup levels through natural attenuation. At some sites (i.e., OU2, OU4, OU5, OU6) it is expected to take longer to achieve these goals than predicted in the RODs. In addition, a treatability study that includes system optimization efforts is underway to address remaining soil contamination at OU6 and the remedy is expected to be protective upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled (i.e., with land use controls).

The remedy at OU5 currently protects human health and the environment in the short-term because, at present, TCE has not exceeded cleanup levels at the point of compliance (i.e., Ship Creek). However, in order for the remedy to be protective in the long-term, Seeps 9, 10, and 11 must be captured and treated, and investigation into the nature and extent of the TCE plume feeding the seeps at OU5 must be continued and evaluated to ensure long-term protectiveness.

The remedy at SA100, immediate response and removal action, is complete and protective of human health and the environment. Confirmation samples show that no contamination above background levels/regulatory cleanup levels remains and SA100 is acceptable for unlimited use and unrestricted exposure.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site name: Elmendorf Air Force Base		
EPA ID: AK8570028649		
Region: X	**State:** Alaska	**City/County:** Anchorage
SITE STATUS		
NPL Status: Currently on the Final NPL		
Remediation status: Operating		
Multiple OUs?: YES	**Construction completion date:** March 2010	
Has site been put into reuse? NO (some areas are being used)		
REVIEW STATUS		
Lead agency: U.S. Air Force		
Author/Organization: 3rd Civil Engineering Squadron, Environmental Restoration		
Review Period: December 2002 through August 2003		
Date(s) of site inspection: January—May, 2003		
Type of review: Post-SARA		
Review number: 2 (second)		
Triggering action: Previous Five-Year Review Report		
Triggering action date: November 4, 1998		
Due date (five years after triggering action date): November 4, 2003		

Issues (Refer to the next section/page for associated recommendations and follow-up actions):

1. Levels of benzene in the seep on the north side of ST41, and upgradient of the point of compliance, exceeded cleanup levels in 2002. Although it is expected that the point of compliance contaminant concentrations will be below Alaska surface water quality criteria as established in the OU2 ROD, the analytical suite doesn't include TAH and TAqH to ensure compliance with these criteria.
2. Additional contaminated seeps at OU5, not currently collected and treated by the remedy, were sampled and three seeps were found to have trichloroethene (TCE) levels above cleanup levels.
3. Although monitoring has shown that the remedies are reducing contaminants, it appears to be occurring at a slower rate than predicted by the RODs and/or models and cleanup levels may not be achieved within the timeframes specified in the RODs. This includes:
   - OU2: BTEX may not reach groundwater cleanup levels by 2016.
   - OU4: TCE concentrations in the East Plume; TCE, tetrachloroethane, and 1,2-dichloroethene in the fire training area Plume (FT23); and benzene in wells OU4W-04 and OU4W-06 may not reach groundwater cleanup levels by the target date of 2008. In addition, the bioventing system at FT23 was expanded in 2003 to address additional soil contamination discovered at this site. Therefore, soil cleanup levels in the new area may not be met by 2008.
   - OU5: TCE groundwater cleanup levels may not be met by 2026.
   - OU6: Monitoring trends indicate that COCs in groundwater at the WP14/LF04 South area may not meet cleanup levels by 2025; however, cleanup work as part of a State agreement at a nearby site is expected to improve the cleanup schedule. At SD15, benzene and TCE concentrations remain above groundwater cleanup levels and contaminant removal rates suggest that the high vacuum extraction (HVE) system is approaching design limitations and natural attenuation will be more heavily relied upon to reach groundwater cleanup levels and COCs may not reach cleanup levels within the timeframe (5 years of HVE operation) predicted in the OU6 ROD.
4. Possible migration of contaminants from soils having DRO, GRO, and BTEX concentrations exceeding ADEC ACM Level D cleanup criteria exists at two locations in relatively shallow soils above the perched aquifer at SD15. A treatability study is being implemented for the shallow soil locations to determine if HVE system modifications will effectively treat these areas.

Recommendations and Follow-up Actions (Item #s refer to Issue #'s in previous section):

1. To ensure compliance with Alaska surface water quality criteria as established in the OU2 ROD, sample for TAH and TAqH.
2. To address the three newly identified TCE-contaminated seeps at OU5, the USAF will contract design of additional discharge structures to capture and divert the seeps to the WRS in 2003. Construction will occur in 2004. The WRS will be operated and monitored until cleanup levels are met.
3. For groundwater, conduct a thorough review of modeling results and evaluate the potential for natural attenuation to achieve cleanup levels in the timeframes specified in the RODs. Revise and/or recalibrate the models, if needed. Continue groundwater monitoring according to the guidelines of the Basewide Groundwater Monitoring Program until cleanup levels are met. For OU4, continue bioventing at the new site until soil cleanup levels are met.
4. Monitor effectiveness of the recently implemented treatability study (modifications to the HVE system at SD15) and verify effectiveness of treating shallow soils at the two areas of contamination.

In addition to the recommendations and follow-up actions presented above, several additional recommendations are suggested to optimize the remedy and/or minimize unnecessary costs. These include:

- In OU1, cleanup levels have been met at sites LF05, LF07, LF13 and OT56. Wells at these sites should be removed from the Basewide Groundwater Monitoring Program and the sites are recommended for closure.
- In OU4, close the bioventing system at SD25 because it has been documented that residential soil cleanup levels have been reached.
- Monitor for natural attenuation of groundwater at a reduced frequency as determined by the Decision Guide for Monitoring Well Sampling Frequency (Attachment C, Figure C-2). These include:
  - Discontinue monitoring for manganese at LF59 because manganese concentrations have been below the ROD-specified cleanup level for two consecutive sampling rounds in all wells.
  - Review and revise the frequency of sampling for some wells in OU4, OU5, and OU6 in accordance with the decision guide (USAF, 2002f). Several wells in OU4 have been shown to meet COC cleanup levels and warrant less frequent monitoring; benzene monitoring may be reduced at wells within OU5 that have historically been below cleanup levels; TCE monitoring may be reduced at several OU6 wells that have consistently been below cleanup levels; and some wells associated with unstable plumes in OU5 may require more frequent monitoring.
- Annual sediment sampling at ST37 in OU5 has been conducted annually since 1997 and none of the sediment samples have contained fuel constituents (i.e., TFH-diesel, BTEX, PAH) at concentrations above State regulatory cleanup levels. Sediment results collected to date are sufficient to demonstrate that significant levels of COCs are not accumulating in the sediment in the Wetland Cell or Beaver Pond; therefore, sediment monitoring at ST37 should be discontinued.
- A site closure report demonstrates applicable cleanup levels, acceptable for residential use, have been met and land use controls are not needed at SA100; therefore, USAF considers this site closed following this five-year review and it is not necessary to include SA100 in subsequent five-year reviews.

FIVE-YEAR REVIEW SUMMARY FORM (Continued)

Protectiveness Statements:

- The remedy at OU1 is expected to be protective of human health and the environment upon attainment of groundwater cleanup levels, through natural attenuation, at one remaining site (LF59). In the interim, exposure pathways that could result in unacceptable risks are being controlled.
- The remedy at OU2 is expected to be protective of human health and the environment upon attainment of groundwater cleanup levels, through natural attenuation, at ST41. In the interim, exposure pathways that could result in unacceptable risks are being controlled.
- The remedy at OU4 is expected to be protective of human health and the environment upon attainment of soil cleanup levels through bioventing at two remaining sites (FT23 and SS10) and attainment of groundwater cleanup levels through natural attenuation. In the interim, exposure pathways that could result in unacceptable risks are being controlled.
- The remedy at OU5 currently protects human health and the environment in the short-term because at present, TCE has not exceeded cleanup levels at the point of compliance (i.e., Ship Creek). However, in order for the remedy to be protective in the long-term, Seeps 9, 10, and 11 must be captured and treated, and the investigation into the nature and extent of the TCE plume feeding the seeps at OU5 must be continued and evaluated to ensure long-term protectiveness.
- For OU6 the following protectiveness statements apply:
  - The remedy at LF04 North/Beach is protects human health and the environment by annual removal of exposed landfill debris. In the interim, exposure pathways that could result in unacceptable risks are being controlled.
  - The remedies at LF04 South, WP14 and LF02 are expected to be protective of human health and the environment upon attainment of groundwater cleanup goals through natural attenuation and recovery of free product (at LF04 South and WP14). In the interim, exposure pathways that could result in unacceptable risks are being controlled.
  - At SD15, the remedy currently protects human health and the environment in the short-term because the HVE has significantly reduced contamination and LUCs are in place to eliminate known points of exposure. However, in order for the remedy to be protective in the long-term, methods to treat the remaining areas of shallow soil contamination must be implemented or continued, as needed following evaluation of the treatability study that is currently in progress.
- The remedy (immediate response and removal actions) at SA100 is complete and protective of human health and the environment. Confirmation samples show that no contamination above background levels/regulatory cleanup levels remains and the site is acceptable for unlimited use and unrestricted exposure.