FIFTH FIVE-YEAR REVIEW REPORT FOR CERCLA SITES JBER-ELMENDORF, ALASKA



Final

February 2020

Prepared by

United States Air Force
Joint Base Elmendorf-Richardson, Alaska

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LEAD AGENCY ACCEPTANCE
FIFTH FIVE-YEAR REVIEW, JBER-ELMENDORF, ALASKA

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

Jeffrey Domm

29 Jun 20

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ACRONYMS AND ABBREVIATIONS

%	percent
µg/L	micrograms per liter
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Squadron
amsl	above mean sea level
Army	United States Army
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and total xylenes
CAH	chlorinated aliphatic hydrocarbons
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	contaminant of concern
DCA	dichloroethane
DCE	dichloroethylene (dichloroethene)
DDD	dichlorodiphenyldichloroethane
DNAPL	dense non-aqueous phase liquid
DRO	diesel-range organics
EDB	1,2-dibromoethane
EPA	United States Environmental Protection Agency
EQ	Ecological Quotients
ERA	ecological risk assessment
ERP	Environmental Restoration Program
ERPIMS	Environmental Restoration Program Information Management System
ESD	Explanation of Significant Difference
FFA	Federal Facility Agreement
FS	feasibility study
FTA	Fire Training Area
FYR	Five-Year Review
GIS	geographic information system
GRO	gasoline range organics
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
HVE	high-vacuum extraction
IC	institutional control
IRA	Interim Remedial Action
IRACR	Interim Remedial Action Completion Report
IRP	Installation Restoration Program
JBER	Joint Base Elmendorf-Richardson
JBER-E	JBER-Elmendorf

JBER-R	JBER-Richardson
JP-4	Grade 4 jet propulsion fuel
LNAPL	light non-aqueous phase liquid
LSI	limited site investigation
LUC	land use control
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
MNA	monitored natural attenuation
NFA	No Further Action
NPL	National Priorities List
OU	Operable Unit
PAH	polynuclear aromatic hydrocarbon
PCA	tetrachloroethane
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene (tetrachloroethene or perchloroethylene)
POL	Petroleum, Oil, and Lubricant
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RME	reasonable maximum exposure
ROD	Record of Decision
RSL	Regional Screening Level
Stantec	Stantec Consulting Services Inc.
SVOC	semi-volatile organic compound
SWQC	surface water quality criteria
TAH	Total Aromatic Hydrocarbon
TAqH	Total Aqueous Hydrocarbon
TCA	trichloroethane
TCE	trichloroethylene (trichloroethene)
TFH	total fuel hydrocarbons
USAF	United States Air Force
UST	underground storage tank
UU/UE	unlimited use/ unrestricted exposure
VC	vinyl chloride
VOC	volatile organic compound

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EXECUTIVE SUMMARY

The United States Air Force (USAF) 673d Civil Engineer Squadron (673 CES) conducted this Five-Year Review (FYR) of environmental remedial action remedies pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) at Joint Base Elmendorf-Richardson (JBER), Alaska, beginning in May 2017. This report presents the results of the review for the following JBER-Elmendorf (JBER-E) sites, listed by operable unit (OU), if applicable:

- OU1: LF059
- OU2: ST041
- OU4: FT023 and SD029
- OU5: ST037
- OU6: LF002, LF003, LF004, SD015, and WP014
- DP098

The purpose of this review is to ensure that remedies selected in each of the JBER-E Records of Decision (RODs) have been implemented, are performing effectively, and continue to be protective of human health and the environment. The methods, findings, and conclusions of FYRs identify issues found through an examination of the data collected in the past five years, if any, and provide recommendations to address them. This report covers activities that have occurred and conditions as they have developed since the previous FYR for JBER-E, which was conducted in 2014. This review evaluates the remedy (as selected in the RODs) and implementation status, ROD modifications in the form of Explanations of Significant Differences (ESDs) and Memorandums to the Site File, identifies discrepancies, and makes recommendations for resolving identified issues and improving performance of the selected remedies.

This statutory review is required by CERCLA. All the RODs for this National Priorities List (NPL) facility were signed after the effective date of the Superfund Amendments and Reauthorization Act of 1986 (SARA) and the selected remedies result in CERCLA-listed hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure (UU/UE). UU/UE means that the selected remedy will place no restrictions on the potential use of land or other natural resources. In general, if the selected remedy relies on restrictions of land and/or groundwater use by humans and/or ecological populations to be protective, then the use has been limited and a FYR should be conducted. For example, if a site is cleaned up to an industrial-use level and/or other types of uses are restricted (e.g., residential use), then, generally, UU/UE is not met (USEPA, 2001). Remedies were evaluated in this FYR in accordance with United States Environmental Protection Agency (USEPA) guidance (USEPA, 2001; 2011a; 2011b; 2012).

The contaminant sources at JBER-E addressed in this FYR are grouped into six areas, including: OU1, OU2, OU4, OU5, OU6, and DP098. Dates of ROD signatures, ROD Amendments, ESDs, and Memoranda to the Site File for each OU and DP098 include the following:

- OU1 – ROD (September 1994); Memorandum to the Site File (May 2004, January 2010).
- OU2 – ROD (May 1995); Memoranda to the Site File (January 2010, March 2011).

- OU4 – ROD (October 1995); Memoranda to the Site File (September 2003, January 2010); ESD (January 2018); Interim Remedial Action Completion Report for SD024 (November 2017); Interim Remedial Action Completion Report for SD028 (March 2018).
- OU5 – ROD (February 1995); Memoranda to the Site File (October 2003, March 2005, January 2010, June 2011) .
- OU6 – ROD (January 1997); Memoranda to the Site File (September 2003; March 2008); ESD (August 2007).
- DP098 – ROD (June 2004).

The FYR found that the implemented remedy for **OU1** to be **Short-Term Protective** of human health and the environment. Land use controls (LUCs) are implemented and effective, and no exposures to contaminated materials remaining at the site are occurring. However, for the remedy to be protective in the long term, further investigation into the sources and extent of groundwater contamination within OU1 must occur. Groundwater contains concentration of trichloroethylene (TCE), an OU1 COC, above the OU1 groundwater remedial action goal in two distinct locations. Remedial investigation in accordance with the CERCLA process is required to evaluate source areas for the chlorinated contaminated groundwater observed to the northeast of LF059, designated as CG704 groundwater plume, and CG703 groundwater plume.

The FYR found that the implemented remedy for **OU2** to be **Short-Term Protective**. LUCs are in place and preventing exposures to contaminated groundwater that remains at the site, but the timeframe for achieving remedy cleanup levels was not met. The contingent remedy for ST041 should be reevaluated, and a determination made on its appropriateness for implementation.

The FYR found that the implemented remedy for **OU4** to be **Short-Term Protective**. Soil and groundwater LUCs are in place and preventing exposures, but the timeframes for achieving remedy cleanup levels were not met at Sites FT023 and SD029. Additional studies should be conducted to optimize the approach to achieve remediation goals at these sites

The FYR found that the implemented remedy for **OU5** to be **Short-Term Protective**; however, limited natural attenuation in groundwater is occurring at ST037, and it is unclear if the remedy, as is, will be able to achieve cleanup goals within the estimated timeframe. Additional studies should be performed to optimize the remedial approach. LUCs are preventing exposure to contaminated groundwater that remains at the site.

The FYR found that the implemented remedy for **OU6** to be **Short-Term Protective**. LUCs are preventing exposure to contaminated groundwater that remains at the site. However, limited natural attenuation is occurring at Sites LF004, SD015, and WP014, and remedial cleanup goals were not achieved in the projected timelines for these sites. Additional studies should be performed to optimize the remedial approach at LF004, SD015, and WP014.

The FYR found that the implemented remedy for **DP098** to be **Short-Term Protective**. LUCs are preventing exposure to contaminated groundwater and soil that remains at the site. However, in order for the remedy to be protective in the long-term, the following actions need to be taken conduct additional treatability / pilot studies to address the contaminant plume which has shown

increasing contaminant concentrations indicating plume migration at DP098, using newer technologies. Monitor/ install further downgradient wells to monitor for VOCs, cis-1,2-DCE and TCE.

Perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) have been detected in groundwater at several JBER-E locations and at sites within OU3, OU4, OU5, and OU6 (USAF, 2018e). These sites will be addressed through ongoing and future expanded site inspection or remedial investigation, in accordance with the CERCLA process. Future investigation may also include the OU1 Landfill sites.

OU3 (including sites SD016, SS021, SD031, SD052 and SA100) was previously closed having achieved UU/UE status and was not reviewed under this FYR. The contaminant of concern (COC), polychlorinated biphenyls (PCBs), was below the ROD cleanup levels. Under the 2018 Site Inspection (USAF, 2018e), PFOS/PFOA is detected above the EPA drinking water lifetime health advisory levels in surface water located in the Cherry Hill Ditch (SD052), which is within the geographic boundary of OU3. Although surface water in Cherry Hill Ditch is not a known drinking water source, out of an abundance of caution, an interim LUC advising people to avoid contact with the water is recommended until a risk assessment can determine the level of risk to human health. Additional investigation at OU3 Cherry Hill Ditch will occur in the future.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: JBER-E (Formerly Elmendorf Air Force Base)		
EPA ID: AK8570028649		
Region: 10	**State:** AK	**City/County:** Anchorage
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the site achieved construction completion?** No	
REVIEW STATUS		
Lead agency: Other Federal Agency ***[If "Other Federal Agency", enter Agency name]*:** United States Air Force (USAF)		
Author name (Federal or State Project Manager): Stantec Consulting Services Inc. (Stantec) on behalf of the Air Force Civil Engineer Center (AFCEC). Federal Project Manager: Elizabeth Godden		
Author affiliation: Contractor		
Review period: 3/17/2014 – 3/17/2019		
Date of site inspection: 7/28/2017 – 8/16/2017		
Type of review: Statutory		
Review number: 5		
Triggering action date: 3/17/2014		
Due date *(five years after triggering action date)*: 3/17/2019		

PROTECTIVENESS STATEMENTS

Protectiveness Statement		
Site: **OU1**	*Protectiveness Determination:* **Short-term Protective**	*Planned Addendum Completion Date:* Not Applicable
Protectiveness Statement: The remedy at OU1 currently protects human health and the environment because land use controls (LUCs) are implemented and effective, and no exposures to contaminated materials remaining at the site are occurring. However, for the remedy to be protective in the long-term, further investigation into the sources and extent of groundwater contamination within OU1 must occur groundwater contains concentration of trichloroethylene (TCE), an OU1 COC, above the OU1 groundwater remedial action goal in two distinct locations. Remedial investigation in accordance with the CERCLA process is required to evaluate source areas for the chlorinated contaminated groundwater observed to the northeast of LF059, designated as CG704 groundwater plume, and CG703 groundwater plume.		
Site: **OU2**	*Protectiveness Determination:* **Short-term Protective**	*Planned Addendum Completion Date:* Not Applicable
Protectiveness Statement: The remedy at OU2 currently protects human health and the environment because LUCs are preventing exposure to contaminated groundwater that remains at the site. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure protectiveness: the contingent remedy at ST041 should be reevaluated, and a determination made on its appropriateness for implementation.		
Site: **OU4**	*Protectiveness Determination:* **Short-term Protective**	*Planned Addendum Completion Date:* Not Applicable
Protectiveness Statement: The remedy at OU4 currently protects human health and the environment because LUCs are preventing exposure to contaminated groundwater and soil that remains at the site. However, the timeframes for achieving remedy cleanup levels were not met at Sites FT023 and SD029. In order for the remedy to be protective in the long-term, the following actions need to be taken to ensure protectiveness: additional studies should be conducted at Sites FT023 and SD029 to optimize the approach to achieve remediation goals at these sites.		
Site: **OU5**	*Protectiveness Determination:* **Short-term Protective**	*Planned Addendum Completion Date:* Not Applicable
Protectiveness Statement: The remedy at OU5 currently protects human health and the environment because LUCs are preventing exposure to contaminated groundwater that remains at the site. However, because limited natural attenuation in groundwater is occurring at ST037, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure protectiveness: additional studies should be conducted to determine if the remedy will be able to achieve remediation goals within the estimated time frame		

Site:	*Protectiveness Determination:*	*Planned Addendum Completion Date:*
OU6	**Short-term Protective**	Not Applicable
Protectiveness Statement: The remedy at OU6 currently protects human health and the environment because LUCs are preventing exposure to contaminated groundwater and soil that remains at the site. However, in order for the remedy to be protective in the long-term, the following actions need to be taken to ensure protectiveness: additional studies should be performed to optimize the remedial approach at LF004, SD015, and WP014. Any changes made to the original remedy, including the addition of COCs or LUCs, will be documented in a modification to the decision document.		
Site:	*Protectiveness Determination:*	*Planned Addendum Completion Date:*
DP098	**Short-term Protective**	Not Applicable
Protectiveness Statement: The remedy at DP098 currently protects human health and the environment because LUCs are preventing exposure to contaminated groundwater and soil that remains at the site. However, in order for the remedy to be protective in the long-term, the following actions need to be taken: Conduct additional treatability / pilot studies to address the contaminant plume which has shown increasing contaminant concentrations indicating plume migration at DP098, using newer technologies. Monitor/ install further downgradient wells to monitor for VOCs: cis-1,2-DCE and TCE.		

ISSUES AND RECOMMENDATIONS

Issues and Recommendations Identified in the Five-Year Review				
OU(s): OU1	**Issue Category:** Remedy Performance			
	Issue: Groundwater contains concentration of trichloroethylene (TCE), an OU1 COC, above the OU1 groundwater remedial action goal in two distinct locations.			
	Recommendation: Remedial investigation in accordance with the CERCLA process is required to evaluate source areas for the chlorinated contaminated groundwater observed to the northeast of LF059, designated as CG704 groundwater plume, and CG703 groundwater plume.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023
OU(s): OU2, Site ST041	**Issue Category:** Remedy Performance			
	Issue: Groundwater COCs (benzene, toluene, ethylbenzene, and total xylenes) have not achieved RAOs in the timeframe specified by the ROD (2016).			
	Recommendation: The contingent remedy was reevaluated in the Supplemental Site Characterization Report (USAF, 2018d). This should be determined if appropriate for implementation. Groundwater cleanup timelines should be reestablished using groundwater modelling.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023
OU(s): OU2, Site ST041	**Issue Category:** Remedy Performance			
	Issue: Due to changes in toxicity data or regulatory cleanup standards, some chemicals current final remediation goals may exceed EPA human health guidance: (in groundwater) benzene, ethylbenzene and total xylenes.			
	Recommendation: The AF will evaluate any changes in promulgated standards and chemical toxicity characteristics in accordance with OSWER 9355.7-03B, Appendix G (June 2001) to determine if the current remedy will reduce contamination to within the acceptable CERCLA risk ranges for protectiveness. If the evaluation determines that acceptable risk will not be achieved by the current remedy, the decision document will be appropriately revised following the CERCLA process			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023

OU(s): OU4, Site FT023	**Issue Category:** Remedy Performance			
	Issue: Due to changes in toxicity data or regulatory cleanup standards, some chemicals current final remediation goals may exceed EPA human health guidance: (in groundwater) TCE.			
	Recommendation: The AF will evaluate any changes in promulgated standards and chemical toxicity characteristics in accordance with OSWER 9355.7-03B, Appendix G (June 2001) to determine if the current remedy will reduce contamination to within the acceptable CERCLA risk ranges for protectiveness. If the evaluation determines that acceptable risk will not be achieved by the current remedy, the decision document will be appropriately revised following the CERCLA process.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023
OU(s): OU4, Site FT023	**Issue Category:** Remedy Performance			
	Issue: Limited natural attenuation of COCs in groundwater is occurring at the site, and RAOs were not achieved within the projected timeline.			
	Recommendation: Conduct additional studies to optimize the approach to achieve remediation goals. Other studies may include, but are not limited to: site characterization, ecological assessment, focused feasibilities studies, groundwater modeling, treatability studies, and/or sampling. Groundwater cleanup timelines should be reestablished.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023
OU(s): OU4, Site SD029	**Issue Category:** Remedy Performance			
	Issue: Limited natural attenuation of COCs (TCE and PCE) in groundwater is occurring at the site, and RAOs were not be achieved within the projected time frame.			
	Recommendation: Conduct additional studies to optimize the approach to achieve remediation goals. Other studies may include, but are not limited to: site characterization, ecological assessment, focused feasibilities studies, groundwater modeling, treatability studies, and/or sampling. Groundwater cleanup timelines should be reestablished.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023

OU(s): OU5, Site ST037	**Issue Category:** Remedy Performance			
	Issue: Limited natural attenuation of COCs (benzene and TCE) in groundwater is occurring at the site, indicating that RAOs may not be achieved within the projected timeline of 30 years.			
	Recommendation: Conduct additional site characterization activities as recommended in the *Data Compilation and Remedial Action Evaluation Report, Western and Eastern ST037 Plumes, August 2017*. Upon completion of site characterization activities, data analysis should be performed to refine understanding of the plume configuration, aquifer hydraulics, and extent of source area contamination. When data evaluation is complete, prepare a treatability study proposing focused treatment based on results of the site characterization activities to prevent off-site migration of contaminated groundwater, remediate areas of saturated and smear zone soils, and reduce concentrations in the plume to expedite cleanup to ROD established levels. Groundwater cleanup timelines should be reestablished using groundwater modeling.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023
OU(s): OU5, Site ST037	**Issue Category:** Remedy Performance			
	Issue: Due to changes in toxicity data or regulatory cleanup standards, some chemicals current final remediation goals may exceed EPA human health guidance: (in both groundwater and surface water) TCE and 1,1,2,2-tetrachloroethane.			
	Recommendation: The AF will evaluate any changes in promulgated standards and chemical toxicity characteristics in accordance with OSWER 9355.7-03B, Appendix G (June 2001) to determine if the current remedy will reduce contamination to within the acceptable CERCLA risk ranges for protectiveness. If the evaluation determines that acceptable risk will not be achieved by the current remedy, the decision document will be appropriately revised following the CERCLA process.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023

OU(s): OU6, Site LF002	**Issue Category:** Remedy Performance			
	Issue: Due to changes in toxicity data or regulatory cleanup standards, some chemicals current final remediation goals may exceed EPA human health guidance: (in groundwater) benzene, ethylbenzene, naphthalene, total xylenes.			
	Recommendation: The AF will evaluate any changes in promulgated standards and chemical toxicity characteristics in accordance with OSWER 9355.7-03B, Appendix G (June 2001) to determine if the current remedy will reduce contamination to within the acceptable CERCLA risk ranges for protectiveness. If the evaluation determines that acceptable risk will not be achieved by the current remedy, the decision document will be appropriately revised following the CERCLA process.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023
OU(s): OU6, Site LF004	**Issue Category:** Remedy Performance			
	Issue: Due to changes in toxicity data or regulatory cleanup standards, some chemicals current final remediation goals may exceed EPA human health guidance: (in groundwater) benzene, ethylbenzene, naphthalene; and (in surface water) benzene, ethylbenzene.			
	Recommendation: The AF will evaluate any changes in promulgated standards and chemical toxicity characteristics in accordance with OSWER 9355.7-03B, Appendix G (June 2001) to determine if the current remedy will reduce contamination to within the acceptable CERCLA risk ranges for protectiveness. If the evaluation determines that acceptable risk will not be achieved by the current remedy, the decision document will be appropriately revised following the CERCLA process.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023
OU(s): OU6, Site LF004	**Issue Category:** Remedy Performance			
	Issue: Limited natural attenuation of benzene in groundwater is occurring at the site, and RAOs were not achieved within the projected time frame			
	Recommendation: Conduct additional studies to optimize approach to achieve remediation goals. Other studies may include, but are not limited to site characterization, ecological assessment, focused feasibility studies, groundwater modeling, treatability studies, and/or sampling. Groundwater cleanup timelines should be reestablished.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023

OU(s): OU6, Site SD015	**Issue Category:** Remedy Performance			
	Issue: Limited natural attenuation of benzene and TCE in groundwater is occurring at the site, and the anticipated date (2015) of achieving concentrations below cleanup levels was not achieved.			
	Recommendation: Conduct additional studies to optimize the approach to achieve remediation goals. Other studies may include, but are not limited to: site characterization, ecological assessment, focused feasibility studies, groundwater modeling, treatability studies, and/or sampling. Groundwater cleanup timelines should be reestablished.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023

OU(s): OU6, Site SD015	**Issue Category:** Remedy Performance			
	Issue: Due to changes in toxicity data or regulatory cleanup standards, some chemicals current final remediation goals may exceed EPA human health guidance: (in groundwater) benzene and TCE.			
	Recommendation: The AF will evaluate any changes in promulgated standards and chemical toxicity characteristics in accordance with OSWER 9355.7-03B, Appendix G (June 2001) to determine if the current remedy will reduce contamination to within the acceptable CERCLA risk ranges for protectiveness. If the evaluation determines that acceptable risk will not be achieved by the current remedy, the decision document will be appropriately revised following the CERCLA process.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023

OU(s): OU6, Site SD015	**Issue Category:** Remedy Performance			
	Issue: The 2014 FYR recommended investigation for the presence of 1,4-dioxane in conjunction with TCE contamination at the site. A 1,4-dioxane investigation was conducted at JBER in 2017; however, no samples were collected at SD015.			
	Recommendation: Assess 1,4-dioxane in groundwater to address the 2014 recommendation.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023

OU(s): OU6, Site WP014	**Issue Category:** Remedy Performance			
	Issue: Due to changes in toxicity data or regulatory cleanup standards, some chemicals current final remediation goals may exceed EPA human health guidance: (in groundwater) TCE			
	Recommendation: The AF will evaluate any changes in promulgated standards and chemical toxicity characteristics in accordance with OSWER 9355.7-03B, Appendix G (June 2001) to determine if the current remedy will reduce contamination to within the acceptable CERCLA risk ranges for protectiveness. If the evaluation determines that acceptable risk will not be achieved by the current remedy, the decision document will be appropriately revised following the CERCLA process.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023
OU(s): OU6, Site WP014	**Issue Category:** Remedy Performance			
	Issue: Limited natural attenuation of COCs in groundwater is occurring at the site, and the anticipated date (2011) of achieving concentrations below cleanup levels was not achieved.			
	Recommendation: Conduct additional studies to optimize the approach to achieve remediation goals. Other studies may include, but are not limited to site characterization, ecological assessment, focused feasibility studies, groundwater modeling, treatability studies, and/or sampling. Groundwater cleanup timelines should be reestablished.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023
OU(s): DP098	**Issue Category:** Remedy Performance			
	Issue: Due to changes in toxicity data or regulatory cleanup standards, some chemicals current final remediation goals may exceed EPA human health guidance: (in groundwater) cis-1,2-DCE, TCE, and vinyl chloride.			
	Recommendation: The AF will evaluate any changes in promulgated standards and chemical toxicity characteristics in accordance with OSWER 9355.7-03B, Appendix G (June 2001) to determine if the current remedy will reduce contamination to within the acceptable CERCLA risk ranges for protectiveness. If the evaluation determines that acceptable risk will not be achieved by the current remedy, the decision document will be appropriately revised following the CERCLA process.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023

OU(s): DP098	Issue Category: Remedy Performance			
	Issue: Site COCs (TCE and cis-1,2-DCE) are increasing in concentration, downgradient of the plume.			
	Recommendation: The groundwater plume should be investigated and modeled to determine if source areas are controlled and the plume boundary revised regularly. New treatment technologies to address the plume migration should be explored.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023

Other Findings Not Affecting Remedy Protectiveness

Recommendations identified during this FYR for issues that do not affect the protectiveness of the remedies include the following:

Issue No.	OU-Site	Finding/ Recommendation
1	OU1-LF059	The next groundwater sampling event at CG704 should include an assessment of current TCE, 1,1,2,2-PCA (and all the daughter products of PCA), butyl(2-ethylhexyl)phthalate and lead concentrations
2	OU2-ST041	Repair the damaged information kiosk, which has been noted in previous reports
3	OU2-ST041	The 2014 FYR recommended the sampling frequency for Monitoring Well ST41-10R be modified to adhere to the sampling frequency decision guide presented in the *Memorandum to the Site File for Operable Unit 2* (USAF, 2011b). The monitoring frequency appears to have been reviewed in 2015; it was on a 2-3 year cycle and was changed to a 2-year cycle; however, this frequency does not adhere to the decision guide. It is recommended that the sampling frequency for all wells be reviewed in order to ensure compliance with the decision guide in the *Memorandum to the Site File for Operable Unit 2* (USAF, 2011b).
4	OU2-ST041	Recommend that OU2-ST041 be transferred from CERCLA under the FFA to monitoring and compliance under the State as a Petroleum only site
5	OU2-ST041	Due to changes in toxicity data and regulatory cleanup standards, site historic data for some chemicals may exceed EPA human health guidance for risk analysis some non COCs: (in groundwater): 2-methylnaphthalene, naphthalene, thallium, and vanadium; (in surface water) thallium; and (in soil): mercury, pentachlorophenol, and 2-methylnaphthalene. Conduct a sampling event to identify current concentrations in groundwater and soil for these chemicals.
6	OU4-FT023	Due to changes in toxicity data and regulatory cleanup standards, site historic data for some chemicals may exceed EPA human health guidance for risk analysis some non COCs: (in soil) benzene, TCE, and total xylenes. Conduct a sampling event to identify current concentrations in soil for these chemicals.
7	OU4- SD029	Maintenance of Monitoring Well IS6-01: The casing lid is missing a bolt, and is below grade, resulting in inundation. The asphalt apron around the well should be brought up to grade.
8	OU4- SD029	Due to changes in toxicity data and regulatory cleanup standards, site historic data for some chemicals may exceed EPA human health guidance for risk analysis some non COCs: (in soil) cyanide, naphthalene, and total xylenes. Conduct a sampling event to identify current concentrations in soil for these chemicals.

Issue No.	OU-Site	Finding/ Recommendation
9	OU5-ST037	• Maintenance of monitoring wells, including: o OU5MW-38: the concrete apron is damaged and needs repair. o OU5MW-44: the casing lid is missing bolts and needs repair or replacement. o OU5MW-07: the casing lid is slightly elevated, indicating possible frost heaving. o OU5MW-06: the casing lid is missing a bolt and is slightly elevated, indicating possible frost heaving. o OU3MW-02: the casing lid is missing its bolts. o OU3MW-11: the casing lid is missing a bolt and is slightly elevated, indicating possible frost heaving.
10	OU5-ST037	Due to changes in toxicity data and regulatory cleanup standards, site historic data for some chemicals may exceed EPA human health guidance for risk analysis some non COCs: (in groundwater) vanadium; and (in soil) ethylbenzene and total xylenes. Conduct a sampling event to identify current concentrations in groundwater and soil for these chemicals.
11	OU5-ST037	Optimize the early warning, sentry, and groundwater monitoring well network as recommended in the *2016 Annual Remedial Action-Operations and Monitoring Report for Select CERCLA Sites* (USAF, 2018c).
12	OU6-LF002	Due to changes in toxicity data and regulatory cleanup standards, site historic data for some chemicals may exceed EPA human health guidance for risk analysis some non COCs: (in groundwater) vanadium and (in soil) benzene, ethylbenzene, naphthalene, thallium, and TCE. Conduct a sampling event to identify current concentrations in groundwater and soil for these chemicals.
13	OU6-LF003	Due to changes in toxicity data and regulatory cleanup standards, site historic data for some chemicals may exceed EPA human health guidance for risk analysis some non COCs: (in groundwater) vanadium and (in soil) thallium. Conduct a sampling event to identify current concentrations in groundwater and soil for these chemicals.
14	OU6-LF004	Due to changes in toxicity data and regulatory cleanup standards, site historic data for some chemicals may exceed EPA human health guidance for risk analysis some non COCs: (in groundwater) 4,4-DDD, aldrin, heptachlor epoxide and vanadium; and (in soil) 1,1,2,2-PCA, 4,4-DDD, aldrin, alpha-hexachlorocyclohexane, benzene, cis-1,2-DCE, dieldrin, ethylbenzene, heptachlor epoxide, naphthalene, thallium, and TCE. Conduct a sampling event to identify current concentrations in groundwater and soil for these chemicals.

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I. INTRODUCTION

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy at a site in order to determine if the remedy is, and will continue to be, protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The United States Air Force (USAF) is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP) (40 Code of Federal Regulations [CFR] Section 300.430(f)(4)(ii)) and considering United States Environmental Protection Agency (EPA) policy.

Joint Base Elmendorf-Richardson (JBER) comprises the former Elmendorf Air Force Base (JBER-E) and former Fort Richardson Army Post (JBER-R). Separate FYR reports are generated for each of the former installations (JBER-E and JBER-R). This is the fifth FYR for JBER-E CERCLA sites. The triggering action for this FYR is the signature date on the previous FYR, March 2014.

The remedy selected under CERCLA in the Record of Decision (ROD) for each Operable Unit (OU) requires that FYRs be performed. FYRs are being conducted at these sites because hazardous substances, pollutants, or contaminants remain above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The USAF conducted this FYR of selected remedies for CERCLA sites on JBER-E, Anchorage, Alaska (**Figure I-1**). This report presents the results of the review for the following JBER-E sites, listed by OU, if applicable (**Figure I-2**):

- OU1: LF059
- OU2: ST041
- OU4: FT023 and SD029
- OU5: ST037
- OU6: LF002, LF003, LF004, SD015, and WP014
- DP098

Table 1-1 lists sites at JBER-E with a history of CERCLA contamination, sites that are no further action (NFA) at the time the ROD was signed, or have since met cleanup requirements that allow for UU/UE are not included in this FYR.

Table 1-1: Status of JBER-E OUs or Active Sites

OU	Open under CERCLA (included in 2019 FYR)	NFA or Closed CERCLA Sites
OU1	LF059	LF005, LF007, LF013, OT056
OU2	ST041	ST020
OU3	--	SD016, SS021, SD031, SD052, SA100
OU4	FT023, SD029	SS010, SS018, SD026, SD024, SD025, SD028
OU5	ST037	ST038, SD040, SS042, ST046, SS053
OU6	LF002, LF003, LF004, SD015, WP014	SS019, SD073
--	DP098	--

Key:
-- – not applicable
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
FYR – Five-Year Reviews
JBER-E – Joint Base Elmendorf-Richardson – Elmendorf
NFA – No Further Action
OU – Operable Unit

Changes in status since 2014 FYR:

- OU1-LF059 – Response Complete (January 2017 IRACR) and groundwater plume transferred to newly created site CG704
- OU1 – newly created site CG703 is being added to the FFA to investigate TCE plume in groundwater
- OU4-SD024 – site closed. Achieved UU/UE status in August 2015
- OU4-SD025 – transferred to State oversight. Based on the absence of CERCLA hazardous substances, the USAF determined that No Further Action (NFA) under CERCLA was required due to the petroleum exclusion. The site was closed under CERCLA in January 2018, and restoration will proceed pursuant to State of Alaska environmental cleanup regulations.
- OU4-SD028 – site closed. Achieved UU/UE status in January 2018.

Sites under investigation:

- CG703, CG704, SS022, SA110, SS109, SS116 and DA115 these sites are still in the investigative stage and no remedies have been selected.
- Perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) have been detected in groundwater at several JBER-E locations and at sites within OU3, OU4, OU5, and OU6 (USAF, 2018e). These sites will be addressed through ongoing and future expanded site inspection or remedial investigation, in accordance with the CERCLA process. Future investigation may also include the OU1 Landfill sites.

- OU3 (including sites SD016, SS021, SD031, SD052 and SA100) was previously closed having achieved UU/UE status and was not reviewed under this FYR. The contaminant of concern (COC), polychlorinated biphenyls (PCBs), was below the ROD cleanup levels. Under the 2018 Site Inspection (USAF, 2018e), PFOS/PFOA is detected above the EPA drinking water lifetime health advisory levels in surface water located in the Cherry Hill Ditch (SD052), which is within the geographic boundary of OU3. Although surface water in Cherry Hill Ditch is not a known drinking water source, out of an abundance of caution, an interim LUC advising people to avoid contact with the water is recommended until a risk assessment can determine the level of risk to human health. Additional investigation at OU3 Cherry Hill Ditch will occur in the future.

This FYR was led by Stantec Consulting Services Inc. (Stantec), on behalf of the Air Force Civil Engineer Center (AFCEC) under Contract Number FA8903-16-D-0032, Task Order FA8903-17-F-0069. Participants included AFCEC, Stantec, EPA, and Alaska Department of Environmental Conservation (ADEC) staff with expertise in site investigation and remediation. The review began in July 2017, with data acquired through July 2018 included in the review.

1.0 AGENCY OVERSIGHT AGREEMENTS

Elmendorf Air Force Base (AFB) was placed on the National Priorities List (NPL) in August 1990. In November 1991, a Federal Facility Agreement (FFA) was signed between the USAF, EPA, and ADEC (USEPA, 1991). The FFA established the procedural framework and schedule for CERCLA activities. At that time, 29 disposal/source areas were identified and organized into seven OUs on the basis of geographic proximity and/or similar source characteristics or contaminants.

2.0 INSTALLATION BACKGROUND

The United States Army (Army) Fort Richardson Post was constructed in the 1940s. In October 1950, the military reservation was divided between the newly created Department of the Air Force and the Army. The real property comprising Elmendorf AFB was transferred to the Department of the Air Force and the remaining real property remained as an active Army post under the jurisdiction of the Department of the Army.

In 2005, the Department of Defense (DoD) recommended realignment of Fort Richardson and Elmendorf AFB under the base closure and realignment process, establishing JBER. JBER became fully-functional in October 2010, combining installation management functions of Elmendorf AFB and Fort Richardson.

JBER encompasses approximately 75,180 acres in south-central Alaska and is within the Municipality of Anchorage. JBER-E is located in the western portion of the installation, covering approximately 13,804 acres, and is bounded on the west and north by the Knik Arm of Cook Inlet and on the east by JBER-R (**Figure I-1**). Immediately to the south of JBER-E lies urban development within the Municipality of Anchorage.

JBER provides defense for the United States through projection of air power, communication, surveillance, and logistical support. Land use varies across the Base and consists of military

support uses, including: industrial, commercial, residential, recreational, and undisturbed/vacant. The majority of the contaminated sites are located in or adjacent to industrial/commercial areas. Land use in adjacent, off-base locations is a mixture of industrial and residential. Two residential areas (Mountain View and Government Hill) are immediately adjacent to JBER-E. No CERCLA sites are located in the immediate vicinity of these areas. Past, current, and anticipated future specific land uses at the active CERCLA sites have not changed since the time of the RODs (USAF, 1994a [OU1]; 1995a [OU2]; 1995b [OU4]; 1995c [OU5]; 1997a [OU6]; and 2004b [DP098]).

3.0 COMMUNITY NOTIFICATION

A public notice was made available by newspaper posting stating that an FYR was being conducted and inviting the public to submit any comments to the USAF (**Appendix B**). No comments were received from the public. The results of the FYR will be made available in the Administrative Record for JBER-E, a copy of which is available online at: http://afcec.publicadmin-record.us.af.mil/. Public notice publications included the following:

- *Alaska Dispatch News* on 21 June and 25 June 2017
- *Chugiak Eagle River Star* on 29 June 2017
- *Arctic Warrior* issue of the *Anchorage Press Newspaper* on 30 June 2017

3.1 SITE INTERVIEWS

During the FYR process, interviews were conducted to document any issues, perceived problems, or successes with the implemented remedies. Interviews were conducted, and eight responses were received. Responses were from contractors, community environmental board members, state and federal agencies, USAF personnel, and the native community.

Generally, comments regarding the overall remediation process at JBER-E were positive, with the following comments applicable to JBER-E CERCLA sites as a whole:

- Reporting of groundwater monitoring results is often delayed by 1 or 2 years following a sampling event, which could result in missed opportunities to react or change procedures in subsequent monitoring events.
- PFOS/PFOA contamination was recently detected in soil and groundwater above ADEC cleanup levels and groundwater contamination above EPA Lifetime Health Advisory levels.

Comments received that are applicable to specific sites located on JBER-R were addressed in JBER-R FYRs. Formal interview records for this FYR are provided in **Appendix C**.

II. SITE-SPECIFIC FIVE-YEAR REVIEWS

Due to past operations, CERCLA hazardous substances have been released at JBER-E that resulted in soil, sediment, surface water, and groundwater contamination at various locations. The initial risk assessments in each ROD determined that human and/or ecological risks exceeded the EPA's average or reasonable maximum exposure risk management criteria. OU-specific COCs are discussed in detail in the following sections.

Some of the OUs include sites designated as NFA at the time the ROD was signed or have since met cleanup requirements. Sites that achieved NFA status and were closed under CERCLA prior to the review period for this FYR are not included in this review. Source areas formally closed or achieved NFA status and were closed under CERCLA may need to be reopened or given a new site ID for contamination if they require to be investigated under CERCLA.

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4.0 OPERABLE UNIT 1 (LF059)

OU1 consists of Sites LF005, LF007, LF013, LF059, and OT056. LF059 is the only remaining open site within this OU.

4.1 SITE BACKGROUND

LF059 is a landfill on JBER-E and occupies approximately 1 acre near the intersection of Arctic Warrior Drive and Vandenberg Avenue (**Figure 4-1**). Site LF059 was originally part of the OU1 Landfill Complex, which consisted of five landfill cells (LF05, LF07, LF13, LF059, and OT56) that received domestic and solid waste and construction debris from the 1950s through the 1980s. The LF059 landfill received general refuse and construction debris from 1965 until 1983 and may have housed an asphalt batch plant in the 1950s and 1960s (USAF, 2018c). During a site visit in June 1991, "fluid asphalt" was observed pooled and partially solidified on top of a hiking trail. As a result, the trail was closed. The site was excavated in 1996, and over 10,000 gallons of asphalt were recovered and recycled. This site contains one plume, referred to as the CG704 groundwater plume **(Figure 4-2)**. The current land use designation at LF059 is "Open Space."

4.2 RESPONSE ACTION SUMMARY

4.2.1 Basis for Taking Action

CERCLA hazardous substances released at JBER-E resulted in soil, sediment, surface water, and groundwater contamination in various locations. The initial risk assessment at OU1 determined that the human and/or ecological risks exceeded the EPA's average or reasonable maximum exposure risk management criteria, and that remedial action must be taken.

The OU1 ROD identified manganese, 1,2-dibromoethane (EDB), trichloroethylene (TCE), and vinyl chloride (VC) as COCs in groundwater at LF059 and is the basis for cleanup goals (USAF, 1994a). The OU1 remedy for LF059 is institutional controls (ICs) for soil and groundwater and monitored natural attenuation (MNA) for groundwater.

Risk Summary

The OU1 ROD included the results of a baseline human health risk assessment (HHRA), conducted to estimate the risk posed to human health by OU1 (USAF, 1994a). Two land use scenarios were evaluated: future residential and future commercial/industrial. Exposure assumptions included potential future receptors drinking and showering from an unfiltered shallow well in the immediate vicinity of the highest concentration of COCs over a time of 30 years (USAF, 1994a).

COCs were identified in the OU1 ROD based on results of the risk assessment and by considering regulatory standards. The OU1 COCs were detected at concentrations below the acceptable risk ranges cited in the ROD (1×10^{-4} to 1×10^{-6}) for soil and groundwater. Only shallow groundwater samples exhibited COC concentrations above the acceptable risk ranges. These COCs included arsenic, EDB, PCBs, lead, and manganese. Risks for TCE, VC, and EDB were identified based on

maximum contaminant levels (MCLs) to comply with federal or state Applicable or Relevant and Appropriate Requirements (ARARs).

Although lead, arsenic, and PCBs were detected at concentrations above risk in the OU1 ROD, they were not included as COCs. Comparison of site-related risks and background risks associated with arsenic showed that the risk was not spill related. It was also determined that lead concentrations detected at OU1 did not appear to pose a threat under the current land use (outdoor recreational use area). PCBs were originally detected in only one well, and subsequent sampling did not confirm the presence of any PCBs. The validity of the original PCB detection was questioned. At the time the ROD was written, out of all the contaminants that were detected above the acceptable risk range, only manganese was observed consistently distributed throughout the shallow groundwater at OU1 (USAF, 2017a).

The OU1 ROD also included the results of an ecological risk assessment (ERA) at OU1, which evaluated risks to terrestrial and aquatic ecosystems. The terrestrial risk assessment identified a potential environmental risk due to the presence of several heavy metals within the soils of OU1. Localized small mammal and passerine bird populations were found to possibly be at risk from ingestion of heavy metals; however, exposure is expected to be limited due to the limited aerial extent of contamination and the relatively large habitat. The results of the ERA indicated potential theoretical risk to migratory peregrine falcons exposed to heavy metals at OU1; however, there was no habitat which would attract them to the area at the time of the assessment (USAF, 1994a).

4.2.2 Response Actions

Contamination was initially discovered at LF059 in 1991. A Remedial Investigation/Feasibility Study (RI/FS) was conducted from 1991 to 1992 to determine the physical characteristics at OU1, as well as the extent of groundwater and soil contamination, the contaminant transport media, and the hydraulic relationship between Ship Creek and groundwater at OU1. Three potential source areas were identified at LF059: a tar seep area and two potential landfill disposal areas (western and eastern). The primary release mechanisms at the site were anticipated to be percolation or infiltration of contaminants within the tar or landfill debris into the soil and groundwater; however, groundwater was determined to be the only medium of concern for the protection of human health because only groundwater COCs exceeded risk screening values (USAF, 2017a).

In 1995 and 1996, remedial and removal activities occurred at LF059. The primary objective of this project was to delineate and remove asphalt cement and asphalt-containing soil and debris and to restore the site to natural conditions. Site restoration followed excavation and removal activities and included re-establishment of grasses and replanting of trees and seedlings (USAF, 2017a).

Surface soil contaminants of interest (COIs) at LF059 were determined to be: benzo(a)anthracene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, 2-methylnaphathalene, arsenic, barium, and copper. Subsurface COIs included benzo(a)anthracene, chrysene, PCBs, total petroleum hydrocarbons (TPHs), arsenic, beryllium, and sodium. However, groundwater was determined to be the only medium of concern for the protection of human health. During the OU1 RI, only one groundwater sampling event occurred. At LF059, concentrations of chemicals detected included: benzene, toluene, ethylbenzene, and total xylenes (BTEX); methylene chloride; TCE;

1,1-dichloroethane (DCA); 1,1,2,2-tetrachloroethane (PCA); 1,1,1-TCE; EDB; dalapon; arsenic; and manganese (USAF, 1994a).

Remedial Action Objectives

According to the RI/FS and the baseline risk assessment, the greatest risks posed at OU1 were associated with manganese in shallow groundwater. The OU1 remedial action objective (RAO) documented in the ROD is to prevent ingestion and/or direct contact with groundwater containing contaminants in concentrations in excess of background levels or MCLs, whichever is greater (USAF, 1994a).

Remedy Components

In 1994, a ROD was signed for the OU1 Landfill Complex that identified COCs and the selected remedy (USAF, 1994a). In 2004, four of the five landfills (LF05, LF07, LF13, and OT056) were removed from the CERCLA program (USAF, 2004a), with three of the landfill cells (LF05, LF07, and LF13) continuing to be managed as part of a landfill closure permit under ADEC Solid Waste Regulations (USAF, 2017a). Site-specific COCs and their cleanup levels, as defined in the OU1 ROD, are presented in **Table 4-1**.

Table 4-1: OU1-LF059 Contaminants of Concern and ROD Cleanup Levels

Contaminant of Concern	ROD Cleanup Level/ RAO	Basis for Cleanup Level
Groundwater (µg/L)		
1,2-Dibromoethane	0.05	MCL
Manganese	9,100	Background
Trichloroethene (TCE)	5.0	MCL
Vinyl chloride	2.0	MCL

Key:
µg/L – micrograms per liter
CFR – Code of Federal Regulations
MCL – Maximum contaminant level, Safe Drinking Water Act (40 CFR 141 and 40 CFR 143).
OU – Operable Unit
RAO – Remedial Action Objective
ROD – Record of Decision

The major components of the selected remedy that address the principal threats posed by the conditions within OU1 source areas include:

- Institutionally-controlled access to groundwater.
- Groundwater monitoring for 5 years or until groundwater poses acceptable risk.
- FYR to assess the protectiveness of the remedial action.
- Periodic evaluation of monitoring results to determine the need for further remedial action.

There have been two Memorandums to the Site File that addressed and updated USAF land use control (LUC) implementation at LF059 (USAF, 1997b; 2010). The current status of remedy components is presented in **Table 4-2**.

Table 4-2: OU1-LF059 Remedy Status

Remedy Component	Status
Implement LUCs, which include: • Restrict land use and define areas designated for recreational use. • Enforce Base policy prohibiting installation of groundwater wells into the shallow aquifer. • Secure existing water supply and groundwater monitoring wells. LUCs will be managed and implemented in accordance with the *Memorandum to the Site File for Operable Units (OUs) 1, 2, 4, and 5* (USAF, 2010).	LUCs were implemented in May 1995. LUC implementation was clarified in Memoranda to the Site File in 1997 and 2010, and the May 2011 673d Air Base Wing Instruction 32-7003 LUC Management. No LUC breaches were identified during the period of review for this FYR.
Monitor groundwater for 5 years, or until the groundwater no longer poses an unacceptable health risk.	Cleanup levels were met for 1,2-dibromoethane in 1996, vinyl chloride in 1997, and manganese in 2001. TCE contamination at LF059 has been determined to originate from an upgradient source, and monitoring was transferred to the new site (CG704) in 2017. No groundwater monitoring is occurring at LF059.
FYR to assess the protectiveness of the remedial action.	Ongoing (1998, 2003, 2008, 2014, 2019).
Periodic evaluation of monitoring results to determine if there is a need for further remedial action.	No groundwater monitoring is occurring at LF059; however, monitoring is occurring for the new site (CG704) and is evaluated regularly.

Key:
FYR – Five-year Review
LUC – land use control
OU – Operable Unit
TCE – trichloroethylene

4.2.3 Status of Implementation

The OU1 ROD identified arsenic, EDB, manganese, PCBs, and lead as COCs in groundwater at LF059 and established cleanup levels for EDB, manganese, TCE, and VC (**Table 4-1**). During removal actions at LF059, contaminated soil and asphalt were removed from the site and soil samples were collected from the excavation area. These samples confirmed that soil concentration of the COCs were below applicable cleanup levels. Therefore, groundwater monitoring and ICs were the selected remedy at LF059 (USAF, 2017a).

Groundwater monitoring was conducted at LF059 from 1992 until 2016. Concentrations of EDB and VC were below the MCLs in 1996 and 1997, and these COCs were removed from the sampling program. The manganese cleanup level was met in 2001 and sampling was discontinued. EDB and VC have not been detected above cleanup levels in any subsequent monitoring. TCE is the only remaining COC above ROD cleanup levels (USAF, 2017a). Groundwater sampling has been discontinued at LF059 and transferred to CG704.

It has been determined that TCE and VC (a breakdown product of TCE) contamination at LF059 are associated with an unknown upgradient source. Interpretation of an unknown upgradient TCE source is based on groundwater flow direction, distribution of TCE concentrations in three monitoring wells, and the lack of onsite TCE sources (USAF, 2017a).

In 2014, water samples were collected from LF059-09SEEP-SE (**Figure 4-2**). Manganese and TCE were detected at concentrations of 3,300 and 2.29 micrograms per liter (µg/L), respectively. These concentrations are below the ROD background level for manganese (9,100 µg/L) and the ROD groundwater cleanup level for TCE (5 µg/L). At a TCE concentration of 2.29 µg/L, the seep sample concentration is below the ROD cleanup level (5 µg/L) (USAF, 2017a).

An *Interim Remedial Action Completion Report* (IRACR) (USAF, 2017a) was completed for LF059 documenting that all RAOs had been achieved for LF059 and recommending that the site be given a "Response Complete" status. The USAF opened a new site, CG704, associated with the unknown upgradient source for the LF059 plume, and investigations at CG704 are ongoing. Groundwater monitoring for LF059 was transferred to CG704, and Monitoring Wells LF59-MW-02 and LF59MW-03 will be sampled in association with the new site.

4.2.4 LUC Summary

LUCs were implemented at LF059 in May 1995 to prevent access to soil and contaminated shallow groundwater at OU1. LUCs are part of the selected remedy for LF059.

The LUCs are designed to: prevent activities that could affect the performance of the other components of the selected remedy; prevent the migration of contaminants in contaminated soil and groundwater; and maintain current land uses to protect human health and the environment. Specific measures have been implemented to restrict access and limit exposure to and/or use of contaminated groundwater and soil, as required by site-specific LUCs. These measures consist of:

- The inclusion and documentation of LUCs in the Base General Plan.
- Maintenance of existing administrative controls through review of work clearance and dig permits.
- Strict prohibition of the construction of manned facilities.
- Groundwater use restrictions.
- Periodic LUC inspections of LF059.

As stated in the *Land Use Controls Management Plan* (USAF, 2003a) (**Appendix D**), OU1 (including LF059) is designated as a "Restricted Use Area" for recreational use only. Construction of manned facilities is prohibited at the site. Excavation that would compromise the landfill caps or impact the shallow groundwater is also prohibited.

Compliance with LUCs applies to all soil-disturbing activities on JBER and is reviewed annually (USAF, 2018c). A geographical information system (GIS)-based tracking system is in place to ensure that LUCs are enforced and has been incorporated into the *Base General Plan*. A copy of the LUC inspection form for LF059 is provided in **Appendix E**.

4.2.5 Systems Operations / Operations and Maintenance

No active systems are currently operated as part of the LF059 remedy.

4.3 PROGRESS SINCE THE LAST REVIEW

This is the fifth FYR for OU1 at JBER-E. The protectiveness determination and statement from the 2014 FYR are presented in **Table 4-3**. Issues and recommendations from the 2014 FYR and the current status of those recommendations are presented in **Table 4-4**.

Table 4-3: OU1-LF059 Protectiveness Determination/Statement from the 2014 FYR

Site	Protectiveness Determination	Protectiveness Statement
OU1	Short-term Protective	The remedy at OU1 is currently protective of human health and the environment because LUCs restrict access to the subsurface. However, in order for the remedy to be protective in the long-term, the upgradient plume affecting LF059, likely originating at closed site LF007, will need to be fully delineated.

Key:
FYR – Five-Year Review
LUC – land use control
OU – Operable Unit

A 1,4-dioxane investigation was completed at JBER in 2017 (USAF, 2017c). The 1,4-dioxane result from Monitoring Well LF05GW-2B (1.1 µg/L), located in the CG704 Groundwater plume, exceeded the EPA Region 9 Regional Screening Level (RSL) for residential tapwater (0.46 µg/L). The detected concentration is below the current ADEC promulgated cleanup level of 4.6 µg/L.

4.4 FYR PROCESS

4.4.1 Site Interviews

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. Site interviews for JBER-E were conducted as discussed in Section 3.1. There were no specific comments regarding OU1 or LF059.

4.4.2 Data Review

A summary of data since the 2014 FYR is presented in Section 4.2.3. Data collected at LF059 during the period of this FYR (2014-2018) were reviewed. Data reviewed included: 2014 through 2016 monitoring activities (USAF, 2015; 2017b; 2017c), 1,4-dioxane sampling (USAF, 2017c), and the IRACR (USAF, 2017a). Data is presented on **Figure 4-2**.

Table 4-4: OU1-LF059 Status of Recommendations from the 2014 FYR

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date
An upgradient source of TCE and 1,1,2,2-tetrachloroethane is contaminating groundwater in the northwest portion of the Site LF059 LUC area. Although TCE concentrations at affected wells are relatively low, TCE shows no decreasing trends. The 1994 OU1 ROD predicted that contaminant levels in groundwater would meet acceptable human risk levels and Safe Drinking Water standards within 5 years of implementing the monitoring program (by 1999).	Pursue a "Response Complete" status for LF059. Delineate the upgradient plume affecting LF059 that likely originates at closed site LF007. Pursue re-opening LF007 under the CERCLA program and manage the groundwater plume that is affecting part of LF059 as part of the upgradient source.	Completed	The USAF opened a new site, CG704, associated with the unknown upgradient source for the LF059 plume, and investigations at CG704 are ongoing. Groundwater monitoring for LF059 was transferred to the new CG704 site. An Interim Remedial Action Completion Report (I-RACR) was completed for LF059 documenting that all RAOs had been achieved for LF059 and recommending that the site be given a "Response Complete" status (USAF, 2017a).	1/1/2017
The potential exists for concentrations of 1,4-dioxane to be present in conjunction with TCE contamination at the site.	Based on USAF guidance (*Interim Air Force Guidance on Sampling and Response Actions for 1,4-Dioxane at Operational and BRAC Installations, 15 Aug 2013*), recommend a sampling event be conducted to identify if concentrations of 1,4-dioxane exist. Determine whether there is an unacceptable risk at the site.	Completed	A 1,4-dioxane investigation was completed at JBER in 2017 (USAF, 2017c). The 1,4-dioxane result from Monitoring Well LF05GW-2B (1.1 µg/L), located in the LF59MW-03 plume, exceeded the EPA Region 9 Regional Screening Level (RSL) for residential tapwater (0.46 µg/L). The detected concentration is below the current ADEC promulgated cleanup level of 4.6 µg/L.	2017

Table 4-4 (Cont.) OU1-LF059 Status of Recommendations from the 2014 FYR

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date
The LF004 CERCLA site boundary appears to extend beyond JBER-E site boundaries. *Note: this issue was specifically noted for LF004 but applied to all sites covered by the FYR.*	All CERCLA site boundaries should be reviewed for accuracy and be revised, when applicable, in a memorandum to the site file.	Completed	CERCLA site and LUC boundaries are maintained in a GIS database. At the time of this FYR, there are no noted boundary discrepancies at LF059.	--
An in-depth description of the historical site events for each OU and DP098 was not included within Table 2-1 of this FYR.	Expand Table 2-1 in the next FYR to include detailed information concerning the chronology of site events for each OU and DP098.	Considered But Not Implemented	Chronology table not required in approved template for this FYR.	--

Key:
µg/L – micrograms per liter
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
ADEC – Alaska Department of Environmental Conservation
EPA – U.S. Environmental Protection Agency
FYR – Five-year Review
GIS – geographic information system
JBER – Joint Base Elmendorf-Richardson
JBER-E – JBER-Elmendorf
LUC – land use control
OU – Operable Unit
RAO – Remedial Action Objective
ROD – Record of Decision
TCE – trichloroethylene
USAF – U.S. Air Force

Data collected under the Environmental Restoration Program (ERP) are archived in the USAF ERP Information Management System (ERPIMS) database; however, not all data collected over the life of LF059 may have been archived into the system. All historical data available in ERPIMS (21 July 1992 through 27 July 2017) were reviewed to support a technical assessment of chemical-specific toxicity changes since the ROD was signed. See Section 4.5.2.

4.4.3 Site Inspection

A site inspection was conducted at LF059 on 2 August 2017. The purpose of the inspection was to assess the protectiveness of the remedy. A site inspection form and photographs are provided in **Appendix E**. No issues were discovered that affect the current or future protectiveness of the remedy at the site.

4.5 TECHNICAL ASSESSMENT

4.5.1 Question A – Is the remedy functioning as intended by the decision documents?

The review of documents, site data, and the results of the site inspections indicate that the remedy for LF059 is functioning as intended by the ROD, and all RAOs have been achieved. TCE contamination in groundwater at LF059 has been determined to be originating from an upgradient source, Site CG704. Groundwater monitoring at LF059 has been transferred to CG704.

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

Revised cleanup levels have been promulgated and toxicity data has changed since the ROD was signed; however, MCLs in groundwater have not changed.

Changes in Standards:

ROD cleanup levels at LF059 are based on MCLs for 1,2-dibromoethane, TCE, and VC; the cleanup level for manganese is based on background concentration. MCLs have not changed since the ROD was signed. However, Alaska regulatory cleanup levels (18 Alaska Administrative Code [AAC] 75) have recently been revised, and these changes are presented in **Table 4-5**. The new cleanup levels are human health based, and account for toxicity changes that have occurred since the ROD was signed. The chemical-specific ARARs (40 Code of Federal Regulations [CFR] 141) listed in the ROD (USAF, 1994a) do not have any changes that affect regulatory-based cleanup levels for groundwater COCs at LF059.

All available data for LF059 were evaluated against the ADEC standards (ADEC, 2017). Calculations were performed for chemicals with detections within the last 5 years above the new standards to determine exposure risk (**Appendix F, Tables F-1** through **F-3**). These calculations are based on the recent concentrations and the residential exposure assumption.

Table 4-5: OU1-LF059 Comparison of ROD Final Remediation Goals to 2017 Standards

Chemical	ROD Cleanup Level	2017 ADEC Cleanup Level[1]	Federal MCL	Historic Site Concentration[2]	LTM Site Concentration
Groundwater (µg/L)					
1,2-Dibromoethane	0.05	0.075	0.05	0.38	--
Manganese	9,100	--	--	33,300	--
Trichloroethene (TCE)	5.0	2.8	5.0	11	5.24
Vinyl chloride	2.0	0.19	2.0	3.3	ND

Key:
1 – ADEC cleanup levels (18 AAC 75.341(c), as amended through 7 November 2017).
2 – The maximum historic detection was used as the applicable site concentration (see Appendix F, Table F-3).
-- – not applicable
µg/L – micrograms per liter
AAC – Alaska Administrative Code
ADEC – Alaska Department of Environmental Conservation
LTM – long-term monitoring
MCL – Maximum contaminant level, Safe Drinking Water Act (40 CFR 141 and 40 CFR 143)
ND – non detect
OU – Operable Unit
ROD – Record of Decision

A review was also conducted on chemicals with new toxicity data, this did not identify any other chemicals at LF059 that required further investigation.

Although calculated risks and hazards would exceed thresholds at LF059 for TCE (in groundwater), the LUCs currently in place restricting excavation and construction of manned facilities, as well as the basewide restriction on the use of groundwater from the shallow aquifer, are preventing exposure to contaminated media.

TCE concentrations remaining in groundwater have been determined to originate from upgradient Site CG704 and monitoring of TCE has been transferred to that site. The most recent concentration (7/27/2017) of 1,1,2,2-PCA in groundwater downgradient from LF059 (Well OU5MW-33) was non-detect. It is, however, recommended that 1,1,2,2-PCA be included in the next round of sampling for CG704 to assess current concentrations at that site.

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

No other information has been discovered that calls into question the protectiveness of the remedy at LF059.

4.6 ISSUES / RECOMMENDATIONS

RAOs for LF059 have been met, monitoring for remaining TCE contamination in groundwater at LF059 has been transferred to the upgradient source CG704, and the site is eligible for "Response Complete" status.

Issues identified during this FYR that affect the protectiveness at OU1 are shown below:

Issues and Recommendations Identified in the Five-Year Review				
OU(s): OU1	**Issue Category:** Remedy Performance			
	Issue: Groundwater contains concentration of trichloroethylene (TCE), an OU1 COC, above the OU1 groundwater remedial action goal in two distinct locations.			
	Recommendation: Remedial investigation in accordance with the CERCLA process is required to evaluate source areas for the chlorinated contaminated groundwater observed to the northeast of LF059, designated as CG704 groundwater plume, and CG703 groundwater plume.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023

Recommendations identified during this FYR that do not affect the protectiveness of the remedy at LF059 include:

Issue No.	OU-Site	Finding/ Recommendation
1	OU1-LF059	The next groundwater sampling event at CG704 should include an assessment of current TCE, 1,1,2,2-PCA (and all the daughter products of PCA), butyl(2-ethylhexyl)phthalate and lead concentrations

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5.0 OPERABLE UNIT 2 (ST041)

OU2 consists of sites ST020 and ST041. ST041 is the only remaining open site within this OU.

5.1 SITE BACKGROUND

Site ST041 (known as Four-Million Gallon Hill) is an approximately 20-acre site located at the top of a ridge, east of the Knik Arm and north of Fairchild Avenue (**Figure 5-1**). In 1942, four one-million-gallon underground storage tanks (USTs) were installed at the site and used to store aviation fuel for flight line operations. In 1991, these tanks were taken out of service. During the mid-1960s, an estimated 60,000 gallons of aviation gasoline spilled and, in 1974, a UST was overfilled – spilling 33,000 gallons of Grade 4 jet propulsion fuel (JP-4). No fuel was recovered from the gasoline spill, but 16,000 gallons of fuel were recovered from the JP-4 spill; the remainder infiltrated into the ground northwest of the USTs. An oil-water separator was installed in 1976 to reduce the amount of fuel being discharged to a drainage ditch and an Interim Remedial Action (IRA) was conducted in 1992 to remove floating product and intercept contaminated water, as discussed in Section 5.2.2. Two groundwater plumes (ST041 North and ST041 South) are tracked at the site (**Figure 5-1**).

5.2 RESPONSE ACTION SUMMARY

5.2.1 Basis for Taking Action

CERCLA hazardous substances released at JBER-E resulted in soil, sediment, surface water, and groundwater contamination in various locations. The initial risk assessment at OU2 determined that the human and/or ecological risks exceeded the EPA's average or reasonable maximum exposure risk management criteria, and that remedial action must be taken.

The OU2 ROD identified BTEX as the groundwater COCs for ST041, and benzene, toluene, and ethylbenzene as surface water and seep COCs. Chemical-specific cleanup goals were established for these COCs. Additional COCs were identified in the ROD (bis[2-ethylhexyl]phthalate, arsenic, beryllium, manganese, and thallium), but no numeric cleanup goals were established. The remedy included treatment for groundwater and surface water and MNA (USAF, 1995a).

Risk Summary

The OU2 ROD included the results of a baseline HHRA, conducted to estimate the risk posed to human health by OU2 (USAF, 1995a). Two land use scenarios were evaluated: future residential and future commercial/industrial. The HHRA determined that exposure to contaminated groundwater at ST041 would pose an unacceptable risk to human health. The COCs exhibiting an unacceptable risk or hazard using residential exposure parameters included BTEX, arsenic, beryllium, manganese, and thallium. Arsenic concentrations were found to be within background range, and manganese concentrations were attributed to biological activity associated with natural attenuation of petroleum compounds. Thallium and beryllium were not considered to pose an unacceptable risk due to the sporadic nature of detections (USAF, 1995a).

The OU2 ROD also included the results of an ERA at OU2. The ERA conducted at ST041 consisted of:

- An ecological screening evaluation involving identification and characterization of the biological resources at risk.
- Development of the ecological conceptual site model.
- Identification of the contaminants of ecological concern (COECs).
- Discussion of the potential toxicological effects of the selected COECs.
- Selection of assessment end points.
- Initial quantification of toxicity and risk characterization.
- Discussion of future data needs for biological diversity assessments and/or population studies, that would be conducted if deemed necessary.

Minimal ecological risk was identified using conservative calculation assumptions, primarily due to contaminant occurrences being limited to very small, localized areas (USAF, 1995a).

In addition to ecological risk, compliance with State of Alaska surface water quality criteria (SWQC) were also considered as part of the ERA. The environmental risk assessment did not identify significant ecological impacts warranting any additional action, because operation of the IRA eliminated the primary exposure pathway by intercepting the surface water seeps that discharge into wetlands (USAF, 1995a).

5.2.2 Response Actions

An oil/water separator was installed at ST041 in 1976 to reduce the amount of fuel being discharged to a drainage ditch adjacent to Fairchild Avenue. Contamination was initially discovered in 1982. Monitoring wells were sampled in 1984 and 1988. In 1989, a small dam was placed in a nearby drainage ditch. In 1992, the USAF implemented an IRA to remove free product floating on the groundwater, and to intercept contaminated water prior to being discharged from seeps on both the north and south sides of the source area. This action was documented in an Interim ROD signed in September 1992,with construction of the IRA completed in 1993 (USAF, 1995a), and the system operated until 1999.

Remedial Action Objectives

RAOs provide a general description of what the cleanup will accomplish. RAOs specified in the OU2 ROD are as follows:

- Prevent ingestion and contact with groundwater containing contaminants in concentrations in excess of background or MCLs, whichever is greater.
- Prevent use of groundwater for aquaculture, or if aquaculture use is proposed in the future, treat water to an acceptable level.
- Prevent contaminated seep water (surface water) from entering wetlands.
- Reduce further migration of contaminants due to free-phase product currently at the water table and of any residual product that may exist in piping and underground tanks.

- Prevent migration of contaminants found in soil that would result in groundwater contamination in excess of MCLs or health-based levels.
- Attain residual contaminant levels which would restore groundwater as a potential source of drinking water.
- Compliance with all action-, chemical-, and location-specific ARARs.

Final remediation goals for groundwater at ST041 include preventing ingestion or direct contact with groundwater containing contaminants with concentrations in excess of background levels or federal drinking water standards (primary MCLs, 40 CFR 141), as shown in **Table 5-1**. Final remediation goals for surface water include compliance with location- and chemical-specific ARARs. The location-specific goal is avoidance of long-term and short-term adverse impacts associated with destruction or modification of the wetlands area.

Table 5-1: OU2-ST041 Contaminants of Concern and ROD Cleanup Levels

Contaminant of Concern	ROD Cleanup Level	Basis for Cleanup Level
Groundwater (µg/L)		
Benzene	5	MCL
Ethylbenzene	700	MCL
Toluene	1,000	MCL
Xylenes	10,000	MCL
Surface Water (µg/L)		
Benzene	10[a]	18 AAC 70
Ethylbenzene	10[a]	18 AAC 70
Toluene	10[a]	18 AAC 70

Key:
18 AAC 70 – Title 18 Alaska Administrative Code, Chapter 70 (surface water quality criteria).
µg/L – micrograms per liter
a – The established cleanup level is the sum of benzene, ethylbenzene, and toluene concentrations.
CFR – Code of Federal Regulations
MCL – maximum contaminant level, Safe Drinking Water Act (40 CFR 141 and 40 CFR 143)
ROD – Record of Decision

The chemical-specific cleanup levels include compliance with State of Alaska SWQC as established in 18 AAC 70, which are based on total aromatic hydrocarbons (TAHs) for surface water COCs (benzene, ethylbenzene, and toluene).

Remedy Components

The OU2 ROD identified BTEX as the groundwater monitoring COC at ST041, but by 1998 toluene and xylene were below cleanup levels in the North Plume, leaving benzene and ethylbenzene as the only two COCs that remain above cleanup levels. In the South Plume, benzene, toluene, and ethylbenzene are still present above cleanup goals. The OU2 ROD identified only benzene, toluene, and ethylbenzene as the surface water monitoring COCs. The sum of benzene, toluene, and ethylbenzene results must also be below the surface water cleanup level (10 µg/L) to

meet Alaska Water Quality Standards for TAH (USAF, 1995a). COCs and ROD cleanup levels for ST041 are presented in **Table 5-1**.

The selected remedy for ST041 included actions for both source control and groundwater. The source control components were completed through the free-product collection systems operated in the ST041 North Plume from 1993 to 1999, and included the following components:

- Cleaning of the four one-million-gallon USTs, disposal of the residuals according to applicable statutes, filling them with an inert material such as sand or gravel, and abandoning the tanks *in situ*.
- Excavation, removal, and disposal/recycling of the piping system.
- Removal of contaminated soil associated with the piping, and offsite disposal and low thermal treatment of soils.
- Revegetation of the area.

The remedy for groundwater includes the following major components:

- Monitoring the groundwater beneath and adjacent to ST041 to evaluate contaminant migration and timely reduction of contaminant concentrations by natural attenuation within 21 years. This will include FYRs to assess the protectiveness of the remedial action as long as contamination remains above unacceptable levels.
- Maintaining ICs that restrict access to groundwater and groundwater development at ST041 as long as hazardous substances remain on the site at levels that preclude unrestricted use.

A contingent remedy for ST041 was also outlined in the ROD, and includes the following major components (USAF, 1995a):

- Continuing the operation of the IRA free-product recovery system until all technically practicable free product has been recovered to mitigate this continuing source of contamination.
- Extracting groundwater from the shallow aquifer to eliminate further migration.
- Treating the extracted water with an air stripping process to meet federal, state, and local water quality regulations.
- Treating the air emissions from the air stripping process, as needed, to meet substantive state and Base air emission permit requirements.
- Disposing of the treated groundwater in accordance with federal, state, and local regulations and substantive permit requirements.
- Conducting FYRs to assess the protectiveness of the remedial action.
- Monitoring the effectiveness of the groundwater containment and treatment process until the concentrations reach the MCL and groundwater no longer poses an unacceptable risk.

The current status of remedy components at ST041 is presented in **Table 5-2**.

Table 5-2: OU2-ST041 Remedy Status

Remedy Component	Status
Groundwater	
Continuing the operation of the interim remedial action free-product recovery system until all practicable free product has been recovered to mitigate the continuing source of contamination.	The recovery system met the requirements and was shut down in April 1999.
Continue seep mitigation until performance criteria outlined in the ROD or a later governing document (i.e., memorandum to the site file) are met. Samples will be collected once every 5 years from seep water (ST41SP-01) to track the progress of natural attenuation. In addition, long-term monitoring must show that natural attenuation will continue to be protective of the wetlands in the area, which will be demonstrated by collected annual surface water samples at the point of compliance (ST41SW-13).	The recovery system met the requirements at the surface water points of compliance and was shut down in April 1999. Seep and wetland monitoring is ongoing to ensure protection.
Monitoring the groundwater beneath and adjacent to the site to evaluate contaminant migration and timely reduction of contaminant concentrations by natural attenuation within 21 years. This will include FYRs to assess the protectiveness of the remedial action as long as contamination remains above acceptable levels. Groundwater monitoring will be conducted in accordance with the long-term monitoring plan schedule set forth in the Remedial Design/Remedial Action Statement of Work.	Monitoring has been ongoing since 1996. The monitoring plan is reviewed annually to ensure the program remains comprehensive and protective. The 21-year timeframe was not achieved; groundwater concentrations remain above ROD cleanup levels.
Maintain LUCs that restrict access to groundwater and groundwater development at the site. The specific institutional controls (now known as LUCs) implemented and/or maintained at OU2 are as follows: • Designate the affected area for outdoor/recreational use and unmanned industrial use, excluding the development of commercial aquaculture. • Continue enforcement of Base policy prohibiting installation of groundwater wells (other than for monitoring purposes) into the shallow aquifer underlying OU2. • Prohibit unauthorized access to existing water supply and groundwater monitoring wells. LUCs will be managed and implemented in accordance with the *Memorandum to the Site File for Operable Units (OUs) 1, 2, 4, and 5* (USAF, 2010).	Implemented in March 1995 and ongoing. Land use designations were updated in the Remedial Action Report in 1998. LUCs were updated in 2007 and 2010, and the May 2011 673d Air Base Wing Instruction 32-7003 Land Use Control Management. No LUC breaches were identified during the period of review for this FYR.

Table 5-2 (Cont.) OU2-ST041 Remedy Status

Remedy Component	Status
Groundwater (Cont.)	
To ensure long-term integrity of LUCs, the USAF will ensure that, to the extent that groundwater remains above acceptable levels, deed restrictions or equivalent safeguards will be implemented in the event that property containing such contamination is transferred by the USAF. The measures taken will include: • FYR to assess the protectiveness of the remedial action. • Periodic evaluation of monitoring results to determine if there is a need for further remedial action.	FYRs have been conducted in 1998, 2003, 2008, 2014, and 2019.
Source Control	
Cleaning the four 1-million-gallon USTs, disposal of the residual sludge according to applicable statutes, and filling them with inert material	Completed in September 1996.
Excavating, removing, and disposal/recycling of the piping system.	Completed in September 1996.
Removing contaminated soil associated with piping that contains leachable concentrations of fuel-related contaminants, and offsite disposal and thermal treatment of those soils.	Completed in September 1996.
Re-vegetating the area.	Completed in September 1996.

Key:
FYR – Five-Year Review
LUC – land use control
OU – Operable Unit
ROD – Record of Decision
USAF – U.S. Air Force
UST – underground storage tank

5.2.3 Status of Implementation

The remedy included a treatment system for groundwater and surface water (source control) and MNA. Free-product collection systems operated in the ST041 North Plume from 1993 to 1999, after which collection activities ceased because recovery rates had diminished to negligible levels (USAF, 2018c).

Current monitoring requirements at ST041 include groundwater, seep, and surface water sampling and an annual LUC inspection. Monitoring is conducted in accordance with the Sampling Frequency Decision Guide in the *OU2 Memorandum to the Site File* (USAF, 2011b).

Groundwater monitoring has been ongoing at ST041 since 1996. Groundwater COC concentrations remain above ROD cleanup levels, but Mann-Kendall trend tests for all analytes in all monitoring wells sampled show statistically significant decreasing contaminant trends (USAF, 2018c). The surface water point of compliance (ST41SW-13) has consistently shown COC concentrations below ROD cleanup levels (USAF, 2018c).

5.2.4 LUC Summary

LUCs were implemented in March 1995 to restrict access to groundwater and groundwater development at ST041 and include the following:

- Designate the affected area for outdoor/recreational use and unmanned industrial use, excluding the development of commercial aquaculture.
- Continue enforcement of Base policy prohibiting installation of groundwater wells (other than for monitoring purposes) into the shallow aquifer underlying OU2.
- Prohibit unauthorized access to existing water supply and groundwater monitoring wells.

LUCs were updated in 2007 and 2010, as well as in the 673d Air Base Wing Instruction 32-7003 *Land Use Control Management* and are managed and implemented in accordance with the *Memorandum to the Site File for Operable Units (OUs) 1, 2, 4, and 5* (USAF, 2010).

As stated in the *Land Use Controls Management Plan* (USAF, 2003a) (**Appendix D**), OU2 (including ST041) is designated as a "Restricted Use Area" for recreational use and unmanned facilities only. Construction of manned facilities is prohibited at the site. Groundwater development and the use of groundwater at the site for any purpose is prohibited, as long as COCs remain above cleanup levels precluding unrestricted use.

Compliance with LUCs applies to all soil-disturbing activities on JBER and is reviewed annually (USAF, 2018c). A GIS-based tracking system is in place to ensure that LUCs are enforced and has been incorporated into the *Base General Plan*. A copy of the LUC inspection form is provided in **Appendix E**.

5.2.5 Systems Operations / Operations and Maintenance

No active systems are currently operated as part of remediation at SST041.

5.3 PROGRESS SINCE THE LAST REVIEW

This is the fifth FYR for JBER-E. The protectiveness determination and statement from the 2014 FYR are presented in **Table 5-3**. Issues and recommendations from the 2014 FYR and the current status of those recommendations are presented in **Table 5-4.**

Table 5-3: OU2-ST041 Protectiveness Determination/Statement from the 2014 FYR

Site	Protectiveness Determination	Protectiveness Statement
OU2	Short-term Protective	The remedy at ST041 is currently protective of human health and the environment because LUCs are preventing exposure to contaminated groundwater and soil. However, in order for the remedy to be protective in the long-term, the remedial processes selected in the ROD will need to be optimized or the contingency remedy will need to be selected and implemented, because it does not appear that there will be sufficient progress in the timeframe established in the ROD.

Key:
FYR – Five-Year Review
LUC – land use control
OU – Operable Unit
ROD – Record of Decision

Table 5-4: OU2-ST041 Status of Recommendations from the 2014 FYR

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date
Although COCs in the groundwater at ST041 are showing decreasing trends, RAOs will not be met within the 21-year timeframe specified in the ROD (by 2016). Additionally, the ROD identifies a "contingent remedy" that will be implemented if the USAF, in consultation with ADEC and the EPA, determine that natural attenuation is not occurring at an acceptable rate.	Determine the rate of natural attenuation at OU2. Evaluate whether the contingency remedy should be implemented.	Ongoing	The timeframe identified in the ROD for achieving cleanup levels (2016) was not met. Groundwater COC concentrations are evaluated annually and remain above ROD cleanup levels, but Mann-Kendall trend tests for all analytes in all monitoring wells sampled show statistically significant decreasing contaminant trends (USAF, 2018c). The surface water point of compliance (ST41SW-13) has consistently shown COC concentrations below ROD cleanup levels. Evaluation of the contingent remedy identified in the ROD has not yet been completed. (USAF, 2018c).	Not applicable
Monitoring Well ST41-25 showed signs of frost heaving during site inspection activities.	Perform maintenance on Monitoring Well ST41-25, which showed signs of frost heaving during site inspection activities.	Complete	Well maintenance was performed at two wells in 2014; ST41-10R and ST41-25 well casings were cut down and resurveyed (USAF, 2015).	2014
Monitoring Well ST41-10R is not being sampled in accordance with the decision guide for monitoring well sampling frequency at OU2 provided in the 2011 *Memorandum to the Site File: Operable Unit 2* (USAF, 2011b).	Reevaluate the sampling frequency for Monitoring Well ST41-10R based on the decision guide for monitoring well sampling frequency at OU2 provided in the 2011 *Memorandum to the Site File: Operable Unit 2.*	Incomplete	The monitoring frequency for Monitoring Well ST41-10R appears to have been reviewed in 2015; it was on a 2-3 year cycle and was changed to a 2-year cycle; however, this frequency does not adhere to the decision guide in the *Memorandum to the Site File, Operable Unit 2* (USAF, 2011b).	Not applicable

Table 5-4 (Cont.) OU2-ST041 Status of Recommendations from the 2014 FYR

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date
The LF004 CERCLA site boundary appears to extend beyond JBER-E site boundaries. *Note: this issue was specifically noted for LF004 but applied to all sites covered by the FYR.*	All CERCLA site boundaries should be reviewed for accuracy and be revised, when applicable, in a memorandum to the site file.	Complete	CERCLA site and LUC boundaries and are maintained in a Geographic Information System (GIS) database. At the time of this FYR, there are no noted boundary discrepancies at ST041.	Not applicable
An in-depth description of the historical site events for each OU and DP098 was not included within Table 2-1 of the 2014 FYR.	Expand the chronology table in the next FYR to include detailed information concerning the chronology of site events for each OU and DP098.	Considered But Not Implemented	Chronology table not required in approved template for this FYR.	Not applicable

Key:
ADEC – Alaska Department of Environmental Conservation
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
COC – contaminant of concern
EPA – U.S. Environmental Protection Agency
FYR – Five-Year Review
JBER-E – Joint Base Elmendorf-Richardson-Elmendorf Air Force Base
LUC – land use control
OU – Operable Unit
RAO – Remedial Action Objective
ROD – Record of Decision
USAF – United States Air Force

5.4 FYR PROCESS

5.4.1 Site Interviews

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. Site interviews for JBER-E were conducted as discussed in Section 3.1. There were no specific comments regarding OU2 or ST041.

5.4.2 Data Review

A summary of data since the 2014 FYR is presented in Section 5.2.3. Data collected at ST041 during the period of this FYR (2014-2018) were reviewed. Data reviewed included: 2014 through 2016 monitoring activities (USAF, 2015; 2017b; 2017c). Data is presented on **Figure 5-1**.

Data collected under the ERP are archived in the USAF ERPIMS database; however, not all data collected over the life of ST041 may have been archived into the system. All historical data available in the ERPIMS for the site (18 September 1991 through 13 September 2016) were reviewed to support a technical assessment of chemical-specific toxicity changes since the ROD was signed. See Section 5.5.2.

5.4.3 Site Inspection

A site inspection was conducted at ST041 on 1 August 2017. The purpose of the inspection was to assess the protectiveness of the remedy. A site inspection form and photographs are provided in **Appendix E**. The only notable item identified during the inspection was damage to the information kiosk. This damage has been noted and recommended for repair in previous monitoring events and LUC inspections.

5.5 TECHNICAL ASSESSMENT

5.5.1 Question A – Is the remedy functioning as intended by the decision documents?

Yes. The review of documents, site data, and the results of the site inspections indicate that the remedy for ST041 is functioning as intended by the ROD; however, the timeframe set out in the ROD by which COC cleanup levels were expected to be achieved (2016) was not met. Groundwater COC concentrations remain above ROD cleanup levels, but Mann-Kendall trend tests for all analytes in all monitoring wells sampled show statistically significant decreasing contaminant trends (USAF, 2018c). The surface water point of compliance (ST41SW-13) has consistently shown COC concentrations below ROD cleanup levels.

The ROD included a contingent remedy to be implemented if natural attenuation at ST041 will not meet RAOs by 2016. The 2014 FYR recommended evaluation of whether the contingent remedy should be implemented; this FYR supports this recommendation, but this has not yet been completed.

The LUCs at ST041 are functioning as intended and continue to be protective of human health and the environment.

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

Revised cleanup levels have been promulgated and toxicity data has changed since the ROD was signed; however, MCLs have not changed.

Changes in Standards:

The chemical-specific ARARs for groundwater (40 CFR 141) and surface water (18 AAC 70) listed in the ROD (USAF, 1995a) do not have any changes that affect regulatory-based cleanup levels for groundwater COCs at ST041. However, regulatory cleanup levels (18 AAC 75) have recently been revised. The new cleanup levels are human health based, and account for toxicity changes that have occurred since the ROD was signed. These changes are presented in **Table 5-5**.

Table 5-5: OU2-ST041 Comparison of ROD Final Remediation Goals to 2017 Standards

Chemical	ROD Cleanup Level	2017 ADEC Cleanup Level[1]	Federal MCLs	Historic Site Concentration	LTM Site Sample
Groundwater (µg/L)					
Benzene	5	4.6	5	1,100	6,300
Ethylbenzene	700	15	700	6,100	1,840
Toluene	1,000	1,100	1,000	20,000	5,780
Xylenes, total	10,000	190	10,000	26,000	8,240
Surface Water (µg/L)					
Benzene	10[2]	4.6	5	1,500	ND
Ethylbenzene	10[2]	15	700	4,200	--
Toluene	10[2]	1,100	1,000	380	--

Key:
1 – ADEC cleanup levels (18 AAC 75.345(c), as amended through 7 November 2017).
2 - Cleanup levels are based on total aromatic hydrocarbons (defined as the sum of benzene, ethylbenzene, and toluene)
-- – not applicable
µg/L – micrograms per liter
AAC – Alaska Administrative Code
ADEC – Alaska Department of Environmental Conservation
LTM – long-term monitoring
MCL – Maximum contaminant level, Safe Drinking Water Act (40 CFR 141 and 40 CFR 143)
ND – non detect
OU – Operable Unit
ROD – Record of Decision

All available data for ST041 were evaluated against the ADEC standards(ADEC 2017) and calculations were performed for chemicals with detections within the last 5 years above the new standards to determine potential exposure risks (**Appendix F**, **Tables F-1** through **F-3**). These calculations, based on the recent concentrations and the residential exposure assumption, included: (in groundwater) benzene, ethylbenzene and total xylenes.

New toxicity data was reviewed and indicates that samples should be collected and analyzed for: 2-methylnaphthalene, naphthalene, thallium vanadium and total xylenes in groundwater and mercury, pentachlorophenol and 2-methylnaphthalene in soil to determine if concentrations of these chemicals pose an unacceptable risk at ST041.

It is recommended that AFCEC and EPA should consider transferring ST041 out of CERCLA oversight to State oversight (18 AAC 75) as soon as possible.

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

No information has been discovered that calls into question the protectiveness of the remedy.

5.6 ISSUES / RECOMMENDATIONS

Issues identified during this FYR that affect the protectiveness of the remedy are shown below.

Issues and Recommendations Identified in the Five-Year Review				
OU(s): OU2, Site ST041	**Issue Category:** Remedy Performance			
	Issue: Groundwater COCs (benzene, toluene, ethylbenzene, and total xylenes) have not achieved RAOs in the timeframe specified by the ROD (2016).			
	Recommendation: The contingent remedy was reevaluated in the Supplemental Site Characterization Report (USAF, 2018d). This should be determined if appropriate for implementation. Groundwater cleanup timelines should be reestablished using groundwater modelling.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023
OU(s): OU2, Site ST041	**Issue Category:** Remedy Performance			
	Issue: Due to changes in toxicity data or regulatory cleanup standards, some chemicals current final remediation goals may exceed EPA human health guidance: (in groundwater) benzene, ethylbenzene and total xylenes.			
	Recommendation: The AF will evaluate any changes in promulgated standards and chemical toxicity characteristics in accordance with OSWER 9355.7-03B, Appendix G (June 2001) to determine if the current remedy will reduce contamination to within the acceptable CERCLA risk ranges for protectiveness. If the evaluation determines that acceptable risk will not be achieved by the current remedy, the decision document will be appropriately revised following the CERCLA process.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023

Recommendations identified during this FYR that do not affect the protectiveness of the remedy at ST041 include:

Issue No.	OU-Site	Finding/ Recommendation
1	OU2-ST041	Repair the damaged information kiosk, which has been noted in previous reports
2	OU2-ST041	The 2014 FYR recommended the sampling frequency for Monitoring Well ST41-10R be modified to adhere to the sampling frequency decision guide presented in the *Memorandum to the Site File for Operable Unit 2* (USAF, 2011b). The monitoring frequency appears to have been reviewed in 2015; it was on a 2-3 year cycle and was changed to a 2-year cycle; however, this frequency does not adhere to the decision guide. It is recommended that the sampling frequency for all wells be reviewed in order to ensure compliance with the decision guide in the *Memorandum to the Site File for Operable Unit 2* (USAF, 2011b).
3	OU2-ST041	Recommend that OU2-ST041 be transferred from CERCLA under the FFA to monitoring and compliance under the State as a Petroleum only site
4	OU2-ST041	Due to changes in toxicity data and regulatory cleanup standards, site historic data for some chemicals may exceed EPA human health guidance for risk analysis some non COCs: (in groundwater): 2-methylnaphthalene, naphthalene, thallium, and vanadium; (in surface water) thallium; and (in soil): mercury, pentachlorophenol, and 2-methylnaphthalene. Conduct a sampling event to identify current concentrations in groundwater and soil for these chemicals.

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6.0 OPERABLE UNIT 4 (FT023)

OU4 is located in the central portion of JBER-E and is made up of two geographic areas: OU4 West and OU4 East (**Figure 6-1**). OU4 West consists of FT023 (former fire training area), SD024 (Hangar 10), SD025 (Hangar 11), SD026 (Hangar 14), and SD027 (Hangar 8), while OU4 East includes SD028 (Hangar 15), SD029 (Building 43-410), and SS010 (former asphalt drum storage area). Additionally, SD030 (Building 21-900) and SS018 (Building 22-021) were also included in the OU4 ROD. Sites SD026, SD027, SD030, and SS018 were recommended for NFA in the OU4 ROD. Additional sites reaching subsequent closure include Site SS010 (2006), SD024 (August 2015), and SD028 (January 2018). In January 2018, an Explanation of Significant Differences (ESD) was signed for SD025 transferring it out of the CERCLA program to be managed under State cleanup regulations since remaining contaminants are fuel related. The sites remaining open in OU4 are FT023 and SD029.

6.1 SITE BACKGROUND

FT023 is located on the west side of JBER-E, west of the North/South Runway between Airlifter Drive and 33rd Street and consists of two plumes (**Figure 6-2**). The FT023 plumes are also referred to as the Fire Training Area (FTA) Plumes. Groundwater contamination at this site has been attributed to two source areas: leaking USTs from a former drum storage area and a possible upgradient unknown source area (comprising the southern plume) and a bermed burning area (comprising the northern plume). The drum storage area was used to store as many as 100 5-gallon drums of contaminated waste oils, paint thinners, waste fuel, and waste solvents from aircraft maintenance and other shop operations. The exact location of the former drum storage area is unknown. Fire training activities were conducted in the bermed area from the 1940s to 1983. From the 1940s to the 1960s, combustible wastes, including oils, fuels, and solvents were used as fuel for the training exercises (USAF, 2018c).

6.2 RESPONSE ACTION SUMMARY

6.2.1 Basis for Taking Action

CERCLA hazardous substances released at JBER-E resulted in soil, sediment, surface water, and groundwater contamination in various locations. The initial risk assessment at OU4 determined that the human and/or ecological risks exceeded the EPA's average or reasonable maximum exposure risk management criteria, and that remedial action must be taken.

The OU4 ROD identified COCs in groundwater and soil as the basis for FT023 cleanup goals (USAF, 1995b). Groundwater COCs include: 1,1,1-trichloroethane (TCA), 1,1-dichloroethylene (DCE), DCA, tetrachloroethylene (PCE), TCE, cis-1,2-DCE, and benzene. Soil COCs include diesel range organics (DRO) and gasoline range organics (GRO). In 2010, corrections were made to some of the groundwater cleanup goals in a Memorandum to the Site File (USAF, 2010).

Risk Summary

The OU4 ROD included the results of a baseline HHRA, conducted to estimate the risk posed to human health by source areas within OU4. Two land use scenarios were evaluated for shallow

soils: future residential and current onsite worker. A construction worker scenario was also evaluated for deep soils. Groundwater risk evaluation was evaluated for future residential and future onsite workers. The HHRA found that risks from exposure to shallow soils at FT023 were 2.7×10^{-5} for future residents and below 1×10^{-6} for current onsite workers. Risks to construction workers from deep soils were below 1×10^{-6}. Groundwater risks were 2.1×10^{-4}, with a noncancer hazard index (HI) of 2.8 for future residents. Groundwater risks for future onsite workers were 1.5×10^{-5}, with a noncancer HI below 1 (USAF, 1995b).

The OU4 ROD also included the results of an ERA at OU4. The ERA was performed to determine if the reported concentrations of chemicals or calculated exposures to plants and wildlife at OU4 are likely to produce adverse effects. The ERA found no significant impacts to plants or animals warranting action (USAF, 1995b).

6.2.2 Response Actions

Environmental investigations have been conducted at OU4 since the early 1980s. The first investigation to examine contamination was conducted in 1990, followed in 1992 by a Limited Field Investigation. A full-scale RI was conducted in 1993.

Several specific sources of groundwater contamination were identified during the RI, including: the training activities at the FTA, a leaking 25,000-gallon UST and some buried drums near the FTA, leaking valve pits and USTs at Hangar 11, leaking valve pits at Hangar 15, and a leaking pumphouse or piping near Hangar 8. Solvent contamination at OU4 East (**Figure 6-2**) was attributed to dry wells (wells used to allow wastewater, used solvents, etc. to be absorbed by the ground) or an upgradient leach field located near Hangar 15.

Remedial Action Objectives

RAOs provide a general description of what the cleanup will accomplish. RAOs specified in the OU4 ROD are as follows:

- Protect human health and the environment by preventing ingestion of and contact with contaminated media by people.
- Protect uncontaminated media by preventing releases from sources.
- Use treatment techniques whenever practicable.
- Implement a cost-effective solution that can achieve the cleanup levels for the final COCs.

Remedy Components

The OU4 ROD-selected remedy included bioventing and LUCs for subsurface soil contamination, and natural attenuation and LUCs for groundwater contamination (USAF, 1995b). Minor modifications to the ROD were documented as memoranda to the site file, through which a sampling frequency decision guide was established in 2003 (USAF, 2003b), and corrected the cleanup values that had been previously listed in error (USAF, 2010). ROD cleanup levels for FT023 COCs are presented in **Table 6-1**.

Table 6-1: OU4-FT023 Contaminants of Concern and ROD Cleanup Levels

Contaminant of Concern	ROD Cleanup Level	Basis for Cleanup Level[1]
Groundwater (µg/L)		
1,1,1-Trichloroethane (1,1,1 TCA)	200	MCL
1,1-Dichloroethylene (1,1 DCE)	7	MCL
1,2-Dichloroethane (1,2 DCA)	5[2]	MCL
Tetrachloroethylene (PCE)	5[2]	MCL
Trichloroethylene (TCE)	5[2]	MCL
cis-1,2-Dichloroethylene	70	MCL
Benzene	5	MCL
Soil (mg/kg)		
Diesel Range Organics	2,000	ACM
Gasoline Range Organics	1,000	ACM

Key:
1 – MCLs correspond to the values listed in 40 Code of Federal Regulations 131 and 18 AAC 70.010a and d, 70.015 through 70.011, and 80.070.
2 – The cleanup levels for 1,2-dichloroethane, tetrachloroethene, and trichloroethene (TCE) in groundwater as presented in the OU4 ROD were inconsistent with their referenced standards. The cleanup levels here reflect the corrected values established in the Memorandum to the Site File (USAF, 2010).
µg/L – micrograms per liter
AAC – Alaska Administrative Code
ACM – Alaska Cleanup Matrix Level D, promulgated under 18 AAC 78.315.
MCL – maximum contaminant level
mg/kg – milligrams per kilogram
OU – Operable Unit
ROD – Record of Decision

The selected remedy for FT023 included components for both soil and groundwater. The groundwater remedy includes the following major components:

- ICs on land and water use will restrict access to the contaminated groundwater throughout OU4 until cleanup levels have been achieved.
- Groundwater will be monitored and evaluated semi-annually to assess contaminant migration and timely reduction of contaminant concentrations by intrinsic remediation. This will include FYRs to assess the protectiveness of the remedial action, as long as contamination remains above cleanup levels. A monitoring plan will be prepared to address the details involved in sampling.
- All groundwater is expected to be cleaned up within 13 years.

The soil remedy includes the following major components:

- ICs on land use will continue to restrict access to the contaminated shallow soils throughout OU4 until cleanup levels have been achieved.

- Deep soils (greater than 5 feet below ground surface [bgs]) will be treated with bioventing to accelerate degradation of contaminants in those locations.
- Both shallow and deep soils will be monitored biannually to evaluate contaminant migration and timely reduction of contaminant concentrations by bioventing and intrinsic remediation. If cleanup levels are not being achieved, further remedial action will be evaluated. This will include FYRs to assess the protectiveness of the remedial action, as long as contamination remains above cleanup levels. When concentrations in the bioventing areas are below cleanup levels, bioventing will be discontinued.
- All soils are expected to be cleaned up within 11 years.

The current status of remedy components is presented in **Table 6-2**.

Table 6-2: OU4-FT023 Remedy Status

Remedy Component	Status
Groundwater	
Institutional controls (also known as LUCs) on land and water use restrictions will restrict access to the contaminated groundwater throughout OU4 until cleanup levels have been achieved. OU4 is designated "Airfield Use Area" for aircraft operation and maintenance, to include active and inactive runways, taxiways, and parking aprons for aircraft. LUCs will be managed and implemented in accordance with the *Memorandum to the Site File for Operable Units (OUs) 1, 2, 4, and 5* (USAF, 2010).	Implemented in April 1998. LUCs updated in memoranda to the site file in 2007 and 2010, and May 2011 673d Air Base Wing Instruction 32-7003 *Land Use Control Management*. No LUC breaches were identified during the period of review for this FYR.
Groundwater will be monitored and evaluated in accordance with the *Well Sampling Frequency Decision Guide* to assess contaminant migration and timely reduction of contaminant concentrations by intrinsic remediation (i.e., natural attenuation). This will include FYRs to assess the protectiveness of the remedial action, as long as contamination remains above cleanup levels.	Ongoing since 1996. The *Well Sampling Frequency Decision Guide* was used to establish a monitoring schedule in 2003 (USAF, 2003b). FYRs were conducted in 1998, 2003, 2008, 2014, and 2018. Chemical of concern concentrations are generally decreasing.
All groundwater is expected to be cleaned up within 13 years.	The 13-year timeframe was not achieved; groundwater concentrations remain above ROD cleanup levels.

Table 6-2 (Cont.): OU4-FT023 Remedy Status

Remedy Component	Status
Soil	
Institutional controls (also known as LUCs) on land use and water use restrictions will restrict access to the contaminated groundwater throughout OU4 until cleanup levels have been achieved. OU4 is designated "Airfield Use Area" for aircraft operation and maintenance (O&M), to include active and inactive runways, taxiways, and parking aprons for aircraft. LUCs will be managed and implemented in accordance with the *Memorandum to the Site File for Operable Units (OUs) 1, 2, 4, and 5* (USAF, 2010).	Implemented in April 1998. All shallow soils in OU4 met cleanup levels as of 1998.
Deep soils at FT023 will be treated with bioventing to accelerate degradation of contaminants in those locations.	A bioventing system was installed in 1995.
Both shallow and deep soils will be monitored bi-annually to evaluate contaminant migration and timely reduction of contaminant concentrations by intrinsic remediation (i.e., natural attenuation). If cleanup levels are not being achieved, further remedial action will be evaluated. This will include FYRs to assess the protectiveness of the remedial action, as long as contamination remains above cleanup levels.	Soils have reached cleanup levels at all sites. FYRs were conducted in 1998, 2003, 2008, 2014, and 2018.
When concentrations in the bioventing areas are below cleanup levels, bioventing will be discontinued.	The bioventing system at FT023 was shut down and closure sampling was conducted in 2009.
All soils are expected to be cleaned up within 11 years (2006).	Soils meet ROD cleanup levels at all OU4 sites.

Key:
FYR – Five-Year Review
LUC – land use control
OU – Operable Unit

6.2.3 Status of Implementation

A bioventing system was installed at FT023 in 1995 and decommissioned in 2010 after DRO concentrations in soils were demonstrated to be below cleanup levels.

Groundwater monitoring has been ongoing at FT023 since 1996. Groundwater monitoring plans are updated annually to ensure that the program remains comprehensive and protective. Groundwater monitoring results have been evaluated annually since the Fourth FYR. Current monitoring requirements at FT023 include periodic groundwater sampling and an annual LUC inspection. Monitoring is conducted in accordance with the *Well Sampling Frequency Decision Guide* in the OU4 *Memorandum to the Site File* (USAF, 2003b). Groundwater cleanup goals for 1,1,1-TCA, 1,1-DCE, and 1,2-DCA have been met and are no longer monitored at FT023. Annual groundwater sampling occurred at the former bermed fire training pit, part of the North Plume,

until 2011. The northern plume was removed from annual sampling after three successive years of measuring COC concentrations below cleanup goals.

Groundwater sampling results since the Fourth FYR indicate that TCE remains above ROD cleanup levels in Monitoring Well GW-5A, with no statistical contaminant trends (USAF, 2018c). Monitoring Well 407MW-01 did not exceed ROD cleanup goals for any COC and appears to be outside the TCE plume boundary. Results indicate that reductive dechlorination is occurring and anaerobic conditions exist upgradient of the site (USAF, 2017b). In Monitoring Well OU4MW-11, PCE, TCE, and cis-1,2-DCE concentrations remain above cleanup levels, but all, as well as benzene, show statistically significant decreasing trends (USAF, 2015).

In 2014, a limited site investigation (LSI) was conducted at FT023 to better delineate the nature and extent of chlorinated aromatic hydrocarbon contamination in groundwater at the site. The LSI recommended conducting additional work in order to better delineate the extent of the chlorinated solvent contamination by collecting soil samples and installing a downgradient monitoring well (USAF, 2018c).

A vapor intrusion study was conducted at JBER from 2016 to 2017, and included Buildings 17508, 17520, 17534, and 18522 at FT023. The study concluded that the vapor intrusion pathway is considered potentially complete at Building 17534. A vapor intrusion pathway was considered potentially complete if soil gas COC concentrations were greater than indoor air concentrations, but outdoor or non-vapor intrusion sources could not be ruled out. Based on the maximum detected indoor air results, the total HI was below 1 at 0.08 and the cumulative cancer risk was 1×10^{-6} for an indoor worker at Building 17534 (USAF, 2018b).

A 1,4-dioxane investigation was completed at JBER in 2017 (USAF, 2017c). Results from the two monitoring wells sampled at FT023 (GW-4A and OU4W-11) did not exceed EPA RSLs or ADEC cleanup levels (USAF, 2017c).

6.2.4 LUC Summary

LUCs were implemented in April 1998 to restrict access to contaminated media throughout OU4 until cleanup levels are achieved. LUCs were updated in 2010, as well as the 673d Air Base Wing Instruction 32-7003 *Land Use Control Management* and are managed and implemented in accordance with the *Memorandum to the Site File for Operable Units (OUs) 1, 2, 4, and 5* (USAF, 2010).

As stated in the *Land Use Controls Management Plan* (USAF, 2003a) (**Appendix D**), OU4 (including FT023) is designated as an "Airfield Use Area." This restricts activities to aircraft operations and maintenance, which include active and inactive runways, taxiways, and parking aprons for aircraft. The establishment of residential development is strictly prohibited.

Compliance with LUCs applies to all soil-disturbing activities on JBER and is reviewed annually (USAF, 2018c). A GIS-based tracking system is in place to ensure that LUCs are enforced and has been incorporated into the *Base General Plan*. A copy of the LUC inspection form is provided in **Appendix E**.

6.2.5 Systems Operations / Operations and Maintenance

No active systems are currently operated as part of remediation at FT023.

6.3 PROGRESS SINCE THE LAST REVIEW

This is the fifth FYR for JBER-E. The OU4 protectiveness determination and statement from the 2014 FYR are presented in **Table 6-3**. Issues and recommendations for Site FT023 from the 2014 FYR and the current status of those recommendations are presented in **Table 6-4**.

Table 6-3: OU4 Protectiveness Determination/Statement from the 2014 FYR

Site	Protectiveness Determination	Protectiveness Statement
OU4	Protectiveness Deferred	Protectiveness determination of the remedy at OU4 is deferred until the potential impacts associated with the vapor intrusion pathway at the site are evaluated. The vapor intrusion assessment is expected to be performed in 2016. Vapor intrusion evaluations will be conducted prioritizing buildings with the most vulnerable populations (schools, day cares, offices, and residences).

Key:
FYR – Five-Year Review
OU – Operable Unit

6.4 FYR PROCESS

6.4.1 Site Interviews

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. Site interviews for JBER-E were conducted as discussed in Section 3.1. There were no specific comments regarding OU4 or FT023.

6.4.2 Data Review

A summary of data since the 2014 FYR is presented in Section 6.2.3. Data collected at FT023 during the period of this FYR (2014-2018) were reviewed. Data reviewed included: 2014 through 2016 monitoring activities (USAF, 2015; 2017b; 2017c), 1,4-dioxane sampling (USAF, 2017c), and the vapor intrusion study results (USAF, 2018b). Data is presented on **Figure 6-2**.

Data collected under the ERP are archived in the USAF ERPIMS database; however, not all data collected over the life of FT023 may have been archived into the system. All historical data available in ERPIMS (9 October 1986 through 3 February 2017) were reviewed to support a technical assessment of chemical-specific toxicity changes at FT023 since the ROD was signed. See Section 6.5.2.

6.4.3 Site Inspection

A site inspection was conducted at FT023 on 3 August 2017. The purpose of the inspection was to assess the protectiveness of the remedy. A site inspection form and photographs are provided in **Appendix E**. The site was observed to be in good condition, with no indications that LUCs are not functioning as intended.

6.5 TECHNICAL ASSESSMENT

6.5.1 Question A – Is the remedy functioning as intended by the decision documents?

Yes. The review of documents, site data, and the results of the site inspections indicate that the remedy for FT023 is functioning as intended by the ROD; however, the timeframe set out in the ROD by which groundwater COC cleanup levels were expected to be achieved (2008) was not met.

The remedy for groundwater at FT023 included MNA and LUCs. COC concentrations were anticipated to be below ROD cleanup levels within 13 years (2008). COC concentrations in groundwater remain above ROD cleanup levels, with statistically significant decreasing contaminant trends in Monitoring Well OU4MW-11, but no significant trends in Monitoring Well GW-5. Natural attenuation appears to be occurring with generally decreasing trends, but at a rate slower than anticipated in the ROD. It is recommended that additional studies be conducted to optimize the approach to achieve remediation goals. Other studies may include, but are not limited to site characterization, ecological assessment, focused feasibilities studies, groundwater modeling, treatability studies, and/or sampling.

The selected remedy for soils at FT023 included LUCs, bioventing to treat contamination in deep soils, and periodic monitoring of shallow and deep soils, as long as contamination remains above cleanup levels. Both shallow and deep soils have met ROD cleanup levels at all OU4 sites.

LUCs continue to prevent human exposure to contaminated groundwater at FT023.

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

Revised cleanup levels have been promulgated and toxicity data has changed since the ROD was signed; however, MCLs in have not changed.

Changes in Standards:

The chemical-specific ARARs for groundwater (40 CFR 141) listed in the ROD (USAF, 1995b) do not have any changes that affect regulatory-based cleanup levels for groundwater COCs at FT023. However, regulatory cleanup levels (18 AAC 75) have recently been revised. The new cleanup levels are human health based, and account for toxicity changes that have occurred since the ROD was signed. These changes are presented in **Table 6-5**:

Table 6-4: OU4-FT023 Status of Recommendations from the 2014 FYR

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date
Manned facilities are present in the vicinity of the contaminant plumes associated with the OU4 active sites FT023, SD025, and SD029, indicating a potential for vapor intrusion to occur at those facilities.	A vapor intrusion evaluation that provides multiple lines of evidence should be conducted in accordance with EPA guidance for each occupied facility that is in proximity to the VOC plume(s) at FT023, SD025, and SD029. Vapor intrusion evaluations should be conducted prioritizing buildings with the most vulnerable populations (schools, day cares, offices, and residences).	Completed	A vapor intrusion study was conducted from 2016 to 2017 at JBER, and included Buildings 17508, 17520, 17534, and 18522 at FT023. The study concluded that the vapor intrusion pathway is considered potentially complete at Building 17534, but that no risks or hazard thresholds are exceeded. (USAF, 2018b).	1/1/2018
The potential exists for concentrations of 1,4-dioxane to be present in conjunction with TCE contamination at the site.	Based on USAF guidance (*Interim Air Force Guidance on Sampling and Response Actions for 1,4-Dioxane at Operational and BRAC Installations, 15 Aug 2013*), recommend a sampling event be conducted to identify if concentrations of 1,4-dioxane exist. Determine whether there is an unacceptable risk at the site.	Completed	A 1,4-dioxane investigation was completed at JBER in 2017 (USAF, 2017c). Results from the two monitoring wells sampled at FT023 (GW-4A and OU4W-11) did not exceed EPA RSLs or ADEC cleanup levels (USAF, 2017c).	2017
Monitoring Well GW-5A has not been sampled since 2009, making it difficult to determine plume progression at the FT023 South Plume.	Monitoring Well GW-5A has not been sampled since 2009. Because COCs in Monitoring Well OU4W-11 are approaching the cleanup levels, it is recommended that GW-5A be sampled again to gain understanding of how the rest of the plume is progressing.	Completed	Monitoring Well GW-5A was sampled in 2014 and 2016 and remains on a biannual sampling schedule. TCE remains above ROD cleanup levels and shows no statistical trends.	2016
An in-depth description of the historical site events for each OU and DP098 was not included within Table 2-1 of the 2014 FYR.	Expand the chronology table in the next FYR to include detailed information concerning the chronology of site events for each OU and DP098.	Considered But Not Implemented	Chronology table not required in the approved template for this FYR.	Not applicable

Table 6-4 (Cont.) OU4-FT023 Status of Recommendations from the 2014 FYR

Key:
ADEC – Alaska Department of Environmental Conservation
EPA – U.S. Environmental Protection Agency
FYR – Five-Year Review
JBER – Joint Base Elmendorf-Richardson
ROD – Record of Decision
RSL – Regional Screening Level
TCE – trichloroethylene
USAF – United States Air Force
VOC – volatile organic compound
OU – Operable Unit

Table 6-5: OU4-FT023 Comparison of ROD Final Remediation Goals to 2017 Standards

Chemical	ROD Cleanup Level	ADEC Cleanup Level[1]	Federal MCLs	Historic Site Concentration	LTM Site Sample
Groundwater (µg/L)					
1,1,1-Trichloroethane	200	200	200	23	--
1,1-Dichloroethylene	7	7	7	13.7	--
1,2-Dichloroethane	5	1.5	5	12.4	--
Tetrachloroethylene (PCE)	5	5	5	78	18
Trichloroethylene (TCE)	5	2.8	5	96	35.9
cis-1,2-Dichloroethene	70	36	70	904	110
Benzene	5	4.6	5	394	1.2
Soil (mg/kg)					
Diesel Range Organics	2,000		--		--
Gasoline Range Organics	1,000		--		--

Key:
1 – ADEC cleanup levels (18 AAC 75.341(c), as amended through 7 November 2017).
-- – not applicable
µg/L – micrograms per liter
AAC – Alaska Administrative Code
ADEC – Alaska Department of Environmental Conservation
LTM – long-term monitoring
MCL – Maximum contaminant level, Safe Drinking Water Act (40 CFR 141 and 40 CFR 143)
mg/kg – milligrams per kilogram
ND – non detect
OU – Operable Unit
ROD – Record of Decision

All available data for FT023 were evaluated against the ADEC standards (ADEC, 2017). Calculations were performed for chemicals with detections above the new standards to determine exposure risk (**Appendix F**, **Tables F-1** through **F-3**). These calculations are based on recent site concentrations and the residential exposure assumption. These calculations show a changed exposure risk for: (in groundwater) TCE.

New toxicity data was reviewed and indicates that samples should be collected and analyzed for: benzene, TCE, and total xylenes in soil to determine if concentrations of these chemicals pose an unacceptable risk at FT023.

The 2014 LSI recommended conducting additional work in order to better delineate the extent of the chlorinated solvent contamination by collecting soil samples and installing a downgradient monitoring well. The soil investigation should also include analysis for the above chemicals.

Changes in Exposure Pathways

Manned facilities (Building 17534) are present in the vicinity of the FT023 South Plume (**Figure 6-2**), and although the vapor intrusion pathway was found to be potentially complete, risks and hazards are below thresholds.

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

Yes. FT023 was included in a 2016 JBER-wide investigation into the presence or absence of PFOS/PFOA (USAF, 2018e).

6.6 ISSUES / RECOMMENDATIONS

Issues identified during this FYR that affect the protectiveness of the remedy are shown below.

Issues and Recommendations Identified in the Five-Year Review				
OU(s): OU4, Site FT023	**Issue Category:** Remedy Performance			
	Issue: Due to changes in toxicity data or regulatory cleanup standards, some chemicals current final remediation goals may exceed EPA human health guidance: (in groundwater) TCE.			
	Recommendation: The AF will evaluate any changes in promulgated standards and chemical toxicity characteristics in accordance with OSWER 9355.7-03B, Appendix G (June 2001) to determine if the current remedy will reduce contamination to within the acceptable CERCLA risk ranges for protectiveness. If the evaluation determines that acceptable risk will not be achieved by the current remedy, the decision document will be appropriately revised following the CERCLA process.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023
OU(s): OU4, Site FT023	**Issue Category:** Remedy Performance			
	Issue: Limited natural attenuation of COCs in groundwater is occurring at the site, and RAOs were not achieved within the projected timeline.			
	Recommendation: Conduct additional studies to optimize the approach to achieve remediation goals. Other studies may include, but are not limited to: site characterization, ecological assessment, focused feasibilities studies, groundwater modeling, treatability studies, and/or sampling. Groundwater cleanup timelines should be reestablished.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023

Recommendations identified during this FYR that do not affect the protectiveness of the remedy at FT023 include:

Issue No.	OU-Site	Finding/ Recommendation
1	OU4-FT023	Due to changes in toxicity data and regulatory cleanup standards, site historic data for some chemicals may exceed EPA human health guidance for risk analysis some non COCs: (in soil) benzene, TCE, and total xylenes. Conduct a sampling event to identify current concentrations in soil for these chemicals.

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7.0 OPERABLE UNIT 4 (SD029)

OU4 consists of sites FT023, SD024, SD025, SD026, SD027, SD028, SD029, SD030, SS010, and SS018. Sites FT023 and SD029 remain open in this OU (see Section 6.0 for additional information).

7.1 SITE BACKGROUND

SD029 consists of one plume (OU4 East Plume) located between Taxiway F and Talley Avenue (**Figure 7-1**). Hangar 15, which is located east of the plume, was used for aircraft maintenance. The plume is located approximately 500 feet southwest of the F-22 Weapons Release Shop (Building 16718) and Site SS109. Probable sources of contamination for the OU4 East Plume include a dry well, leach fields, pipelines, and valve pits east of Hangar 15.

7.2 RESPONSE ACTION SUMMARY

7.2.1 Basis for Taking Action

CERCLA hazardous substances released at JBER-E resulted in soil, sediment, surface water, and groundwater contamination in various locations. The initial risk assessment at OU4 determined that the human and/or ecological risks exceeded the EPA's average or reasonable maximum exposure risk management criteria, and that remedial action must be taken.

The OU4 ROD identified PCE and TCE as groundwater COCs and is the basis for SD029 cleanup goals. In 2010, corrections were made to some of the groundwater cleanup goals in a Memorandum to the Site File (USAF, 2010).

Risk Summary

The OU4 ROD included the results of a baseline HHRA, conducted to estimate the risk posed to human health by source areas within OU4. Risks associated with SD029 were grouped together with SD028 for evaluation. Two land use scenarios were evaluated for shallow soils: future residential and current onsite worker. A construction worker scenario was also evaluated for deep soils. Groundwater risk evaluation was evaluated for future residential and future onsite workers. The HHRA found that risks from exposure to shallow soils at SD028/SD029 were 2.1×10^{-6} for future residents and below 1×10^{-6} for current onsite workers. Risks to construction workers from deep soils were below 1×10^{-6}. Groundwater risks were 1.5×10^{-5} and less than 1×10^{-6} for future residential and future on-site workers, respectively (USAF, 1995b).

The OU4 ROD also included the results of an ERA at OU4. The ERA was performed to determine if the reported concentrations of chemicals or calculated exposures to plants and wildlife at OU4 are likely to produce adverse effects. The ERA found no significant impacts to plants or animals warranting action (USAF, 1995b).

Response Actions

Environmental investigations have been conducted at OU4 since the early 1980s. The first investigation to examine contamination was conducted in 1990, followed in 1992 by a Limited Field Investigation. A full-scale RI was conducted in 1993.

Several specific sources of groundwater contamination at OU4 were identified during the RI, including: the training activities at FT023, a leaking 25,000-gallon UST and some buried drums near FT023, leaking valve pits and USTs at SD025, leaking valve pits at SD028, and a leaking pumphouse or piping near Hangar 8. Solvent contamination at OU4 East was attributed to dry wells (wells used to allow waste water, used solvents, etc. to be absorbed by the ground) or an upgradient leach field located near SD028.

Remedial Action Objectives

RAOs provide a general description of what the cleanup will accomplish. RAOs specified in the OU4 ROD are as follows:

- Protect human health and the environment by preventing ingestion of and contact with contaminated media by people.
- Protect uncontaminated media by preventing releases from sources.
- Use treatment techniques whenever practicable.
- Implement a cost-effective solution that can achieve the cleanup levels for the final COCs.

Remedy Components

The OU4 ROD-selected remedy included natural attenuation and LUCs for groundwater contamination (USAF, 1995b). Minor modifications to the ROD were documented as memoranda to the site file, through which a sampling frequency decision guide was established in 2003 (USAF, 2003b). ROD cleanup levels for SD029 COCs are presented in **Table 7-1**.

Table 7-1: OU4-SD029 Contaminants of Concern and ROD Cleanup Levels

Contaminant of Concern	ROD Cleanup Level	Basis for Cleanup Level[1]
Groundwater (µg/L)		
Tetrachloroethene (PCE)	5	MCL
Trichloroethene (TCE)	5	MCL

Key:
1 – MCLs correspond to the values listed in 40 CFR 131 and 18 AAC 70.010a and d, 70.015 through 70.011, and 80.070.
µg/L – micrograms per liter
AAC – Alaska Administrative Code
CFR – Code of Federal Regulations
MCL – maximum contaminant level
OU – Operable Unit
ROD – Record of Decision

The selected remedy for SD029 included the following major components:

- ICs on land and water use will restrict access to the contaminated groundwater throughout OU4 until cleanup levels have been achieved.
- Groundwater will be monitored and evaluated semi-annually to assess contaminant migration and timely reduction of contaminant concentrations by intrinsic remediation. This will include FYRs to assess the protectiveness of the remedial action, as long as contamination remains above cleanup levels. A monitoring plan will be prepared to address the details involved in sampling.
- All groundwater is expected to be cleaned up within 13 years.

The current status of remedy components is presented in **Table 7-2**.

Table 7-2: OU4-SD029 Remedy Status

Remedy Component	Status
Groundwater	
LUCs on land use and water use restrictions will restrict access to the contaminated groundwater throughout OU4 until cleanup levels have been achieved. OU4 is designated "Airfield Use Area" for aircraft O&M, to include active and inactive runways, taxiways, and parking aprons for aircraft. LUCs will be managed and implemented in accordance with the *Memorandum to the Site File for Operable Units (OUs) 1, 2, 4, and 5* (USAF, 2010).	Implemented in April 1998. LUCs updated in memoranda to the site file 2007 and 2010, and May 2011 673d Air Base Wing Instruction 32-7003 *Land Use Control Management*. No LUC breaches were identified during the period of review for this FYR.
Groundwater will be monitored and evaluated in accordance with the *Basewide Monitoring Program Well Sampling Frequency Decision Guide* to assess contaminant migration and timely reduction of contaminant concentrations by intrinsic remediation (i.e., natural attenuation). This will include FYRs to assess the protectiveness of the remedial action, as long as contamination remains above cleanup levels.	Ongoing since 1996. The *Well Sampling Frequency Decision Guide* was used to establish a monitoring schedule in 2003; however, the sample frequency was voluntarily increased from annually to quarterly. FYRs were conducted in 1998, 2003, 2008, 2014, and 2018.
All groundwater is expected to be cleaned up within 13 years.	The 13-year timeframe was not achieved; groundwater concentrations remain above ROD cleanup levels.

Key:
FYR – Five-Year Review
LUC – land use control
O&M – operations & maintenance
OU – Operable Unit
ROD – Record of Decision

7.2.2 Status of Implementation

Groundwater monitoring has been ongoing at SD029 since 1996. Groundwater monitoring plans are updated annually to ensure that the program remains comprehensive and protective, and monitoring is conducted in accordance with the Sampling Frequency Decision Guide in the OU4

Memorandum to the Site File (USAF, 2003b). Current monitoring requirements at SD029 include annual groundwater monitoring and an annual LUC inspection. However, in 2015, the sample frequency was voluntarily increased from annually to quarterly in order to gather a large enough data set to show statistical compliance. The current groundwater sampling program at SD029 includes quarterly monitoring at Monitoring Well IS6-01.

Groundwater monitoring results have been evaluated annually since the Fourth FYR. COC concentrations have fluctuated inconsistently above and below ROD cleanup levels. In 2016, TCE and PCE concentrations were above ROD cleanup levels and showed no statistical trends (USAF, 2018c).

A vapor intrusion study was conducted from 2016 to 2017 at JBER and included Buildings 16673 and 16716 at SD029. No positive field screening results were detected at Building 16673, and the building was not selected for further evaluation of risk from the vapor intrusion pathway. For Building 16716, the vapor intrusion pathway was found to be potentially complete. A vapor intrusion pathway was considered potentially complete if soil gas COC concentrations were greater than indoor air concentrations, but outdoor or non-vapor intrusion sources could not be ruled out. Based on the maximum detected indoor air results, the total HI was below 1 at 0.03, and the cumulative cancer risk was 1×10^{-7} for an indoor worker at Building 16716 (USAF, 2018b).

A 1,4-dioxane investigation was completed at JBER in 2017 (USAF, 2017c). Results from the monitoring well sampled at SD029 (IS6-01) did not exceed EPA RSLs or ADEC cleanup levels (USAF, 2017c).

7.2.3 LUC Summary

LUCs were implemented in April 1998 to restrict access to contaminated groundwater and shallow soils throughout OU4 until cleanup levels are achieved. LUCs were updated in 2010, as well as the 673d Air Base Wing Instruction 32-7003 *Land Use Control Management* and are managed and implemented in accordance with the *Memorandum to the Site File for Operable Units (OUs) 1, 2, 4, and 5* (USAF, 2010).

As stated in the *Land Use Controls Management Plan* (USAF, 2003a) (**Appendix D**), OU4 (including SD029) is designated as an "Airfield Use Area." This restricts activities to aircraft operations and maintenance which include active and inactive runways, taxiways, and parking aprons for aircraft. The establishment of residential development is strictly prohibited.

Compliance with LUCs applies to all soil-disturbing activities on JBER and is reviewed annually (USAF, 2018c). A GIS-based tracking system is in place to ensure that LUCs are enforced and has been incorporated into the *Base General Plan*. A copy of the LUC inspection form is provided in **Appendix E**.

7.2.4 Systems Operations / Operations and Maintenance

No active systems are currently operated as part of remediation at SD029.

7.3 PROGRESS SINCE THE LAST REVIEW

This is the fifth FYR for JBER-E. The OU4 protectiveness determination and statement from the 2014 FYR are presented in **Table 6-3**. Issues and recommendations for Site SD029 from the 2014 FYR and the current status of those recommendations are presented in **Table 7-3**.

7.4 FYR PROCESS

7.4.1 Site Interviews

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. Site interviews for JBER-E were conducted as discussed in Section 3.1. There were no specific comments regarding OU4 or SD029.

7.4.2 Data Review

A summary of data since the 2014 FYR is presented in Section 7.2.3. Data collected at SD029 during the period of this FYR (2014-2018) were reviewed. Data reviewed included: 2014 through 2016 monitoring activities (USAF, 2015; 2017b; 2017c), 1,4-dioxane sampling (USAF, 2017c), and the vapor intrusion study results (USAF, 2018b). Data is presented on **Figure 7-1**.

Data collected under the ERP are archived in the USAF ERPIMS database; however, not all data collected over the life of SD029 may have been archived into the system. All historical data available in ERPIMS (31 May 2001 through 27 September 2016) were reviewed to support a technical assessment of chemical-specific toxicity changes at SD029 since the ROD was signed. See Section 7.5.2.

7.4.3 Site Inspection

A site inspection was conducted at SD029 on 16 August 2017. The purpose of the inspection was to assess the protectiveness of the remedy. A site inspection form and photographs are provided in **Appendix E**. The only notable item identified during the inspection was that the casing lid is missing a bolt and is below grade at Monitoring Well IS6-01. The well was observed to be inundated by stormwater. Replacement of the casing lid and bringing the asphalt apron to grade around the well is warranted to for the long-term integrity of the well.

7.5 TECHNICAL ASSESSMENT

7.5.1 Question A – Is the remedy functioning as intended by the decision documents?

Yes. The review of documents, site data, and the results of the site inspections indicate that the remedy for SD029 is functioning as intended by the ROD; however, the timeframe for cleanup anticipated by the ROD (2008) was not met, and contaminant levels have not decreased as expected in the estimated time frame. It is recommended that additional studies be conducted to determine if the remedy, as is, will be able to achieve remediation goals within the ROD time frame of 30 years. Other studies may include, but are not limited to site characterization, ecological assessment, focused feasibility studies, groundwater modeling, treatability studies, and/or sampling. LUCs continue to prevent human exposure to contaminated groundwater at SD029.

Table 7-3: OU4-SD029 Status of Recommendations from the 2014 FYR

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date
Manned facilities are present in the vicinity of the contaminant plumes associated with the OU4 active sites FT023, SD025, and SD029, indicating a potential for vapor intrusion to occur at those facilities.	A vapor intrusion evaluation that provides multiple lines of evidence should be conducted in accordance with EPA guidance for each occupied facility that is in proximity to the VOC plume(s) at FT023, SD025, and SD029. Vapor intrusion evaluations should be conducted prioritizing buildings with the most vulnerable populations (schools, day cares, offices, and residences).	Completed	A vapor intrusion study was conducted from 2016 to 2017 at JBER and included Buildings 16673 and 16716 at SD029. No positive field screening results were detected at Building 16673, and the building was not selected for further evaluation of risk from the vapor intrusion pathway. For Building 16716, the study concluded that the vapor intrusion pathway is considered potentially complete. Based on the maximum detected indoor air results, the total HI was below 1 at 0.03 and the cumulative cancer risk was 1 x 10-7 for an indoor worker at Building 16716 (USAF, 2018b).	1/1/2017
The potential exists for concentrations of 1,4-dioxane to be present in conjunction with TCE contamination at the site.	Based on USAF guidance (*Interim Air Force Guidance on Sampling and Response Actions for 1,4-Dioxane at Operational and BRAC Installations, 15 Aug 2013*), recommend a sampling event be conducted to identify if concentrations of 1,4-dioxane exist. Determine whether there is an unacceptable risk at the site.	Completed	A 1,4-dioxane investigation was completed at JBER in 2017 (USAF, 2017c). Results from the monitoring well sampled at SD029 (IS6-01) did not exceed EPA RSLs or ADEC cleanup.	2017
The LF004 CERCLA site boundary appears to extend beyond JBER-E site boundaries. *Note: this issue was specifically noted for LF004 but applied to all sites covered by the FYR.*	All CERCLA site boundaries should be reviewed for accuracy and be revised, when applicable, in a memorandum to the site file.	Completed	CERCLA site and LUC boundaries are maintained in a GIS database. At the time of this FYR, there are no noted boundary discrepancies at SD029.	Not applicable

Table 7-3 (Cont.) OU4-SD029 Status of Recommendations from the 2014 FYR

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date
An in-depth description of the historical site events for each OU and DP098 was not included within Table 2-1 of this FYR.	Expand chronology table in the next FYR to include detailed information concerning the chronology of site events for each OU and DP098.	Considered But Not Implemented	Chronology table not required in approved template for this FYR.	Not applicable

Key:
ADEC – Alaska Department of Environmental Conservation
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
EPA – United States Environmental Protection Agency
FYR – Five-Year Review
GIS – geographic information system
HI – hazard index
JBER – Joint Base Elmendorf-Richardson
JBER-E – Joint Base Elmendorf-Richardson Elmendorf Air Force Base
LUC – land use control
OU – Operable Unit
RSL – Regional Screening Level
TCE – trichloroethylene
USAF – United States Air Force
VOC – volatile organic compound

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

Revised cleanup levels have been promulgated and toxicity data has changed since the ROD was signed; however, MCLs in have not changed.

Changes in Standards:

The ROD remediation goals are the MCLs, which have not changed since the ROD was signed and the chemical-specific ARARs for groundwater (40 CFR 141) listed in the ROD (USAF, 1995b) do not have any changes that affect regulatory-based cleanup levels for groundwater COCs at SD029. However, regulatory cleanup levels (18 AAC 75) have recently been revised. The new cleanup levels are human health based, and account for toxicity changes that have occurred since the ROD was signed. These changes are presented in **Table 7-4**.

Table 7-4: OU4-SD029 Comparison of ROD Final Remediation Goals to 2017 Standards

Chemical	ROD Cleanup Level	2017 ADEC Cleanup Level[1]	Federal MCL	Historic Site Concentration[2]	LTM Site Concentration
Groundwater (µg/L)					
Tetrachloroethene (PCE)	5	41	5	20	5.6
Trichloroethene (TCE)	5	2.8	5	5.3	8.7

Key:
1 – ADEC cleanup levels (18 AAC 75.341(c), as amended through 7 November 2017).
2 – The maximum historic detection was used as the applicable site concentration (see Appendix F, Table F-3).
-- – not applicable
µg/L – micrograms per liter
AAC – Alaska Administrative Code
ADEC – Alaska Department of Environmental Conservation
LTM – long-term monitoring
MCL – Maximum contaminant level, Safe Drinking Water Act (40 CFR 141 and 40 CFR 143)
ND – non detect
OU – Operable Unit
ROD – Record of Decision

Available data for SD029 was evaluated against the ADEC standards (ADEC, 2017). Calculations were performed for chemicals where detections within the last 5 years were above the ADEC standards (ADEC, 2017) to determine exposure risk (**Appendix F**, **Tables F-1** through **F-3**). These calculations, based on recent sample data or maximum site concentrations and the residential exposure assumption, did not identify any changes in exposure risk for these chemicals.

New toxicity data was reviewed and indicates that samples should be collected and analyzed for cyanide, naphthalene, and total xylenes in soil to determine if concentrations of these chemicals pose an unacceptable risk at SD029.

The Base administrative control prohibiting use of the shallow aquifer south of the Elmendorf Moraine remains in effect and continues to prevent exposures to contaminated groundwater that may pose excessive risk.

Changes in Exposure Pathways

Manned facilities are present SD029, and although the vapor intrusion pathway was found to be potentially complete, risks and hazards are below thresholds

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

Yes. Sites within the LUC boundary for SD029 were included in a 2016 JBER-wide investigation into the presence or absence of PFOS/PFOA (USAF, 2018).

7.6 ISSUES / RECOMMENDATIONS

Issues identified during this FYR that affect the protectiveness of the remedy are shown below.

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): OU4, Site SD029	**Issue Category:** Remedy Performance			
	Issue: Limited natural attenuation of COCs (TCE and PCE) in groundwater is occurring at the site, and RAOs were not achieved within the projected time frame.			
	Recommendation: Conduct additional studies to optimize the approach to achieve remediation goals. Other studies may include, but are not limited to: site characterization, ecological assessment, focused feasibility studies, groundwater modeling, treatability studies, and/or sampling. Groundwater cleanup timelines should be reestablished.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023

Recommendations identified during this FYR that do not affect the protectiveness of the remedy at SD029 include:

Issue No.	OU-Site	Finding/ Recommendation
1	OU4-SD029	Maintenance of Monitoring Well IS6-01: The casing lid is missing a bolt, and is below grade, resulting in inundation. The asphalt apron around the well should be brought up to grade.
2	OU4-SD029	Due to changes in toxicity data and regulatory cleanup standards, site historic data for some chemicals may exceed EPA human health guidance for risk analysis some non COCs: (in soil) cyanide, naphthalene, and total xylenes. Conduct a sampling event to identify current concentrations in soil for these chemicals.

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8.0 OPERABLE UNIT 5 (ST037)

OU5 consists of sites SD040, SS042, SS053, ST037, ST038, and ST046. ST037 is the only remaining open site within this OU.

8.1 SITE BACKGROUND

OU5 is located along the southern boundary of JBER-E and covers an area of about 200 acres (**Figure I-2**). Groundwater generally flows south from the flight line and industrial areas of the Base through OU5. Some groundwater discharges in seeps along a steep bluff in the western part of the OU, or into a wetland area where there are several shallow connected water bodies and marshes in the eastern part of the OU. Bulk storage of diesel fuel, jet fuel, and multi-product fuel pipelines were initially the primary source of contamination within OU5. Chlorinated solvents from sources south of the east-west runway are the significant sources of groundwater contamination in OU5. Any contaminants migrating toward Ship Creek via groundwater and seep/surface water are being treated through OU5 remedial actions (USAF, 2014).

OU5 originally included six source areas: ST037, ST038, SD040, SS042, ST046, and SS053. Due to minimal soil contamination, all sites except ST037 were granted NFA status in 1994. ST037 is the only remaining source area within OU5.

Site ST037 lies at the southern perimeter of JBER-E, north of Ship Creek. Groundwater plumes managed under ST037 include the Slammer Avenue West Plume, SS022/Slammer Avenue East Plume, and the Western ST037 Plume (formerly the Fairchild Avenue, Kenney Avenue, OU3MW-25, OU5MW-02, and SP1-02 Plumes) (**Figure 8-2**). Along with groundwater monitoring of these plumes, an early warning and sentry well network (**Figure 8-2**) is used to determine migration of groundwater contamination and provide an alert prior to contamination reaching a downgradient environmental receptor – such as Ship Creek (**Figure 8-3**). Along the southern boundary of JBER-E, seeps, surface water features, and the Wetland Remediation System (**Figures 8-4** and **8-5**) make up a system of discharge points, monitoring locations, and treatment systems associated with ST037.

Between 1956 and 1958, a diesel fuel line broke approximately 600 feet north of Ship Creek. Fuel from the leaking pipeline reportedly seeped out of the ground near railroad tracks 200 feet south of the spill area. Thousands of gallons of fuel were recovered; however, an unknown amount remained below the ground surface.

8.2 RESPONSE ACTION SUMMARY

8.2.1 Basis for Taking Action

CERCLA hazardous substances released at JBER-E resulted in soil, sediment, surface water, and groundwater contamination in various locations. The initial risk assessment at OU5 determined that the human and/or ecological risks exceeded the EPA's average or reasonable maximum exposure risk management criteria, and that remedial action must be taken.

The OU5 ROD identified COCs in groundwater, surface water, and soil as the basis for remedy cleanup levels at ST037. COCs in groundwater include TCE, benzene, total fuel hydrocarbons (TFH)-diesel and TFH-gas. COCs for surface water includes sheen, TFH-gas, and JP-4. The soil COC is TFH-diesel (USAF, 1995c). There have been several revisions to the ROD. In 2003, the OU5 Memorandum to Site File (USAF, 2003c) identified TAH and Total Aqueous Hydrocarbons (TAqH) as the appropriate water quality standards to replace the former cleanup standards for TFH-gas and TFH-diesel in groundwater and surface water, respectively.

Modifications to the ROD-specified remedy have been documented in three memoranda to the site file. The first adopted a sampling frequency decision guide (USAF, 2003c), while the second clarified how the USAF intends to manage LUCs, and the most recent documents implementation of passive operation of the wetland remediation system for seep water treatment (USAF, 2011a).

Risk Summary

The OU5 ROD included the results of a baseline HHRA, conducted to estimate the risk posed to human health by source areas within OU5. The exposure pathways evaluated included: current and future potential residential, current and future short-term workers, and current and future recreationalists through exposure to contaminated media and consumption of fish. The HHRA found that the only scenario that generates a noncancer HI value exceeding 1, or total excess lifetime cancer risks greater than 1×10^{-4}, is when future residents ingest the upper aquifer groundwater in the western area of OU5 for 70 years (USAF, 1995c).

The OU5 ROD also included the results of an ERA at OU5. The ERA did not link particular contaminants to specific ecological impacts. However, it identified potential risks to the environment and environmental receptors which may have been affected by contaminants. In general, animals could be exposed to contaminants through the soil gas they breathe while burrowing, the plants they eat, and the dermal contact they have with media contaminated by fuels. Plants could potentially be affected by contamination. The RI/FS determined that plant stress exists in OU5 but was probably not caused by identified contaminants in the OU, and that the stress is probably due to natural conditions. The ERA did not discover any impacted endangered species or endangered species habitat at OU5 (USAF, 1995c).

8.2.2 Response Actions

The discovery of hydrocarbon seeps in the early 1980s was the first indication of contamination at OU5. When leaks were identified, they were repaired, and residual hydrocarbon was recovered to the extent possible. Hydrocarbon was recovered at the bluff face using absorbents and by skimming any floating product found on surface water drainages. Environmental investigations have been conducted at OU5 since the mid-1980s. Several small-scale studies discovered evidence of contamination in various parts of OU5. The first investigation to examine contamination throughout the whole area was conducted in 1988, followed by a RI/FS in 1994 (USAF, 1995c).

Remedial Action Objectives

RAOs provide a general description of what the cleanup will accomplish. RAOs specified in the OU5 ROD are as follows:

- Protect human health and the environment by preventing ingestion and contact with contaminated groundwater by people and preventing animal contact with contaminated seep water.
- Use treatment techniques whenever practicable.
- Implement a solution that is capable of managing impacts from upgradient sources as the contaminants reach OU5.
- Implement a cost-effective solution that can achieve the cleanup levels for the final COCs.

Remedy Components

The OU5 ROD, signed on 1 February 1995 (USAF, 1995c), selected a remedial action that included: LUCs, natural attenuation of contaminants in groundwater, construction and operation of an engineered wetland remediation system to treat contaminated seeps on the western and central bluffs, natural attenuation for the Beaver Pond wetland area, and contaminated soil excavation and treatment. Minor modifications to the remedy have been documented in memoranda to the site file. The first memorandum adopted a sampling frequency decision guide (USAF, 2003c). A second memorandum incorporated newly discovered contaminated seeps into the wetland remediation system in 2005 (USAF, 2005).

Also in the 2005 memorandum, decision guides were adopted for shutting down wetland remediation system pumping stations and for re-starting an existing seep collection area or incorporating a new seep collection area for treatment (USAF, 2005). A third memorandum to the site file described the transition of the wetland remediation system from an active to a passive treatment system as a non-significant change to the ROD (USAF, 2011a).

The primary types of contaminants are fuel-related chemicals and chlorinated solvents that are attributed to sources upgradient of OU5 where past spills or disposal occurred. Along with TCE and benzene, the ROD selected TFH-diesel and TFH-gas as COCs for groundwater, and TFH-gas and JP-4 as COCs in surface water. Because there was no specific cleanup standard for these compounds, the ROD set the cleanup standard at the ADEC water quality criterion for TAH. The ROD-specified cleanup levels for TFH-diesel and TFH-gas were conceptually modified in 1998 to include TAH and TAqH (USAF, 2018c). Because there was no standard for these COCs in groundwater, and because groundwater emerges at the seeps that eventually flow into Ship Creek (an aquaculture resource), the aquaculture water standards for TAH and TAqH are referenced, as documented in the 2005 OU5 Memorandum to the Site File (USAF, 2005). ROD cleanup levels for ST037 COCs are presented in **Table 8-1**.

The groundwater remedy for ST037 included the following major components:

- ICs on land and water use to restrict access to contaminated groundwater until cleanup goals are achieved.
- Groundwater monitoring to estimate the rate of natural attenuation, to provide an early warning of potential off-site contaminant migration and ensure protection of human health and the environment.

Table 8-1: OU5-ST037 Contaminants of Concern and ROD Cleanup Levels

Contaminant of Concern	ROD Cleanup Level	Basis for Cleanup Level
Groundwater (µg/L)		
Benzene	5	MCL[1]
Trichloroethylene (TCE)	5	MCL[1]
Surface Water (µg/L)		
Sheen	No sheen	18 AAC 70.020, based on ecological risk
TAH[2]	10	18 AAC 70.020, based on ecological risk
TAqH[2]	15	18 AAC 70.020, based on ecological risk
Soil (mg/kg)		
TFH-diesel[3]	1,000	18 AAC 78.315, ACM Level C

Key:
1 – MCLs correspond to the values listed in 40 Code of Federal Regulations 131 and 18 AAC 70.010a and d, 70.015 through 70.011, and 18 AAC 80.070.
2 – The ROD-specified cleanup levels for TFH-diesel and TFH-gas were conceptually modified in 1998 to include TAH and TAqH. Because there was no standard for these contaminants of concern in groundwater, and because groundwater emerges at the seeps that eventually flow into Ship Creek (an aquaculture resource), the aquaculture water standards for TAH and TAqH are referenced (18 AAC 70.020, based on ecological risk).
3 – TFH-diesel is no longer sampled for at OU5, because the soil remedy has been completed.
µg/L – micrograms per liter
AAC – Alaska Administrative Code
ACM – Alaska Cleanup Matrix Level D, promulgated under 18 AAC 78.315.
mg/kg – milligrams per kilogram
MCL – maximum contaminant level
OU – Operable Unit
ROD – Record of Decision
TAH – Total Aromatic Hydrocarbon
TAqH – Total Aqueous Hydrocarbon
TFH – total fuel hydrocarbons

The seep remedy identified in the ROD and updated in the *Memorandum to the Site File for Passive Operation of the Wetland Remediation System at Operable Unit 5* (USAF, 2011a) includes the following:

- Extracting seep water from areas of contamination along the western and central bluffs. Extracted seep water will either be drained directly to the constructed wetland or treated within the seep collection area where it is extracted. Enhanced natural chemical, physical, and biological processes will reduce contamination below cleanup levels. Baffles will be installed to control flow, or water, and maintain retention time, and native vegetation will be put in place to help degrade contaminants.
- Monitoring surface water near the exit of the constructed wetland and the Pump Station 1 seep collection area to ensure that the passive treatment systems are reducing contaminant concentrations to levels that are below the Alaska Water Quality Standards.
- Using natural attenuation to treat seep and surface water in the Beaver Pond Wetland Area.

- Monitoring water from the seeps and Beaver Pond Wetland Area to estimate the rate of natural attenuation and ensure that contamination does not reach Ship Creek.

The soil remedy for ST037 included the following major components:

- Excavating approximately 3,000 cubic yards of contaminated soil near the ground surface in the western and central areas and transporting to an on-base treatment facility. The treatment facility will be selected in the Remedial Design phase; biopiling is currently being considered.
- Removing soil from the areas of contamination and replacing with treated soil or clean fill from on Base.
- Monitoring soil in the treatment facility for contaminant concentration reduction. When the concentrations are below cleanup levels, the soil will be removed and used as fill around the Base.

The current status of remedy components is presented in **Table 8-2**.

Table 8-2: OU5-ST037 Remedy Status

Remedy Component	Status
Groundwater	
LUCs that prohibit use of the upper aquifer will ensure that people will not be exposed to contaminated groundwater until cleanup goals area achieved. LUCs will be managed and implemented in accordance with the *Memorandum to the Site File for Operable Units (OUs) 1, 2, 4, and 5* (USAF, 2010).	Implemented in July 1996. LUCs updated in memoranda to the site file 2007 and 2010, and May 2011 673d Air Base Wing Instruction 32-7003 *Land Use Control Management*. No LUC breaches were identified during the period of review for this FYR.
Groundwater will be monitored to estimate the rate of natural attenuation, to provide an early warning of potential offsite contaminant migration, and to ensure protection of human health and the environment.	Ongoing. Monitoring frequency decision guide was adopted in 2003.
Seeps	
Seep water will be passively extracted from areas of contamination along the western and central bluffs. The water will be drained to the constructed wetland where enhanced natural chemical, physical, and biological processes will reduce contamination below cleanup levels. Baffles will be installed to control flow of water and maintain retention time, and native vegetation will be put in place to help degrade contaminants.	Ongoing. Five newly discovered contaminated seeps were incorporated into the Wetland Remediation System in 2005. Decision guides for modifying the Wetland Remediation System due to changes in seep contaminant concentrations were adopted in 2005.
The constructed wetland was built in the recommended location at the snowmelt pond, and a layer of gravel was placed over pond sediment.	Completed in 1997. Upon completion of an optimization study, the Wetland Remediation System was transitioned to a passive treatment system.

Table 8-2 (Cont.) OU5-ST037 Remedy Status

Remedy Component	Status
Seeps (Cont.)	
Seep water will be monitored near the exit of the Wetland Remediation System to ensure that the wetland is reducing concentrations below ADEC Water Quality Standards.	Ongoing.
Natural attenuation will be relied upon to treat seep and surface water in the Beaver Pond wetland area.	Ongoing.
Water from seeps and Beaver Pond wetland area will be monitored to estimate the rate of natural attenuation and make sure that contamination does not reach Ship Creek.	Ongoing.
Soil	
Approximately 3,000 cubic yards of fuel-product contaminated soil will be excavated in the western and central areas and transported to an on-base treatment facility. Soil removed from the areas of contamination will be replaced by treated soil or clean fill from on base. Soil in the treatment facility will be monitored for contaminant concentration reduction. When the concentrations are below cleanup levels, the soil will be removed and used as fill around the base.	Excavation completed in 1997, and treatment completed in 1999.

Key:
ADEC – Alaska Department of Environmental Conservation
FYR – Five-Year Review
LUC – land use control
OU – Operable Unit

8.2.3 Status of Implementation

The selected remedy at ST037 includes: source removal (completed), seep water containment and treatment (ongoing), groundwater and surface water monitoring to evaluate for natural attenuation of contaminants (ongoing), and LUCs (ongoing).

All remedial actions at ST037 are operating and functional. Groundwater, seep, and surface water monitoring is ongoing; sediment sampling was recommended to be discontinued in 2016. Although sediment is identified in the ROD along with groundwater and surface water, no RAOs were established for sediment in the ROD and no cleanup levels were identified.

The groundwater, seep, and surface water sampling program for OU5 is designed to demonstrate protectiveness at the point of compliance, Ship Creek. Monitoring is conducted in accordance with the Sampling Frequency Decision Guide in the *OU5 Memorandum to the Site File* (USAF, 2003c). Between the plume wells and Ship Creek, early warning sentry wells are monitored to determine whether the plumes are migrating toward Ship Creek. Seeps along the western and central bluff (many of which are captured by the wetland remediation system) and surface water/seeps in the Beaver Pond wetland area are monitored to track contaminant loading into the wetland remediation system and Beaver Pond wetland. The effluent from the wetland remediation system and Beaver

Pond wetland are monitored prior to their discharge into Ship Creek. Finally, Ship Creek is monitored at two locations. Groundwater monitoring results are evaluated annually, including trend analysis of COCs and assessment of natural attenuation parameters.

Monitoring plans are updated annually to ensure the program remains comprehensive and protective. Groundwater monitoring frequencies are established in accordance with the *Basewide Monitoring Program Well Sampling Frequency Decision Guide*. Historical concentrations of TCE (the primary remaining COC) at key locations in OU5 are presented on **Figures 8-2** through **8-7**. Monitoring at ST037 is currently divided into four groups: Western ST037 Plume; Slammer Avenue Plumes; seeps, surface water, and wetland remediation systems; and the early warning and sentry monitoring well network. Activities conducted and results of monitoring activities since the 2014 FYR are discussed below.

Western ST037 Plume

Groundwater and seep monitoring conducted at the Western ST037 Plume since the 2014 FYR has included sampling for TCE in wells and seeps, and MNA parameters in wells. TCE concentrations in most wells and seeps within the Western ST037 Plume continue to exceed OU5 ROD cleanup levels (**Figure 8-6**). Mann-Kendall trend analyses for TCE in Monitoring Wells 403WL-01, OU3MW-02, OU3MW-11, OU5MW-44, and SP1-02 indicated statistically significant decreasing trends. No trends were identified in Monitoring Well OU5MW-38 or Seep OU5SP-10. TCE concentrations in Seep OU5SP-11 show an increasing trend (USAF, 2018c).

It was noted in the 2016 monitoring report, that volatile organic compound (VOC) contamination at SO552 has been transferred to CERCLA regulation for groundwater monitoring and future investigation, with Monitoring Well 402WL-02 added to the sampling program for the Western ST037 Plume (USAF, 2018c).

Slammer Avenue Plumes

Groundwater and seep monitoring conducted at Slammer Avenue Plumes since the 2014 FYR included sampling for VOCs and MNA parameters in Monitoring Wells GW-4A, OU5MW-06, OU5MW-07, and OU5MW-08. The TCE concentrations measured in the Slammer Avenue East Plume at Monitoring Wells OU5MW-06 and OU5MW-07 continue to exceed the OU5 ROD cleanup goal (**Figure 8-7)**. Concentrations measured at these wells have been similar from 2007 through 2016. The Slammer Avenue East Plume cross-gradient monitoring well (OU5MW-08) does not have a TCE concentration above the OU5 ROD cleanup goal, but the monitoring well located at the leading edge of the plume (GW-4A) exceeded the TCE cleanup goal in both 2015 and 2016. This eastern plume has been identified as the leading edge of the SS022 Plume. Contamination from Site TU091 may be the source of the Slammer Avenue Plume (USAF, 2018c).

Seeps, Surface Water, and Wetland Remediation Systems

Twenty seeps have been identified south of 2nd Street and downgradient of the Western ST037 Plume. Historical sample results for these seeps were reported under the Fairchild Avenue Plume, OU5MW-02 Plume, and Kenney Avenue Plume.

Historically, some of these seeps at ST037 have been contaminated with benzene, TAH, TAqH, and/or TCE at concentrations that exceeded cleanup goals. Six seeps (OU5SP-09, OU5SP-10, OU5SP-11, OU5SP-17, and OU5SP-18) are configured to discharge directly into the Wetland Treatment Cell (**Figure 8-5**). In 2015, a new seep (OU5SP-11A) emerged 5 feet east of OU5SP-11, outside of the Wetland Treatment Cell. The new seep was sampled twice in 2015 for VOCs. The results (10.7 µg/L and 11.7 µg/L) were above the TCE cleanup goal; therefore, the collection area for seeps OU5SP-10 and OU5SP-11 was expanded laterally to the east 20 feet to incorporate the discharge from OU5SP-11A. This collection area flows into the Wetland Treatment Cell. Seep OU5SP-11A was not added to the sampling program because of proximity to the adjacent Seep OU5SP-11, which is representative of the groundwater seeping in that area (USAF, 2018c).

Concentrations of COCs in water at ST037 are currently monitored within the Wetland Treatment Cell at three locations (WCSW-02, WCSW-03, and WCSW-04) and two locations at the Pump Station #1 seep collection area (OU5CP-01 and OU5CP-02) to gauge the effectiveness of the passive operations of the Wetland Remediation System (**Figure 8-5**). Concentrations of COCs were also historically measured at a fourth location (WCSW-01), which was the discharge point for water entering the Wetland Treatment Cell from three pump stations. Samples have not been collected at WCSW-01 since 2011, because the pump stations have not been operated since 2009 (USAF, 2018c).

TCE concentrations have consistently been detected in surface water samples at ST037 collected from the Beaver Pond Area (**Figure 8-4**). The probable sources of TCE contamination in the Beaver Pond Area are the Slammer Avenue Plume and SS022 Plume, with recent site data suggesting that groundwater discharge into the drainage ditch flowing into the Beaver Pond Area is a significant source of the contaminants detected in surface water. The COCs entering the Beaver Pond Area naturally attenuate in the pond before surface water flows into Ship Creek. This process is monitored at four locations (BPSW-01, BPSW-03, BPSW-04, and BPSW-05). Discharge from the Beaver Pond Area is monitored at Sample Point BPSW-01, which is the compliance point. All seeps and surface water ultimately discharge to Ship Creek. Surface water in Ship Creek is monitored at two locations (SC-01B and SC-08, **Figure 8-3**) to evaluate water quality of this receptor (USAF, 2018c).

Seep monitoring conducted at ST037 since the 2014 FYR included sampling for VOCs and polynuclear aromatic hydrocarbons (PAHs) at 10 seeps (OU5SP-01 to OU5SP-03, OU5SP-07, OU5SP-09 to OU5SP-11, OU5SP-15, OU5SP-17, and OU5SP-18), nine surface water locations (BPSW-01, BPSW-03 to BPSW-05, WCSW-02 to WCSW-04, SC-08, and SC-1B), two control points (OU5CP-01 and OU5CP-02), and one sediment location (WCSD-09). Surface water was sampled at two locations in Ship Creek, three locations at the Wetland Treatment Cell, and four locations in the Beaver Pond Area. Sediment was also sampled at one point (WSCD-09) in the Wetland Treatment Cell (USAF, 2018c).

COCs remain above cleanup goals at Seeps BPSW-04 and BPSW-05. Even though TCE is above ROD cleanup goals at BPSW-04 and BPSW-05 (**Figure 8-4**), they are upgradient of the point of compliance (BPSW-01), where COC concentrations are below the ROD cleanup goals and Alaska Surface Water criteria. TAH concentration in surface water at OU5CP-02 exceeded the cleanup level in the 2016 second quarter sampling event, which had never historically occurred

(USAF, 2018c). **Figures 8-3, 8-4,** and **8-5** present historical data results for: Ship Creek; beaver Pond; and the wetland remediation system, seeps, and surface water, respectively.

The results of visual inspection and assessment of analytical data at ST037 continue to demonstrate that pumping is not required for the Wetland Remediation System to reduce influent COC concentrations in seeps to concentrations that are below applicable cleanup goals. Quarterly sample results at the effluent discharge point (V-notch) have consistently been below all applicable cleanup levels since 2011. Continued operation of the Wetland Remediation System in a passive configuration was recommended. It was also recommended to discontinue sediment sampling at WCSD-09 (USAF, 2018c).

Early Warning and Sentry Monitoring Well Network

An Early Warning Monitoring Well network at OU5 was established in 2001 to provide early detection of contaminant plumes that may impact Ship Creek or other downgradient environmental receptors. This network was established based on contaminant migration time and the area hydrology to provide early warning of potential future downgradient impacts and to allow time for implementation of additional parameters to reduce the likelihood of contamination reaching the Sentry Wells. The Sentry Well network consists of 11 monitoring wells located downgradient of the Early Warning Monitoring Well network and OU5 plumes (**Figure 8-2**). Specifically, the Early Warning and Sentry Monitoring Well networks include the following:

- Early Warning Monitoring Wells: 516MW-02 (replacement of abandoned Well 76WL-01), SP4/11-03, OU5MW-46, OU5MW-05, OU5MW-11, and OU5MW-45. Damaged Well 76WL-01 was replaced in 2011 with Well 516MW-02. In 2015, Well OU5MW-46 replaced OU5MW-01 as an Early Warning well, which was decommissioned due to an obstruction in the monitoring well (USAF, 2018c).
- Sentry Monitoring Wells: 401WL-03, 401WL-04, NS3-02, SP2/6-05, OU5MW-09, OU5MW-10, OU5MW-12, OU5-MW13, OU5-MW14, OU5MW-31, and OU5MW-33.

The early warning and sentry well network is used to track chlorinated VOC concentrations in groundwater, as well as detect TCE above the cleanup level (5 µg/L). Groundwater sampling occurs in order to identify if contaminant concentrations increase to levels that would potentially impact environmental receptors, such as Ship Creek.

Since the 2014 FYR, all sampling results from early warning and sentry monitoring wells were below OU5 ROD cleanup levels for TCE (USAF, 2015; 2017b; 2018c).

Additional Remedial Activities

A vapor intrusion study was conducted from 2016 to 2017 at JBER and included 14 buildings located within plumes monitored under OU5 and ST037. The results were:

- A complete vapor intrusion pathway – soil gas COCs were greater than indoor air concentrations, and no impacts from outdoor air or non-vapor intrusion interior sources of VOCs were present was identified at eight of the 14 buildings (Buildings 6211, 7228, 7265, 7309, 8288, 8326, 8515, and 8559).

- A potentially complete pathway – soil gas COC concentrations greater than indoor air concentrations, but outdoor or non-vapor intrusion sources could not be ruled out at three buildings (Buildings 4230, 4314, and 7535).
- An incomplete pathway – COCs not detected or only very infrequently detected in soil gas and/or COCs not detected in indoor air at three buildings (Buildings 4228, 5208A/5211A, and 5223).

The risk assessment did not identify any estimated risks that exceeded cancer risk and noncancer targets/thresholds at any of these buildings. However, at Building 4230, the maximum detected indoor air concentrations of 8.7 and 7.1 micrograms per cubic meter ($\mu g/m^3$) during field screening events are slightly greater than one of both of EPA's TCE industrial Indoor Air Response Action Levels of 7 $\mu g/m^3$ (10-hour work day) and 8 $\mu g/m^3$ (8-hour work day). Additional investigation at Building 4230 was recommended (USAF, 2018b).

A 1,4-dioxane investigation was completed at JBER in 2017. No sample results from any ST037 groundwater monitoring wells exceeded the EPA Region 9 RSL for residential tap water (0.46 µg/L) or the current ADEC cleanup level of 4.6 µg/L (USAF, 2017c).

In 2017, a *Data Compilation and Remedial Action Evaluation Report* (USAF, 2017d) was prepared. The report presented the results of a data review of the ST037 plume areas, conducted to identify potential primary and secondary source areas that may be contributing to the TCE plume areas. The report also reviewed previous attempted remediation strategies and recommended a path forward for accelerating the reduction of TCE concentrations in the plumes and at the southern site borders that include groundwater seeps and surface water areas. The report evaluated a two-pronged remedial action approach as a potential path forward for ST037: 1) prevent migration of TCE contaminated groundwater to seeps or surface water, and 2) reduce TCE plume concentrations within the Western and Eastern ST037 Plumes by treating primary and secondary source areas (USAF, 2017d).

The data review indicated the potential for multiple source areas that may warrant treatment; however, data gaps exist at some source area sites and additional site characterization to refine treatment design was recommended prior to implementation of remedial action. Upon completion of site characterization activities, data analysis should be performed to refine understanding of the plume configuration, aquifer hydraulics, and extent of source area contamination. When data evaluation is complete, prepare a treatability study proposing focused treatment based on the results of site characterization activities to prevent off-site migration of contaminated groundwater, remediate areas of saturated and smear zone soils, and reduce concentrations in the plume to expedite cleanup to ROD cleanup levels (USAF, 2017d).

8.2.4 LUC Summary

LUCs were implemented in July 1996 to prevent exposure to contaminated groundwater throughout OU5 until cleanup levels are attained. LUCs were updated in 2010, as well as the 673d Air Base Wing Instruction 32-7003 *Land Use Control Management* and are managed and implemented in accordance with the *Memorandum to the Site File for Operable Units (OUs) 1, 2, 4, and 5* (USAF, 2010).

Compliance with LUCs applies to all soil-disturbing activities on JBER and is reviewed annually (USAF, 2018c). A GIS-based tracking system is in place to ensure that LUCs are enforced and has been incorporated into the *Base General Plan*. A copy of the LUC inspection form is provided in **Appendix E**.

8.2.5 Systems Operations / Operations and Maintenance

The OU5 wetland remediation system was constructed in 1996 to treat contaminated groundwater emerging from several seeps along the southern bluff of JBER-E. The purpose of the system was to remediate petroleum hydrocarbon contamination in Seeps OU5SP-01 through OU5SP-04 and TCE in five other seeps (OU5SP-09, OU5SP-10, OU5SP-11, OU5SP-17, and OU5SP-18) through a combination of passive and active system components. The following components originally contributed to treatment:

- Gravel-lined collection areas for Seeps OU5SP-01 through OU5SP-04 and OU5SP-09 through OU5SP-11.
- Pump Stations #1, #2, and #3.
- Overland Flow Cell for water collected from seeps OU5SP-01 through OU5SP-04.
- Wetland Treatment Cell for effluent from the Overland Flow Cell and Seeps OU5SP-09, OU5SP-10, OU5SP-11, OU5SP-17, and OU5SP-18.

The primary treatment process in the seep collection areas is believed to be biodegradation, likely accomplished by a petroleum-degrading biofilm on the saturated gravel. Prior to 2007, water from the seep collection areas was transported via the three pump stations to the overland flow cell, which removed hydrocarbon contamination through a combination of volatilization and aerobic biodegradation that was enhanced by increasing dissolved oxygen concentrations in the water. Treated water from the overland flow cell was gravity fed into the wetland treatment cell, except during the coldest winter months; when the overland flow cell was shut down to prevent flooding. While the overland flow cell was shut down, water from the seep collection areas was pumped directly into the wetland treatment cell. The treatment processes active in the wetland treatment cell include volatilization, sorption, phytoremediation, and biodegradation. Retention time in the wetland is controlled and maintained at greater than 5 days to ensure that adequate remediation occurs. Effluent from the wetland treatment cell discharges to Ship Creek via underground culverts and ditches.

In 2007, Pump Station #3 was shut down because concentrations of COCs in the associated seep (OU5SP-04) were below cleanup goals (**Figure 8-5**). The results of Phases I and II of the Optimization Study indicated that COC degradation within the two seep collection areas serviced by Pump Stations #1 and #2 was sufficient to achieve applicable cleanup standards within these areas prior to discharge from those areas.

Components of the remediation system have been shut down based on analytical data which indicated they were no longer needed, or as a result of a three-phased Wetland Remediation System Optimization Study conducted in 2009 and 2010. The purpose of the Optimization Study was to evaluate whether the Wetland Remediation System could achieve treatment objectives established by the OU5 ROD when operated without pump station operation.

The results of the third phase of the Optimization Study were generally consistent with the results of the first two phases, with one exception. Modifications to the configuration of the Pump Station #1 seep collection area might be necessary to: 1) increase the retention time of COCs from seep OU5SP-02 in the collection area, and 2) maintain the water level within the collection area at an elevation below ground level (USAF, 2018c).

The USAF, EPA, and ADEC have agreed and signed the OU5 Memorandum to the Site File (USAF, 2011a) for a non-significant change to the OU5 ROD, formally changing the OU5 Wetland Remediation System treatment approach from an active (i.e., pumping) to a passive system.

8.3 PROGRESS SINCE THE LAST REVIEW

This is the fifth FYR for JBER-E. The protectiveness determination and statement from the 2014 FYR are presented in **Table 8-3**. Issues and recommendations from the 2014 FYR and the current status of those recommendations are presented in **Table 8-4**.

Table 8-3: OU5-ST037 Protectiveness Determination/Statement from the 2014 FYR

Site	Protectiveness Determination	Protectiveness Statement
OU5	Protectiveness Deferred	Protectiveness determination of the remedy at OU5 is deferred until the potential impacts associated with the vapor intrusion pathway at the site are evaluated. The vapor intrusion assessment is expected to be performed in 2016. Vapor intrusion evaluations will be conducted prioritizing buildings with the most vulnerable populations (schools, day cares, offices, residences). Delineation of the OU5 TCE source areas and plume boundaries is needed to ensure long-term protectiveness.

Key:
FYR – Five-Year Review
OU – Operable Unit
TCE – trichloroethylene

8.4 FYR PROCESS

8.4.1 Site Interviews

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. Site interviews for JBER-E were conducted as discussed in Section 3.1. Two comments were received, specifically relating to ST037, from ADEC:

- The TCE/solvent plume at SS022 has the potential to impact Ship Creek as it migrates off site.

Formal interview records are provided in **Appendix B**.

Table 8-4: OU5-ST037 Status of Recommendations from the 2014 FYR

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date
Based on the large historical release of fuel identified in the RI report, the potential exists for significant residual fuel contamination to remain in the soil that may act as a source of groundwater contamination. The extent of the soil source area affecting groundwater and, thereby, contributing to the benzene and petroleum hydrocarbon contamination detected in seeps OU5SP-01 and OU5SP-02 is not well delineated.	Identify the extent of soil contamination that is resulting in elevated concentrations of benzene and petroleum products identified in seeps OU5SP-01 and OU5SP-02. An assessment of residual soil contamination will be needed to predict the timeframe to meet RAOs at Seeps OU5SP-01 and OU5SP-02.	Ongoing	A work plan was prepared, and field work has been conducted to investigate soil contamination identified in OU5 seeps. At the time of this FYR, results from the investigation have not been finalized.	Not applicable
The 2006 vapor intrusion screening evaluation performed for TCE in the vicinity of the Fairchild Avenue Plume and the Dallas Base housing area utilized toxicity information that has since been updated. Additionally, no supplemental testing has been conducted to support the findings of the screening evaluation.	A vapor intrusion evaluation that provides multiple lines of evidence should be conducted in accordance with EPA guidance for each occupied facility that is in proximity to the TCE plumes at OU5. Vapor intrusion evaluations should be conducted, prioritizing buildings with the most vulnerable populations (schools, day cares, offices, and residences).	Completed	A vapor intrusion study was conducted from 2016 to 2017 at JBER and included 14 buildings located within plumes monitored under OU5 and ST037. A complete vapor intrusion pathway was identified at eight of the 14 buildings; a potentially complete pathway at three buildings; and an incomplete pathway at three buildings. The risk assessment did not identify any estimated risks that exceeded cancer risk and noncancer targets/ thresholds at these buildings (USAF, 2018b).	2017

Table 8-4 (Cont.) OU5-ST037 Status of Recommendations from the 2014 FYR

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date
Groundwater monitoring results at OU5 indicate that natural attenuation remedies are generally decreasing COC concentrations. However, the process is slower than anticipated in the 1995 ROD, and it is unlikely that concentrations of COCs will fall below their respective cleanup levels prior to the ROD-specified cleanup date (2025).	Utilize the findings from the *ST37 Plume and Source Area Groundwater Investigation Report* and continue to delineate the plume boundaries and potential source areas at OU5. Evaluate alternative remedial strategies to accelerate attainment of cleanup levels in groundwater.	Completed	All historical sample result data for ST037 was compiled in an effort to identify additional cleanup technologies that may be more effective.	2017
The potential exists for concentrations of 1,4-dioxane to be present in conjunction with TCE contamination at the site.	Based on USAF guidance (*Interim Air Force Guidance on Sampling and Response Actions for 1,4-Dioxane at Operational and BRAC Installations, 15 Aug 2013*), recommend a sampling event be conducted to identify if concentrations of 1,4-dioxane exist. Determine whether there is an unacceptable risk at the site.	Completed	A 1,4-dioxane investigation was completed at JBER in 2017. No sample results from any ST037 groundwater monitoring wells exceeded the EPA Region 9 RSL for residential tapwater (0.46 µg/L) or the current ADEC cleanup level of 4.6 µg/L (USAF, 2017c).	2017
Several monitoring wells that comprise the early warning and sentry monitoring well network are not located downgradient of plumes.	Optimize early warning and sentry monitoring well network to eliminate wells that are not downgradient of plumes and consider additional wells where there is a greater probability of contaminant migration.	Incomplete	Recommendations to optimize the early warning and sentry well network continue to be made in annual monitoring reports, but it does not appear that optimization has been conducted.	Not applicable
The monitoring well network at OU5 needs to be properly optimized to ensure that appropriate delineation of plume boundaries is occurring.	Optimize the groundwater monitoring network at OU5 as recommended in the *ST37 TCE Plume and Source Area Investigation Report*	Incomplete	Recommendations to optimize the monitoring well network continue to be made in annual monitoring reports, but it does not appear that optimization has been conducted.	Not applicable

Table 8-4 (Cont.) OU5-ST037 Status of Recommendations from the 2014 FYR

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date
Several seeps were identified as not being properly labeled and demarcated.	Ensure that the seeps at OU5 are properly labeled and demarcated to ensure that they are sampled appropriately in the future.	Complete	Seep locations were resurveyed and marked in 2014 (USAF, 2017b).	2014
The LF004 CERCLA site boundary appears to extend beyond JBER-E site boundaries. *Note: this issue was specifically noted for LF004 but applied to all sites covered by the FYR.*	All CERCLA site boundaries should be reviewed for accuracy and be revised, when applicable, in a memorandum to the site file.	Completed	CERCLA site and LUC boundaries and LUC boundaries are maintained in a GIS database. At the time of this FYR, there are no noted boundary discrepancies at ST037.	Not applicable
An in-depth description of the historical site events for each OU and DP098 was not included within Table 2-1 of this FYR.	Expand the chronology table in the next FYR to include detailed information concerning the chronology of site events for each OU and DP098.	Considered But Not Implemented	Chronology table not required in approved template for this FYR.	Not applicable

Key:

µg/L – micrograms per liter
ADEC – Alaska Department of Environmental Conservation
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
COC – contaminant of concern
EPA – United States Environmental Protection Agency
FYR – Five-Year Review
GIS – geographic information system
JBER – Joint Base Elmendorf-Richardson
JBER-E – Joint Base Elmendorf-Richardson Elmendorf Air Force Base
LUC – land use control
OU – Operable Unit
RAO – remedial action objective
RI – remedial investigation
ROD – Record of Decision
RSL – Regional Screening Level
TCE – trichloroethylene
USAF – United States Air Force

8.4.2 Data Review

A summary of data since the 2014 FYR is presented in Section 8.2.3. Data collected at ST037 during the period of this FYR (2014-2018) were reviewed. Data reviewed included: 2014 through 2016 monitoring activities (USAF, 2015; 2017b; 2018c), 1,4-dioxane sampling (USAF, 2017c), and the vapor intrusion study results (USAF, 2018b). Data is presented in **Figures 8-2** through **8-7.**

Data collected under the ERP are archived in the USAF ERPIMS database; however, not all data collected over the life of ST059 may have been archived into the system. All historical data available in ERPIMS (2 October 1986 through 27 July 2017) were reviewed to support a technical assessment of chemical-specific toxicity changes at ST037 since the ROD was signed. See Section 8.5.2.

8.4.3 Site Inspection

A site inspection was conducted at ST037 on 15 August 2017. The purpose of the inspection was to assess the protectiveness of the remedy. A site inspection form and photographs are provided in **Appendix E**. Generally, the overall site conditions indicated that LUCs are protective; however, there were a number of minor issues noted at monitoring wells. These include the following:

- OU5MW-38: the concrete apron is damaged and needs repair.
- OU5MW-44: the casing lid is missing bolts and needs repair or replacement.
- OU5MW-07: the casing lid is slightly elevated, indicating possible frost heaving.
- OU5MW-06: the casing lid is missing a bolt and is slightly elevated, indicating possible frost heaving.
- OU3MW-02: the casing lid is missing its bolts.
- OU3MW-11: the casing lid is missing a bolt and is slightly elevated, indicating possible frost heaving.

8.5 TECHNICAL ASSESSMENT

8.5.1 Question A – Is the remedy functioning as intended by the decision documents?

Yes. The review of documents, site data, and the results of the site inspections indicate that the remedy for ST037 is functioning as intended by the ROD; however, the timeframe for natural attenuation of TCE anticipated by the ROD (2025) is unlikely to be met, and a cleanup date cannot be predicted at this time. The performance of natural attenuation is somewhat mixed. In some wells, contaminants are degrading at a rate that will meet the cleanup levels by 2025. In other wells, natural attenuation rates are much slower, and some wells do not show decreasing concentration trends while others show no trend or increasing trends. It is recommended that additional studies be conducted to determine if the remedy, as is, will be able to achieve remediation goals within the estimated time frame. Other studies may include, but are not limited to: site characterization, ecological assessment, focused feasibilities studies, groundwater modeling, treatability studies, and/or sampling.

LUCs continue to prevent human exposure to contaminated groundwater at ST037; however, it is recommended that a treatability study be conducted to evaluate accelerated attainment of groundwater COC cleanup levels.

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

Revised cleanup levels have been promulgated and toxicity data has changed since the ROD was signed; however, MCLs for water have not changed.

Changes in Standards:

The ROD remediation goals are the MCLs, which have not changed since the ROD was signed and the chemical-specific ARARs for groundwater listed in the ROD (USAF, 1995c) do not have any changes that affect regulatory-based cleanup levels for groundwater COCs at ST037. However, regulatory cleanup levels (18 AAC 75) have recently been revised. The new cleanup levels are human health based, and account for toxicity changes that have occurred since the ROD was signed. These changes are presented in **Table 8-5**.

Table 8-5: OU5-ST037 Comparison of ROD Final Remediation Goals to 2017 Standards

Chemical	ROD Cleanup level	2017 ADEC Cleanup Level[1]	Federal MCL	Historic Site Concentration	LTM Site Concentration
Groundwater (µg/L)					
Benzene	5	4.6	5	16	0.75
Trichloroethylene (TCE)	5	2.8	5	64	38.7
Surface Water (µg/L)					
Sheen	No Sheen	--	--	--	--
Total Aromatic Hydrocarbons	10	--	--	--	--
Total Aqueous Hydrocarbons	15	--	--	--	--
Soil (mg/kg)					
TFH-diesel	1,000	--	--	--	--

Key:
1 – ADEC cleanup levels (18 AAC 75.341(c), as amended through 7 November 2017).
2 – The maximum historic detection was used as the applicable site concentration unless recent sample data was available (see Appendix F, Table F-3).
-- – not applicable
µg/L – micrograms per liter
AAC – Alaska Administrative Code
ADEC – Alaska Department of Environmental Conservation
LTM – long-term monitoring
MCL – Maximum contaminant level, Safe Drinking Water Act (40 CFR 141 and 40 CFR 143)
ND – non detect
OU – Operable Unit
ROD – Record of Decision

All available data for ST037 was evaluated against the ADEC standards (ADEC, 2017). Calculations were performed for chemicals with detections within the last 5 years above the new standards to determine exposure risk (**Appendix F**, **Tables F-1** through **F-3**). These calculations, based on recent concentrations and the residential exposure assumption, show a changed exposure risk for: (in both groundwater and surface water) TCE and 1,1,2,2-tetrachloroethane.

New toxicity data was reviewed and indicates that samples should be collected and analyzed for vanadium in groundwater and ethylbenzene and total xylenes in soil, to determine if concentrations of these chemicals pose an unacceptable risk at ST037.

The Base administrative control prohibiting use of the shallow aquifer south of the Elmendorf Moraine remains in effect and continues to prevent exposures to contaminated groundwater that may pose excessive risk. It is recommended that sampling be conducted to assess current concentrations.

Changes in Exposure Pathways

Manned facilities are present at ST037, and the vapor intrusion pathway was found to be complete at Buildings 6211, 7228, 7265, 7309, 8288, 8326, 8515, and 8559. A potentially complete vapor intrusion pathway was identified at Buildings 4230, 4314, and 7535. Additionally, the EPA's TCE industrial Indoor Air Response Action Levels was exceeded during field screening in Building 4230. Further investigation suggested that a commercial product being used/stored in the trailer is the likely source to high TCE concentrations in the indoor air samples. The results of the vapor intrusion study indicate that there is not a short-term risk from a vapor intrusion source attributing to the concentrations in the trailers.

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

Yes. Sites within OU5 were included in a 2016 JBER-wide investigation into the presence or absence of PFOS/PFOA (USAF, 2018).

8.6 ISSUES / RECOMMENDATIONS

Issues identified during this FYR that affect the protectiveness of the remedy are shown below.

Issues and Recommendations Identified in the Five-Year Review				
OU(s): OU5, Site ST037	**Issue Category:** Remedy Performance			
	Issue: Limited natural attenuation of COCs in groundwater is occurring at the site, indicating that RAOs may not be achieved within the projected timeline of 30 years.			
	Recommendation: Conduct additional site characterization activities as recommended in the *Data Compilation and Remedial Action Evaluation Report, Western and Eastern ST037 Plumes, August 2017*. Upon completion of site characterization activities, data analysis should be performed to refine understanding of the plume configuration, aquifer hydraulics, and extent of source area contamination. When data evaluation is complete, prepare a treatability study proposing focused treatment based on results of the site characterization activities to prevent off-site migration of contaminated groundwater, remediate areas of saturated and smear zone soils, and reduce concentrations in the plume to expedite cleanup to ROD established levels. Groundwater cleanup timelines should be reestablished using groundwater modeling.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023
OU(s): OU5, Site ST037	**Issue Category:** Remedy Performance			
	Issue: Due to changes in toxicity data or regulatory cleanup standards, some chemicals current final remediation goals may exceed EPA human health guidance: (in both groundwater and surface water) TCE and 1,1,2,2-tetrachloroethane.			
	Recommendation: The AF will evaluate any changes in promulgated standards and chemical toxicity characteristics in accordance with OSWER 9355.7-03B, Appendix G (June 2001) to determine if the current remedy will reduce contamination to within the acceptable CERCLA risk ranges for protectiveness. If the evaluation determines that acceptable risk will not be achieved by the current remedy, the decision document will be appropriately revised following the CERCLA process.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023

Issues and recommendations identified during this FYR that do not affect the protectiveness of the remedy at ST037 include:

Issue No.	OU-Site	Finding/ Recommendation
1	OU5-ST037	Maintenance of monitoring wells, including: o OU5MW-38: the concrete apron is damaged and needs repair. o OU5MW-44: the casing lid is missing bolts and needs repair or replacement. o OU5MW-07: the casing lid is slightly elevated, indicating possible frost heaving. o OU5MW-06: the casing lid is missing a bolt and is slightly elevated, indicating possible frost heaving. o OU3MW-02: the casing lid is missing its bolts. o OU3MW-11: the casing lid is missing a bolt and is slightly elevated, indicating possible frost heaving.
2	OU5-ST037	Due to changes in toxicity data and regulatory cleanup standards, site historic data for some chemicals may exceed EPA human health guidance for risk analysis some non COCs: (in groundwater) vanadium; and (in soil) ethylbenzene and total xylenes. Conduct a sampling event to identify current concentrations in groundwater and soil for these chemicals.
3	OU5-ST037	Optimize the early warning, sentry, and groundwater monitoring well network as recommended in the *2016 Annual Remedial Action-Operations and Monitoring Report for Select CERCLA Sites* (USAF, 2018c).

9.0 OPERABLE UNIT 6 (LF002)

OU6 consists of sites LF002, LF003, LF004, SD015, SD073, SS019, and WP014. Sites LF002, LF003, LF004, SD015, and WP014 remain open in this OU.

9.1 SITE BACKGROUND

LF002 is an 8-acre landfill located in the southeast area of JBER-E, north of the Boniface gate, and west of Vandenberg Avenue (**Figure 9-1**). LF002 is partially located on a bluff that separates the main floodplain of Ship Creek from an upper stream terrace. The southern portion of the landfill is located on the upper terrace, while the northern portion extends beyond the base of the bluff into the lower floodplain terrace. The bluff itself is associated with a change in elevation of approximately 30 to 40 feet. The landfill was used from 1940 to 1942 as a surface dump for debris thought to have been metal-bearing waste, construction rubble, scrap metal, and general refuse; however, aerial photographs indicate that disposal activity may have continued into the 1950s. Debris was dumped off the bluff, and eventually bulldozers and other equipment pushed it out to the locations now found at the site. The physical shape of the landfill reflects the location of the debris. A 10-foot high berm is the northern extent of the main portion of the landfill; the former natural bluff forms the southern boundary of the debris. The majority of the landfill is 10 to 20 feet thick. During the period of active operation, no daily cover was applied; however, the area is currently covered with several feet of soil and vegetation. Historical documentation does not indicate that hazardous material wastes were disposed of in this landfill (USAF, 2016b).

Waste management practices resulted in soil and groundwater contamination by metals, VOCs, and semi-volatile organic compounds (SVOCs). Groundwater was also contaminated by fueling and maintenance practices at a gun battery located upgradient of the site, which was inactivated and removed prior to 1950. By the time of the OU6 ROD (USAF, 1997a), no continuing source of groundwater contamination existed at the gun battery, and all gun-battery-derived contamination had migrated to the upgradient edge of the landfill. The landfill area is currently covered with several feet of soil and vegetation in accordance with the OU6 ROD selected remedy of capping heavy metals with soil (USAF, 2018c).

9.2 RESPONSE ACTION SUMMARY

9.2.1 Basis for Taking Action

CERCLA hazardous substances released at JBER-E resulted in soil, sediment, surface water, and groundwater contamination in various locations. The initial risk assessment at OU6 determined that the human and/or ecological risks exceeded the EPA's average or reasonable maximum exposure risk management criteria, and that remedial action must be taken.

The OU6 ROD identified 1,1,2,2-PCA as the only groundwater COC and is the basis for cleanup goals at LF002. Uncovered landfill waste was also identified as requiring a response action as part of the remedy for LF002. The 1,1,2,2-PCA cleanup level of 0.43 µg/L presented in the ROD was amended by the OU6 ESD (USAF, 2007) to 4 µg/L.

Risk Summary

The OU6 ROD included the results of a baseline HHRA, conducted to estimate the risk posed to human health by source areas within OU6. Since LF002 is not currently used residentially, a current residential risk scenario was not evaluated, and only current visitor and trench worker scenarios were applied. Even though the future land use at LF002 is restricted, the future residential risk scenario was also evaluated.

Cancer risk using the residential reasonable maximum exposure (RME) scenario for groundwater at LF002 exceeded 1.0×10^{-5}, driven by 1,1,2,2-PCA. No noncarcinogenic risk was identified for groundwater. Shallow soil carcinogenic RME risk exceeded 1.0×10^{-5} for the RME scenario, and 1.0×10^{-6} for the visitor scenario. Only the RME noncarcinogenic risk exceeded 1.0. No significant risk was identified under the trench worker scenario. Soil risk was attributable to metals, which are believed to be at background concentrations (USAF, 1997a).

Lead was detected at depth in LF002 and evaluated using the EPA's Lead Uptake/Biokinetic Model to determine whether the lead levels present posed a risk. It was initially determined that the levels present would not pose sufficient risk to require action. Subsequently, additional sampling demonstrated that lead in excess of EPA screening levels was present closer to the surface than was originally thought to be the case (within 2 feet of the ground surface at some locations). Although the model still indicated that the lead should not pose an unacceptable risk, a remedy including an additional 2-foot soil cover at areas with elevated lead concentrations to reduce potential exposure was preferred (USAF, 1997a).

The OU6 ROD also included the results of an ERA at LF002. The ERA was performed to determine if the reported concentrations of chemicals or calculated exposures to plants and wildlife at OU6 are likely to produce adverse effects. Ecological effects were evaluated quantitatively by calculating Ecological Quotients (EQs). The ERA focused on evaluating potential impacts of the contamination on selected indicator species: moose, masked shrew, meadow vole, black-capped chickadee, merlin, and peregrine falcon (USAF, 1997a).

The EQ of 1.0 was exceeded for the meadow vole, masked shrew, and black-capped chickadee in the landfill area due to elevated concentrations of lead, barium, copper, selenium, and zinc. The highest EQs at the LF002 landfill are associated with zinc (up to 1,320 for the black-capped chickadee), which drives the ecological risk in this area. EQs were calculated based on shallow soil and seep contaminant concentrations. Most of the contribution to ecological risk is associated with metals contamination in shallow soil (USAF, 1997a).

None of the calculated EQs exceeded 1.0 for the moose, peregrine falcon, or merlin at LF002. The upgradient source at LF002 was not evaluated from an ecological risk point of view, because insufficient information was collected to conduct this evaluation. Furthermore, this area is located next to a busy road and is mowed and maintained by JBER. Therefore, it is an unlikely habitat for wildlife.

9.2.2 Response Actions

Environmental investigations have been conducted at LF002 since the early 1980s. Phase I of the Installation Restoration Program (IRP) identified the potential for environmental contamination associated with past waste disposal practices and to assess the potential for contaminant migration. No OU6 sites progressed to Phase II. A Resource Conservation and Recovery Act (RCRA) Facility Assessment was conducted at LF002, but no additional action was recommended (USAF, 2016b).

LF002 was evaluated under the State-Elmendorf Environmental Restoration Agreement (SERA) program in 1993. Concentrations of DRO were detected in several soil samples; however, none of the samples had concentrations exceeding ADEC cleanup standards for Level B soils. The RCRA metals analysis of the soil samples showed normal concentrations of the metals for surface soils in Alaska. The conclusion was that the landfill had not adversely affected the surrounding soils. Concentrations of chromium exceeding state and federal MCLs were detected in all of the groundwater samples. Groundwater contamination was suggested to be attributed to upgradient sources, or is a natural occurrence (USAF, 2016b).

An RI/FS was conducted at LF002 in 1996. The nature and extent of the landfill was established using electromagnetic and ground-penetrating radar surveys. Soil contamination identified included an area of fuel and solvent-related contamination east of the landfill in the static display area, and two areas of metals contamination in the landfill itself. Lead is the primary contaminant in the landfill soils, but antimony and other potentially toxic metals were also present in smaller amounts (USAF, 2016b).

A soil gas survey was conducted at the landfill to characterize the average soil gas methane and other VOC emissions into the atmosphere. Soil gas samples were collected, and results indicated no BTEX detections, no solvent concentrations greater than 20 parts per billion by volume, and methane concentrations much less than 5 percent (%) of the lower explosive level in all locations sampled (USAF, 2016b).

The RI indicated that groundwater contamination was originating from an upgradient source: the former gun battery, in the same location as the static display. The gun battery was inactivated and removed around the same time landfilling at LF002 was terminated, leaving no continuing source of contamination (USAF, 2016b).

Remedial Action Objectives

RAOs provide a general description of what the cleanup will accomplish. RAOs specified in the OU6 ROD for LF002 are as follows:

- Prevent the ingestion and dermal contact of water, and inhalation of vapors while bathing, for water having 1,1,2,2-PCA in excess of cleanup goals and/or resulting in a cancer risk greater than 1×10^{-6}.
- Mitigate, to the extent practicable, human dermal exposure with lead-contaminated shallow soils and exposed landfill waste or debris present on the landfill surface.
- Preserve existing vegetation and ecological habitat to the extent practicable.

Remedy Components

The OU6 ROD-selected remedy addresses contaminated groundwater and soil within LF002 by using a combination of 1) actions to reduce contamination below cleanup levels, and 2) LUCs to prevent exposure to contamination above those cleanup levels. ROD cleanup levels for LF002 COCs are presented in **Table 9-1**.

Table 9-1: OU6-LF002 Contaminants of Concern and ROD Cleanup Levels

Contaminant of Concern	ROD Cleanup Level	Basis for Cleanup Level
Groundwater (µg/L)		
1,1,2,2-Tetrachloroethane	4[1]	18 AAC 75.345
Shallow Soils		
Lead	--[2]	
Exposed Landfill Debris	--	18 AAC 60.390

Key:

1 – At the time of the ROD, a risk-based groundwater cleanup level for 1,1,2,2-tetrachloroethane of 0.43 µg/L was established, because there was no available federal or state applicable or relevant and appropriate requirement (ARAR). Since the ROD was signed, a cleanup level of 4 µg/L was established in 18 AAC 75.345. The *OU6 ESD*, Mar 2007 changed the remedy cleanup level from 0.43 µg/L to 4 µg/L.

2 – The ROD does not specify cleanup levels, because risk analysis resulted in hazard index below standards. A lead uptake/biokinetic model was the basis of listing lead as a COC.

µg/L – micrograms per liter
AAC – Alaska Administrative Code
COC – contaminant of concern
ESD – Explanation of Significant Differences
OU – Operable Unit
ROD – Record of Decision

The groundwater remedy includes the following major components:

- Institutionally-controlled access to groundwater.
- Semi-annual groundwater monitoring with FYR of protectiveness.
- Groundwater monitoring will be discontinued if contaminant levels are below cleanup levels during two consecutive monitoring events; if this is the case, no further action will be required for groundwater.
- During the last round of groundwater monitoring, samples will be collected and analyzed for all constituents that exceeded MCLs during the 1994 investigation.
- All groundwater is expected to be cleaned up within 23 years.

The soil remedy includes the following major components:

- Institutionally-controlled access to soil.
- A limited soil cover will be applied in three areas showing elevated lead concentrations.
- Landfill debris on top of or protruding from the ground surface will be removed.
- Hazardous materials encountered during the removal event will be handled according to appropriate regulations.

- No further action will be required as a means of closing the LF002 Landfill.

The groundwater sampling frequency at LF002 was modified from semi-annual to a frequency determined by the Decision Guide in the *Memorandum to the Site File* (USAF, 2003d). An ESD clarified LUCs for LF002, and also changed the original risk-based groundwater cleanup goal for 1,1,2,2-PCA from 0.43 µg/L to the Alaska cleanup level of 4 µg/L (USAF, 2007). The current status of remedy components for LF002 is presented in **Table 9-2**.

Table 9-2: OU6-LF002 Remedy Status

Remedy Component	Status
Groundwater (including seeps)	
Access to groundwater at LF002 will be institutionally controlled. LF002 is currently designated as a "restricted use area" in the Base General Plan. This designation provides for recreational use of the parcel (e.g., cross-country skiing) and for construction of unmanned facilities, such as a parking lot, storage building, or taxiway, but prohibits the construction of any sort of manned facility, such as an office building or a residence. Drilling into the shallow aquifer is also restricted by the Base General Plan to prohibit residential or agricultural use of contaminated groundwater. (LUCs will be managed and implemented in accordance with the June 2007 ESD, Section 4.3; USAF, 2007).	Implemented in September 1997. LUCs updated in the 2007 ESD and May 2011 673d Air Base Wing Instruction 32-7003 *Land Use Control Management*. No LUC breaches were identified during the period of review for this FYR.
Groundwater will be monitored as indicated by the *Basewide Monitoring Program Well Sampling Frequency Decision Guide* and evaluated on an as-needed basis to determine contaminant migration and to track the progress of contaminant degradation and dispersion, as well as to provide an early indication of unforeseen environmental or human health risk. FYRs will also assess the protectiveness of the remedial action, including an evaluation of any changed site conditions, as long as contamination remains above cleanup levels.	A monitoring frequency decision guide was adopted in 2003. Closure sampling was conducted in 2009 and 2010 in accordance with the OU6 ROD, with additional ADEC-requested sampling for fuel-related parameters in 2010, 2011, and 2013. All results were below applicable cleanup levels. FYRs were conducted in 1998, 2003 2008, and 2014.
Groundwater monitoring will be discontinued if contaminant levels are below cleanup levels during two consecutive monitoring events. In that case, NFA for groundwater will be required.	Groundwater sampling was discontinued after 2008, and closure sampling procedures were initiated in 2009 in accordance with the OU6 ROD.
During the final round of monitoring, samples will be collected and analyzed for all constituents that exceeded MCLs during the 1994 investigation, including volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOC). These results will be evaluated before a final determination is made that groundwater meets all cleanup requirements.	Closure sampling, combined with previous monitoring, indicated that the groundwater COC (1,1,2,2-PCA) was below the cleanup level in four consecutive monitoring events, and the other constituents of historical interest (methylene chloride, TCE, bis-(2-ethylhexyl)phthalate, selenium, and thallium) were found to be non-detect or below their respective cleanup levels.
All groundwater is expected to be cleaned up within 23 years.	Groundwater cleanup for LF002 appeared to be complete after 6 years (since 2003).

Table 9-2 (Cont.) OU6-LF002 Remedy Status

Remedy Component	Status
Soils	
Access to soil at LF002 will be institutionally controlled. LF002 is currently designated as a "restricted use area" in the Base General Plan. This designation provides for recreational use of the parcel (e.g., cross-country skiing) and for construction of unmanned facilities, such as a parking lot, storage building, or taxiway, but prohibits the construction of any sort of manned facility, such as an office building or a residence. LUCs will be managed and implemented in accordance with the June 2007 ESD (USAF, 2007).	Implemented September 1997. LUC procedures were updated and clarified in the 2007 ESD and in the May 2011 673d Air Base Wing Instruction 32-7003 *Land Use Control Management*. No LUC breaches were identified during the period under review.
A limited soil cover will be applied in three areas with elevated lead concentrations at LF002. This will eliminate the pathway for contact with the lead contamination. FYRs will be conducted to evaluate the integrity of the cover, evaluate impacts from any changed site conditions, and assess the continued protectiveness of this remedial action.	Soil covers and exposed debris removal were completed in October 1996. FYRs were conducted in 1998, 2003 2008, and 2014.
Landfill debris on top of, or protruding from, the ground surface at LF002 will also be removed as part of the specific remedy for this area.	Soil cover and exposed debris removal were completed in October 1996.
Hazardous materials encountered during the removal event will be handled according to appropriate regulations. NFA will be required as a means of closing the LF002 landfill.	Any hazardous materials have been disposed of in accordance with appropriate regulations.

Key:
ADEC – Alaska Department of Environmental Conservation
COC – contaminant of concern
ESD – Explanation of Significant Differences
FYR – Five-Year Review
LUC – land use control
MCL – maximum contaminant level
NFA – No Further Action
OU – Operable Unit
PCA – tetrachloroethane
ROD – Record of Decision
TCE – trichloroethylene

9.2.3 Status of Implementation

In 1996, surface debris removal was conducted throughout LF002. Soil covers were constructed over three areas (approximately 0.4 acres) to minimize potential human exposure to lead-contaminated soils. The three areas were identified to have lead concentrations exceeding 500 milligrams per kilogram (mg/kg) at depths of 2 feet bgs or less. One foot of fill material and 1 foot of topsoil were placed in the three identified areas. Annual inspection of these remedies has occurred since 1996 (USAF, 2016b).

Groundwater sampling at LF002 was performed at Monitoring Wells OU6MW-49 (OU6MW-49R) and 53WL-05 semiannually from 1994 until 2002, and intermittently thereafter (**Figure 9-1**). Results from 2003, 2006, and 2007 of 1,1,2,2-PCA were reported at values less than the OU6 ESD cleanup level of 4 µg/L; therefore, final closure sampling was recommended.

In 2009, closure sampling was conducted by collecting and analyzing samples for all constituents exceeding MCLs at the individual wells during the 1994 investigation. All constituents were below cleanup levels in Monitoring Wells OU6MW-49R and 53WL-05, as well as in two other monitoring wells associated with the site: 53WL-02 and 65WL-04R. The cooler containing the SVOC sample jars from Seep LF02SP-01 exceeded temperature standards in 2009 and had to be collected and analyzed again in 2010. The groundwater COC (1,1,2,2-PCA) has been below the cleanup level in four consecutive monitoring events (cleanup requires only two), and the other constituents of historical interest (methylene chloride, TCE, bis-(2-ethylhexyl)phthalate, selenium, and thallium) were found to be non-detect (ND) or below their respective cleanup levels.

ADEC also requested DRO and GRO analyses for all site sampling locations. This additional closure sampling for fuel-related parameters was conducted in 2010 and 2011 at all four monitoring wells. In 2010 and 2013, TAH and TAqH results at Seep LF02SP-01 were below 18 AAC 70 cleanup standards.

In 2015, an IRACR for LF002 was approved by the EPA and ADEC and became final October 2016 (USAF, 2016b). The IRACR identified the following:

- Soil remedies at LF002 have met the RAOs.
- Groundwater COCs have been below cleanup goals since 2003, as established in the OU6 ESD, which indicated the attainment of cleanup goals.
- Monitoring Wells OU6MW-49R and 53WL-05 may be decommissioned.
- The implemented remedies for soil and groundwater achieved the degree of cleanup or protection, as specified in the OU6 ROD for all pathways of exposure.
- LF002 will remain in the FYR for JBER-E, because the remedy includes ICs and soil cover and does not meet the requirements of UU/UE.

Thus, the site is considered "Response Complete" (RC) as presented in the IRACR (USAF, 2016b). As a former landfill, LF002 will continue with a "restricted use area" designation in the *Base General Plan* indefinitely, or until all waste is removed from the site to achieve UU/UE. Prohibition on the use of the shallow groundwater aquifer and construction of any sort of manned facility, such as an office building or residence, remains in effect. Annual LUC inspections are performed to ensure that the LUCs remain appropriate and adequate.

9.2.4 LUC Summary

LUCs were implemented in September 1997 to restrict access to contaminated media throughout OU6 until cleanup levels are achieved. LUCs were updated in 2010, as well as the 673d Air Base Wing Instruction 32-7003 *Land Use Control Management* and are managed and implemented in accordance with the *Explanation of Significant Differences, Operable Unit 6* (USAF, 2007).

LUCs in effect at LF002 include its designation as a "restricted use area" in the Base General Plan and ICs. This designation provides for recreational use of the parcel (e.g., cross-country skiing) and for construction of unmanned facilities (e.g., a parking lot, storage building, or taxiway), but prohibits the construction of any sort of manned facility (e.g., an office building or a residence). LUCs also include ICs on soil and groundwater at LF002. Drilling into the shallow aquifer is also restricted by the Base General Plan to prohibit residential or agricultural use of contaminated groundwater (USAF, 2007).

Compliance with LUCs applies to all soil-disturbing activities on JBER and is reviewed annually (USAF, 2018c). A GIS-based tracking system is in place to ensure that LUCs are enforced and has been incorporated into the *Base General Plan*. A copy of the LUC inspection form is provided in **Appendix E**.

9.2.5 Systems Operations / Operations and Maintenance

No active systems are currently operated as part of remediation at LF002.

9.3 PROGRESS SINCE THE LAST REVIEW

This is the fifth FYR for JBER-E. The OU6 protectiveness determination and statement from the 2014 FYR are presented in **Table 9-3**. Issues and recommendations for Site LF002 from the 2014 FYR and the current status of those recommendations are presented in **Table 9-4**.

Table 9-3: OU6 Protectiveness Determination/Statement from the 2014 FYR

Site	Protectiveness Determination	Protectiveness Statement
OU6	Short-term Protective	The remedies at OU6 currently protect human health and the environment, because LUCs are preventing exposure to contaminated groundwater and soil. However, in order for the remedy to be protective in the long-term, the remedial action selected in the ROD will need to be optimized, because it does not appear that there will be sufficient progress in meeting groundwater cleanup levels in the timeframe established in the ROD. LF002 meets the ROD-specified cleanup levels; therefore, a "Response Complete" determination with continued implementation of LUCs is recommended for the site.

Key:
FYR – Five-Year Review
LUC – land use control
OU – Operable Unit
ROD – Record of Decision

9.4 FYR PROCESS

9.4.1 Site Interviews

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. Site interviews for JBER-E were conducted as discussed in Section 3.1. There were no specific comments regarding LF002.

Table 9-4: OU6-LF002 Status of Recommendations from the 2014 FYR

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date
Contaminants in the groundwater at LF002 are below cleanup levels.	Continue with the plan to sample the LF002 seep (LF025P-01) for TAH and TAqH to assess whether this seep meets surface water quality standards. Once the LF002 seep has been determined to meet these closure requirements, prepare a memorandum to the site file documenting that groundwater and surface water meet cleanup levels and recommend a status of "Response Complete" for this site.	Completed	TAH and TAqH samples at the LF002 seep were below applicable cleanup levels. An IRACR was prepared in 2016 and "Response Complete" status achieved.	10/1/2016
The LF004 CERCLA site boundary appears to extend beyond JBER-E site boundaries. *Note: this issue was specifically noted for LF004 but applied to all sites covered by the FYR.*	All CERCLA site boundaries should be reviewed for accuracy and be revised, when applicable, in a memorandum to the site file.	Completed	CERCLA site and LUC boundaries are maintained in a GIS database. At the time of this FYR, there are no noted boundary discrepancies at LF002.	Not applicable
An in-depth description of the historical site events for each OU and DP098 was not included within Table 2-1 of this FYR.	Expand the chronology table in the next FYR to include detailed information concerning the chronology of site events for each OU and DP098.	Considered But Not Implemented	Chronology table not required in approved template for this FYR.	Not applicable

Key:
CERCLA – contaminant of concern
FYR – Five-Year Review
GIS – geographic information system
IRACR – Interim Remedial Action Completion Report
JBER-E – Joint Base Elmendorf-Richardson Elmendorf Air Force Base
LUC – land use control
OU – Operable Unit
TAH – Total Aromatic Hydrocarbon
TAqH – Total Aqueous Hydrocarbon

9.4.2 Data Review

A summary of data since the 2014 FYR is presented in Section 9.2.3. Data collected at LF002 during the period of this FYR (2014-2018) were reviewed. Data reviewed included: 2014 through 2016 LUC inspection activities (USAF, 2015; 2017b; 2018c), and the IRACR (USAF, 2016b). Data is presented on **Figure 9-1**.

Data collected under the ERP are archived in the USAF ERPIMS database; however, not all data collected over the life of LF002 may have been archived into the system. All historical data available in ERPIMS (22 July 1993 through 21 September 2016) were reviewed to support a technical assessment of chemical-specific toxicity changes since the ROD was signed. See Section 9.5.2.

9.4.3 Site Inspection

A site inspection was conducted at LF002 on 2 August 2017. The purpose of the inspection was to assess the protectiveness of the remedy. A site inspection form and photographs are provided in **Appendix E**. No issues were discovered that affect the current or future protectiveness of the remedy at the site.

9.5 TECHNICAL ASSESSMENT

9.5.1 Question A – Is the remedy functioning as intended by the decision documents?

Yes. The review of documents, site data, and the results of the site inspections indicate that the remedy for LF002 is functioning as intended by the ROD. The selected remedy for groundwater included MNA and LUCs. The only groundwater COC, 1,1,2,2-PCA, was expected to reach concentrations below the ESD cleanup level of 4 µg/L within 23 years (2020); the cleanup level was achieved in 6 years (2003).

As a former landfill, LUCs on land use and the construction of manned facilities continue to be adequate and protective and will remain in place indefinitely.

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

Revised cleanup levels have been promulgated and toxicity data has changed since the ROD was signed.

Changes in Standards:

The chemical-specific ARAR for groundwater listed in the ESD (USAF, 2007) does not have any changes that affect regulatory-based cleanup levels for the groundwater COC, 1,1,2,2-PCA, at LF002. However, regulatory cleanup levels (18 AAC 75) have recently been revised. The new cleanup levels are human health based, and account for toxicity changes that have occurred since the ROD was signed. These changes are presented in **Table 9-5**.

Table 9-5: OU6-LF002 Comparison of ROD Final Remediation Goals to 2017 Standards

Chemical	ROD Cleanup Level	2017 ADEC Cleanup Level[1]	Federal MCL	Historic Site Concentration	LTM Site Concentration
Groundwater (µg/L)					
1,1,2,2-Tetrachloroethane (1,1,2,2-PCA),	4	0.76		45.1	ND
Shallow Soils (mg/kg)					
Lead	--[2]	400	--	206	--
Exposed Debris	--	--	--	--	--

Key:
1 – ADEC cleanup levels (18 AAC 75.341(c), as amended through 7 November 2017).
2 – No cleanup level specified in ROD, due to risk analysis giving hazard index below standards
-- – not applicable
µg/L – micrograms per liter
AAC – Alaska Administrative Code
ADEC – Alaska Department of Environmental Conservation
MCL – Maximum contaminant level, Safe Drinking Water Act (40 CFR 141 and 40 CFR 143)
mg/kg – milligrams per kilogram
LTM – long-term monitoring
ND – non detect
OU – Operable Unit
ROD – Record of Decision

All available data for LF002 were evaluated against the ADEC standards (ADEC, 2017). Calculations were performed for chemicals with detections above the new standards to determine exposure risk (**Appendix F**, **Tables F-1** through **F-3**). These calculations, based on recent site concentrations and the residential exposure assumption, show a changed exposure risk for (in groundwater) benzene, ethylbenzene, naphthalene, total xylenes;

New toxicity data was reviewed and indicates that samples should be collected and analyzed for: vanadium in groundwater and benzene, ethylbenzene, naphthalene, thallium, and TCE in soil, to determine if concentrations of these chemicals pose an unacceptable risk at LF002.

In accordance with the ROD, closure sampling conducted in 2009 and 2010 included analysis for concentrations of chemicals of potential concern (COPCs) with MCL exceedances in the 1994 RI/FS. Of the chemicals listed above with calculated risk/hazard exceedances, only 1,1,2,2-PCA and TCE were evaluated as part of closure sampling (both were below cleanup levels). So, although groundwater sampling was discontinued after 2008 and the site was recommended for closure (USAF, 2016b).

LUCs on land use and the construction of manned facilities, as well as the Base administrative control prohibiting use of the shallow aquifer south of the Elmendorf Moraine, are adequate and preventing exposures to contaminated media at the site; however, sampling should be conducted to determine if current concentrations result in risk and hazard exceedances.

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

No other information has been discovered that calls into question the protectiveness of the remedy for LF002.

9.6 ISSUES / RECOMMENDATIONS

Issues identified during this FYR that affect the protectiveness of the remedy are shown below.

OU(s): OU6, Site LF002	**Issue Category:** Remedy Performance			
	Issue: Due to changes in toxicity data or regulatory cleanup standards, some chemicals current final remediation goals may exceed EPA human health guidance: (in groundwater) benzene, ethylbenzene, naphthalene, total xylenes.			
	Recommendation: The AF will evaluate any changes in promulgated standards and chemical toxicity characteristics in accordance with OSWER 9355.7-03B, Appendix G (June 2001) to determine if the current remedy will reduce contamination to within the acceptable CERCLA risk ranges for protectiveness. If the evaluation determines that acceptable risk will not be achieved by the current remedy, the decision document will be appropriately revised following the CERCLA process.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023

Recommendations that do not affect the protectiveness of the remedy at LF002 include:

Issue No.	**OU-Site**	**Finding/ Recommendation**
1	OU6-LF002	Due to changes in toxicity data and regulatory cleanup standards, site historic data for some chemicals may exceed EPA human health guidance for risk analysis some non COCs: (in groundwater) vanadium and (in soil) benzene, ethylbenzene, naphthalene, thallium, and TCE. Conduct a sampling event to identify current concentrations in groundwater and soil for these chemicals.

10.0 OPERABLE UNIT 6 (LF003)

OU6 consists of sites LF002, LF003, LF004, SD015, SD073, SS019, and WP014. Sites LF002, LF003, LF004, SD015, and WP014 remain open in this OU.

10.1 SITE BACKGROUND

LF003 is located south of Provider Drive and east of Wilkins Avenue in the southeastern corner of the JBER-E (**Figure 10-1**). The historical 15-acre landfill, which operated between 1943 and 1957, holds general refuse, construction rubble, and shop wastes. Spent ammunition may also have been disposed of in the landfill. No daily cover was applied, and some limited open burning occurred during the 1950s. In 1957, due to subsequent odor and nuisance complaints, the landfill was closed and covered with several feet of native soil, which now supports a substantial growth of trees and shrubs.

10.2 RESPONSE ACTION SUMMARY

10.2.1 Basis for Taking Action

CERCLA hazardous substances released at JBER-E resulted in soil, sediment, surface water, and groundwater contamination in various locations. The initial risk assessment at OU6 determined that the human and/or ecological risks exceeded the EPA's average or reasonable maximum exposure risk management criteria, and that remedial action must be taken.

No COCs were identified for LF003. The OU6 ROD required no further action at this site and LUCs were implemented based on the nature of the site (USAF, 1997a). The ROD was modified by the OU6 ESD (USAF, 2007), which clarified how the USAF intended to implement LUCs at this site.

Risk Summary

The OU6 ROD included the results of a baseline HHRA, conducted to estimate the risk posed to human health by source areas within OU6. Since LF003 is not currently used residentially, a current residential risk scenario was not evaluated, and only current visitor and trench worker scenarios were applied. Even though the future land use at LF003 is restricted, the future residential risk scenario was also evaluated.

Cancer risk using the RME scenario for groundwater at LF003 exceeded 1.0×10^{-4}, driven by low levels of 1,1,2,2-PCA and beryllium present at the site (both below MCLs). Noncarcinogenic risk above 1.0 was also identified for groundwater at LF003, driven by the occurrences of beryllium and antimony in the groundwater. No soil risk was identified (USAF, 1997a).

The OU6 ROD also included the results of an ERA at LF003. The ERA was performed to determine if the reported concentrations of chemicals or calculated exposures to plants and wildlife at OU6 are likely to produce adverse effects. Ecological effects were evaluated quantitatively by calculating EQs. The ERA focused on evaluating potential impacts of the contamination on

selected indicator species: moose, masked shrew, meadow vole, black-capped chickadee, merlin, and peregrine falcon (USAF, 1997a).

The EQ of 1.0 was exceeded for the black-capped chickadee, meadow vole, and shrew at LF003 due to an elevated selenium concentration. The highest selenium EQ was equal to 180 for the masked shrew. EQs were calculated based on surface soil contaminant concentrations. None of the calculated EQs exceed 1.0 for moose, peregrine falcon, or merlin at LF003. It is highly likely that the data used to calculate the EQs for selenium at LF003 are not representative of landfill contamination since: 1) the results were collected at locations cross-gradient to and away from the landfill, and 2) there is substantial uncertainty associated with the selenium results based upon the method used and the low levels detected (USAF, 1997a).

10.2.2 Response Actions

The OU6 RI/FS found low levels of fuel constituents, VOCs, and metals in both soil and groundwater at LF003. Metals results were evaluated and found to be at or near background concentrations in both soil and groundwater.

Remedial Action Objectives

RAOs are developed based on COCs, potential exposure routes and receptors, and remediation goals. No RAOs were developed for LF003.

Remedy Components

The OU6 ROD required no remedial action at LF003 and LUCs were implemented (USAF, 1997a). The ROD was modified by the OU6 ESD (USAF, 2007), which clarified how the USAF intended to implement LUCs at the site, and included the following:

- Access to groundwater and soil at LF003 will be institutionally controlled. LF003 is currently designated as a "restricted use area" in the Base General Plan. This designation provides for recreational use of the parcel (e.g., cross-country skiing, etc.) and for construction of unmanned facilities (e.g., a parking lot, storage building, or taxiway), but prohibits the construction of any sort of manned facility (e.g., an office building or a residence). Drilling into the shallow aquifer is also restricted by the Base General Plan to prohibit residential or agricultural use of contaminated groundwater.

10.2.3 Status of Implementation

The current status of LUC components at LF003 is presented in **Table 10-1**.

10.2.4 LUC Summary

LUCs were implemented in September 1997 to restrict access to contaminated media throughout OU6 until cleanup levels are achieved. LUCs were updated in 2010, as well as the 673d Air Base Wing Instruction 32-7003 *Land Use Control Management* and are managed and implemented in accordance with the *Operable Unit 6 Explanation of Significant Differences* (USAF, 2007).

Table 10-1: OU6-LF003 LUC Status

Remedy Component	Status
Groundwater	
Access to groundwater and soil at LF003 will be institutionally controlled. LF003 is currently designated as a "restricted use area" in the Base General Plan. This designation provides for recreational use of the parcel (e.g., cross-country skiing) and for construction of unmanned facilities (e.g., a parking lot, storage building, or taxiway), but prohibits the construction of any sort of manned facility (e.g., an office building or a residence). Drilling into the shallow aquifer is also restricted by the Base General Plan to prohibit residential or agricultural use of contaminated groundwater. LUCs will be managed and implemented in accordance with the June 2007 ESD.	Implemented in September 1997. LUCs updated in the 2007 ESD and May 2011 673d Air Base Wing Instruction 32-7003 *Land Use Control Management*. No LUC breaches were identified during the period of review for this FYR.

Key:
ESD – Explanation of Significant Differences
FYR – Five-Year Review
LUC – land use control
OU – Operable Unit

Access to groundwater and soil at LF003 is institutionally controlled. LF003 is currently designated as a "restricted use area" in the Base General Plan. This designation provides for recreational use of the parcel (e.g., cross-country skiing) and for construction of unmanned facilities (e.g., a parking lot, storage building, or taxiway), but prohibits the construction of any sort of manned facility (e.g., an office building or a residence). Drilling into the shallow aquifer is also restricted by the Base General Plan to prohibit residential or agricultural use of contaminated groundwater (USAF, 2007).

Compliance with LUCs applies to all soil-disturbing activities on JBER and is reviewed annually (USAF, 2018c). A GIS-based tracking system is in place to ensure that LUCs are enforced and has been incorporated into the *Base General Plan*. A copy of the LUC inspection form is provided in **Appendix E**.

10.2.5 Systems Operations / Operations and Maintenance

No active systems are currently operated as part of remediation at LF003.

10.3 PROGRESS SINCE THE LAST REVIEW

This is the fifth FYR for JBER-E. The OU6 protectiveness determination and statement from the 2014 FYR are presented in **Table 9-3**. Issues and recommendations for Site LF003 from the 2014 FYR and the current status of those recommendations are presented in **Table 10-2**.

Table 10-2: OU6-LF003 Status of Recommendations from the 2014 FYR

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date
The LF004 CERCLA site boundary appears to extend beyond JBER-E site boundaries. *Note: this issue was specifically noted for LF004 but applied to all sites covered by the FYR.*	All CERCLA site boundaries should be reviewed for accuracy and be revised, when applicable, in a memorandum to the site file.	Completed	CERCLA site and LUC boundaries are maintained in a GIS database. At the time of this FYR, there are no noted boundary discrepancies at LF003.	Not applicable
An in-depth description of the historical site events for each OU and DP098 was not included within Table 2-1 of this FYR.	Expand the chronology table in the next FYR to include detailed information concerning the chronology of site events for each OU and DP098.	Considered But Not Implemented	Chronology table not required in the approved template for this FYR.	Not applicable

Key:
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
FYR – Five-Year Review
GIS – geographic information system
JBER-E – Joint Base Elmendorf-Richardson Elmendorf Air Force Base
LUC – land use control
OU – Operable Unit

10.4 FYR PROCESS

10.4.1 Site Interviews

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. Site interviews for JBER-E were conducted as discussed in Section 3.1. There were no specific comments regarding LF003.

10.4.2 Data Review

A summary of data since the 2014 FYR is presented in Section 10.2.3. Data collected at LF003 during the period of this FYR (2014-2018) were reviewed. Data reviewed included: 2014 through 2016 LUC inspection activities (USAF, 2015; 2017b; 2018c). Data is presented on Figure 10-1.

Data collected under the ERP are archived in the USAF ERPIMS database; however, not all data collected over the life of LF003 may have been archived into the system. All historical data available in ERPIMS (12 July 1988 through 27 October 1997) were reviewed to support a technical assessment of chemical-specific toxicity changes since the ROD for OU6 was signed. See Section 10.5.2.

10.4.3 Site Inspection

A site inspection was conducted at LF003 on 2 August 2017. The purpose of the inspection was to assess the protectiveness of the remedy. A site inspection form and photographs are provided in **Appendix E**. No issues were discovered that affect the current or future protectiveness of the remedy at the site.

10.5 TECHNICAL ASSESSMENT

10.5.1 Question A – Is the remedy functioning as intended by the decision documents?

Yes. The review of documents, site data, and the results of the site inspections indicate that the remedy for LF003 is functioning as intended by the ROD. The selected remedy for groundwater included LUCs. As a former landfill, LUCs on land use and the construction of manned facilities continue to be adequate and protective and will remain in place indefinitely.

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

No. Revised cleanup levels have been promulgated and toxicity data has changed since the ROD was signed.

Changes in Standards:

Regulatory cleanup levels (18 AAC 75) have recently been revised. The new cleanup levels are human health based, and account for toxicity changes that have occurred since the ROD was signed.

All available data for LF003 were evaluated against the ADEC standards (ADEC, 2017). Calculations were performed for chemicals with detections within the last 5 years above the new standards to determine exposure risk (**Appendix F**, **Tables F-1** through **F-3**). These calculations, based on recent site concentrations and the residential exposure assumption, did not find any chemicals with an increased exposure risk.

New toxicity data was reviewed and indicates that samples should be collected and analyzed for vanadium in groundwater and thallium in soil to determine if concentrations of these chemicals pose an unacceptable risk at LF003.

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

No other information has been discovered that calls into question the protectiveness of the remedy for LF003.

10.6 ISSUES / RECOMMENDATIONS

There were no issues identified during the FYR that affect the protectiveness of the remedy for LF003. The remedy is functioning as intended.

Issues not affecting protectiveness:

Issue No.	OU-Site	Finding/ Recommendation
1	OU6-LF003	Due to changes in toxicity data and regulatory cleanup standards, site historic data for some chemicals may exceed EPA human health guidance for risk analysis some non COCs: (in groundwater) vanadium and (in soil) thallium. Conduct a sampling event to identify current concentrations in groundwater and soil for these chemicals.

11.0 OPERABLE UNIT 6 (LF004)

OU6 consists of sites LF002, LF003, LF004, SD015, SD073, SS019, and WP014. Sites LF002, LF003, LF004, SD015, and WP014 remain open in this OU.

11.1 SITE BACKGROUND

LF004 is a landfill (also known as the Knik Bluff Landfill) located east of Knik Arm on the west side of JBER-E, west of the east-west runway (**Figure I-2**). LF004 extends approximately 3,000 feet along the Knik Arm bluff and is approximately 600 feet wide. Between 1945 and 1957, the landfill was used as a surface dump for old cars, construction rubble, 55-gallon drums, and general refuse. Much of the waste was burned in place. The surface of the landfill is covered with soil and vegetation; however, tidal action along the base of the bluff has eroded the bluff face and exposed portions of the landfill. As a result, fill and waste material has sloughed onto the beach. Expansion work at the Port of Anchorage conducted between 2006 and 2009 filled most of the beach adjacent to LF004, eliminating tidal influence and erosion along the base of the bluff for most of the length of LF004. The rate of erosion and exposure of the landfill has been significantly reduced.

The OU6 ROD divided LF004 into North/Beach and South sections (USAF, 1997a). An ESD (USAF, 2007) gives the boundary between LF004 North/Beach and LF004 South as an east-west line through Seep LF04SP-04 (**Figure 11-1**). A Memorandum to the Site File (USAF, 2008) removed reference to the beach area of LF004 North in acknowledgment of the Port of Anchorage expansion. A subsurface seepage collection system and surface drainage swale were constructed at the base of the bluff. The OU6 ROD refers to groundwater in the LF004 South area as bluff groundwater and seep groundwater.

Chlorinated VOCs in the groundwater at LF004 are attributed to past waste management practices. Fuel-related contaminants in the groundwater are attributed to leaking Petroleum, Oil, and Lubricant (POL) facilities – such as PL081 (an approximately 6,000-foot long fuel pipeline corridor located in the southwestern portion of the base, adjacent to Knik Arm) and WP014. Site PL081 (not formally identified as a site until after the OU6 ROD was signed) is a former 10-inch inactive pipeline that extended from the Port of Anchorage to the east end of the east/west runway that was damaged during the 1964 earthquake and abandoned in place. The PL081 Decision Document states that groundwater contamination attributable to PL081 will be managed by the OU6 ROD. Site WP014 is a former fuel tank sludge disposal pit and fuel filter weathering location, which is located east of LF004 South. The general direction of groundwater flow in the vicinity of LF004 is southwesterly. Three aquifers are located in this area, complicating the site assessment and source history (USAF, 2018c).

LF004 South consists of two separate benzene plumes that are monitored by monitoring wells and seeps (**Figure 11-1**). Additionally, the WP014 plume extends across LF004 South and a mixing zone for LF004 South COCs occurs before the WP014 plume discharges at seeps LF04SP-03 and -04. Seeps LF04SP-03 and -04 are currently monitored for both LF004 South COCs and the WP014 plume COCs.

11.2 RESPONSE ACTION SUMMARY

11.2.1 Basis for Taking Action

CERCLA hazardous substances released at JBER-E resulted in soil, sediment, surface water, and groundwater contamination in various locations. The initial risk assessment at OU6 determined that the human and/or ecological risks exceeded the EPA's average or reasonable maximum exposure risk management criteria, and that remedial action must be taken.

The OU6 ROD identified benzene, ethylbenzene, toluene, 1,2-DCA, and methylene chloride as groundwater COCs for LF004 (USAF, 1997a) and is the basis all LF004 groundwater COC cleanup levels. Uncovered landfill waste was also identified as requiring a response action as part of the remedy for LF004. The OU6 ROD included long-term monitoring in the selected remedy for groundwater.

Risk Summary

The OU6 ROD included the results of a baseline HHRA, conducted to estimate the risk posed to human health by source areas within OU6. Since LF004 is not currently used residentially, a current residential risk scenario was not evaluated, and only current visitor and trench worker scenarios were applied. Even though the future land use at LF004 is restricted, the future residential risk scenario was also evaluated.

The calculated risks at LF004 are based on hypothetical exposure to soil and groundwater. Groundwater risk at LF004 was calculated separately for the bluff and the beach, since these two areas were distinct geographically and had differing types and concentrations of contaminants. The shallow groundwater aquifers at LF004 are not currently used and will not be used in the future for supplying potable or non-potable water. For carcinogenic soil risk, the calculated results for the future resident, construction worker, and visitor are listed. Only the future resident scenario was used to calculate carcinogenic groundwater risk.

Groundwater carcinogenic risk at the bluff for the residential scenario exceeded 1.0×10^{-3}. Benzene is the predominant risk driver, with several other constituents, primarily solvents and pesticides, driving the risk. This risk is consistent with that identified for the groundwater at WP014, further supporting the conclusion that the aquifers in these locations are interconnected. Toluene and 1,2-DCA are the primary contributors to noncarcinogenic risk, which exceeded an acceptable HI of 1.0. Beach groundwater risk was moderately elevated at 1.7×10^{-5}. Solvents, pesticides, and benzene were the primary beach risk contributors for bluff groundwater. The noncarcinogenic risk for the beach groundwater was at an acceptable level (USAF, 1997a).

Shallow soil carcinogenic risk at the LF004 beach and bluff were at similar levels, near 1.0×10^{-5}. The visitor scenario risk also slightly exceeded 1.0×10^{-6} for both areas. The noncarcinogenic risk for soils in both areas exceeded 1.0. Risk to trench workers from subsurface soil is at an acceptable level. Bluff soil risk was attributable to metals, pesticide, and dioxin contamination. Bluff soil risk was caused by metals and dioxins only.

The OU6 ROD also included the results of an ERA at LF004. The ERA was performed to determine if the reported concentrations of chemicals or calculated exposures to plants and wildlife

are likely to produce adverse effects. Ecological effects were evaluated quantitatively by calculating EQs. The ERA focused on evaluating potential impacts of the contamination on selected indicator species: moose, masked shrew, meadow vole, black-capped chickadee, merlin, and peregrine falcon. The spotted sandpiper was also identified as an indicator species for evaluating ecological risk on the beach (USAF, 1997a).

Calculated EQs for the bluff soils exceeded 1.0 for small animals due to concentrations of barium, lead, benzo(a)anthracene, and seven pesticides. The highest EQ was associated with barium and was 8,300 for the black-capped chickadee. This is followed by lead, which has an EQ of 4,600, also for the black-capped chickadee. EQs on the beach soils also exceeded 1 .0 due to copper, lead and zinc concentrations for small animals, as well as numerous pesticides and SVOCs. The highest EQs are associated with lead for the black-capped chickadee, masked shrew, and spotted sandpiper (24,000, 7,400, and 3,800, respectively) and with 4,4'-dichlorodiphenylcloroethylene (DDE) (3,800), also for the spotted sandpiper. EQs were calculated (USAF, 1997a), based on surface soil and seep contaminant concentrations. None of the calculated EQs exceeded 1.0 for the moose, peregrine falcon, or merlin at LF004.

The sandpiper had the most EQ exceedances for constituents in the beach soils, some exceedances being substantial. It should be noted that sandpipers are infrequent users of the beach, and that their period of occupancy is only a maximum of about 5 months. This 5-month occupancy factor was incorporated into the exposure evaluation.

11.2.2 Response Actions

Environmental investigations have been conducted at LF004 since the early 1980s. Prior to the RI conducted in 1994, the site was addressed under Phases I and II of the IRP, and a RCRA Facility Assessment (USAF, 1997a).

Remedial Action Objectives

RAOs provide a general description of what the cleanup will accomplish. RAOs specified for LF004 in the OU6 ROD are as follows:

LF004 South (bluff groundwater):

- Prevent the ingestion, dermal contact, and inhalation of vapors from groundwater having benzene, toluene, ethylbenzene, 1,2-DCA, and methylene chloride in excess of MCLs and/or resulting in a cancer risk greater than 1.0×10^{-6} or a HI greater than 1.0.

LF004 North/Beach (beach soils):

- Mitigate human dermal exposure, to the extent practicable, to landfill waste or debris.
- Mitigate exposure, to the extent practicable, of environmentally sensitive receptors to landfill waste. Relevant exposure pathways for wildlife include incidental ingestion of contaminated soil, ingestion of contaminated vegetation, and ingestion of contaminated animals (e.g., insects and earthworms).

Remedy Components

The OU6 ROD-selected remedy addresses contaminated groundwater and soil within LF004 by using a combination of free-product recovery, debris removal, MNA, and LUCs to prevent exposure to contaminated media. ROD cleanup levels for LF004 COCs are presented in **Table 11-1**.

Table 11-1: OU6-LF004 Contaminants of Concern and ROD Cleanup Levels

Contaminant of Concern	ROD Cleanup Level	Basis for Cleanup Level
Groundwater (µg/L)		
1,2-Dichloroethane	5	MCL[1]
Benzene	5	MCL[1]
Ethylbenzene	700	MCL[1]
Methylene chloride	5	MCL[1]
Toluene	1,000	MCL[1]
Shallow Soils		
Exposed landfill debris	Not applicable	18 AAC 60.390

Key:
1 – MCLs correspond to the values listed in 40 CFR 141.61 and 18 AAC 80.070.
µg/L – micrograms per liter
AAC – Alaska Administrative Code
CFR – Code of Federal Regulations
MCL – maximum contaminant level
OU – Operable Unit
ROD – Record of Decision

The specific components of the selected remedy, subsequent revisions (ESD [USAF, 2007], and Memoranda to the Site File [USAF, 2008; 2016a]) are discussed below.

Groundwater (North):

- No further action is required for the groundwater at LF004 North.

Groundwater (South):

- Access to groundwater at LF004 South will be institutionally controlled. LF004 is currently designated as a "restricted use area" in the Base General Plan. This designation provides for recreational use of the parcel (e.g., cross-country skiing) and for construction of unmanned facilities (e.g., a parking lot, storage building, or taxiway), but prohibits the construction of any sort of manned facility (e.g., an office building or a residence). Drilling into the shallow aquifer is also restricted by the Base General Plan to prohibit residential or agricultural use of contaminated groundwater. (LUCs will be managed and implemented in accordance with the *OU6 ESD* [USAF, 2007], Section 4.3.)
- Groundwater will be monitored and evaluated as indicated by the Decision Guide in the *OU6 Memorandum to the Site File,* Appendix A (USAF, 2016a), to determine contaminant migration and to track the progress of contaminant degradation and dispersion, as well as

to provide an early indication of unforeseen environmental or human health risk. FYRs will also assess the protectiveness of the remedial action, including an evaluation of any changed site conditions, as long as contamination remains above cleanup levels.

- Recoverable quantities of free product found on top of the water table at LF004 will be regularly removed during groundwater monitoring events.
- Groundwater monitoring will be discontinued if contaminant levels are below cleanup levels during two consecutive monitoring events, in which case, no further action for groundwater will be required.
- During the final round of monitoring, samples will be collected and analyzed for all constituents that exceeded MCLs during the 1994 investigation, including VOCs, SVOCs, and metals. These results will be evaluated before a final determination is made that groundwater meets all cleanup requirements. (Table 3.1 of the *OU6 ESD* provides a list of specific constituents to be sampled and analyzed.).
- All groundwater is expected to be cleaned up within 14 years.

Soil (North):

- Access to soil at LF004 North will be institutionally controlled. LF004 is currently designated as a "restricted use area" in the Base General Plan. This designation provides for recreational use of the parcel (e.g., cross-country skiing) and for construction of unmanned facilities (e.g., a parking lot, storage building, or taxiway), but prohibits the construction of any sort of manned facility (e.g., an office building or a residence). LUCs will be managed and implemented in accordance with the OU6 ESD, Section 4.3.
- No further action is required for soil contamination at LF004 North; however, landfill debris on the Port of Anchorage fill that is at the base of LF004 will be removed once every 3 years as the specific remedy for this area.
- The removal of debris will include all LF004 landfill material which has fallen onto the Port of Anchorage fill that is at the base of LF004 that can be reasonably collected for disposal, as well as debris on the bluff slope or other low-lying areas that can be accessed and removed without hazard.
- Hazardous materials encountered during each removal event (once every 3 years) will be handled according to appropriate regulations.
- Removal of fallen debris from LF004 is expected to continue once every 3 years for 30 years, or as long as the landfill remains, subject to erosional action by tides. FYRs will assess the protectiveness of the remedial action, including an evaluation of any changed site conditions. In the event of a significant weather or seismic event, inspection and/or collection activities may occur more frequently than the 3-year schedule.
- No further action will be required as a means of closing the LF004 landfill.

Soil (South):

- No further action is required for the soil at LF004 South.

The current status of remedy components is presented in **Table 11-2**.

Table 11-2: OU6-LF004 Remedy Status

Remedy Component	Status
Groundwater – LF004 North	
NFA is required for the groundwater at LF004 North.	NFA.
Access to groundwater at LF004 North will be prevented through the implementation of LUCs. LF004 is currently designated as a "restricted use area" in the Base General Plan. This designation provides for recreational use of the parcel (e.g., cross-country skiing) and for construction of unmanned facilities (e.g., a parking lot, storage building, or taxiway), but prohibits the construction of any sort of manned facility (e.g., an office building or a residence). Drilling into the shallow aquifer is also restricted by the Base General Plan to prohibit residential or agricultural use of contaminated groundwater. LUCs will be managed and implemented in accordance with the June 2007 ESD.	Implemented in September 1997. LUCs updated in the 2007 ESD and May 2011 673d Air Base Wing Instruction 32-7003 *Land Use Control Management*. No LUC breaches were identified during the period of review for this FYR.
Groundwater – LF004 South	
Groundwater will be monitored and evaluated in accordance with the Basewide Monitoring Program Well Sampling Frequency Decision Guide to determine contaminant migration and to track the progress of contaminant degradation and dispersion, as well as to provide an early indication of unforeseen environmental or human health risk. FYRs will also assess the protectiveness of the remedial action, including an evaluation of any changed site conditions, as long as contamination remains above cleanup levels.	Monitoring is ongoing to evaluate natural attenuation. A monitoring frequency decision guide was adopted in 2003. FYRs were conducted in 1998, 2003, 2008, 2014, and 2018.
Recoverable quantities of free product found on top of the water table at LF004 South will be regularly removed during groundwater monitoring events.	No recoverable quantities of free product have been detected since 2005.
Groundwater monitoring will be discontinued if contaminant levels are below cleanup levels during two consecutive monitoring events, in which case, NFA for groundwater will be required.	Groundwater monitoring is ongoing as require by the OU6 ROD.
During the final round of monitoring, samples will be collected and analyzed for all constituents that exceeded MCLs during the 1994 investigation including VOCs, SVOCs, and metals. These results will be evaluated before a final determination is made that groundwater meets all cleanup requirements. (Table 3.1 of the 2007 ESD provides a list of specific constituents to be sampled and analyzed).	Final sampling not yet conducted, as annual monitoring results continue to exhibit contaminant concentrations above ROD cleanup levels.
All groundwater is expected to be cleaned up within 14 years (2011).	COC concentrations remain above ROD cleanup levels, and regular monitoring is ongoing. Remedial Process Optimization was recommended in the 2014 FYR.

Table 11-2 (Cont.) OU6-LF004 Remedy Status

Remedy Component	Status
Soil – LF004 North	
Access to soil at LF004 North will be institutionally controlled. LF004 is currently designated as a "restricted use area" in the Base General Plan. This designation provides for recreational use of the parcel (e.g., cross-country skiing) and for construction of unmanned facilities (e.g., a parking lot, storage building, or taxiway), but prohibits the construction of any sort of manned facility (e.g., an office building or a residence). LUCs will be managed and implemented in accordance with the June 2007 ESD.	Implemented in September 1997. LUCs updated in the 2007 ESD and May 2011 673d Air Base Wing Instruction 32-7003 *Land Use Control Management*. Reference to "beach" in the ROD was removed by the 2008 Memorandum to the Site File when the Port of Anchorage filled in the former beach below LF004 North with soil and gravel as part of its facility expansion in 2007. No LUC breaches were identified during the period of review for this FYR.
NFA is required for soil contamination at LF004 North; however, landfill debris on the Port of Anchorage fill that is at the base of LF004 will be removed once every 3 years as the specific remedy for this area.	Debris removal was conducted annually from 1997 through 2016. The 2016 *Memorandum to the Site File* (USAF, 2016a) changed the debris removal frequency to once every 3 years. The next debris survey will be conducted in 2019.
The removal of debris will include all LF004 landfill material which has fallen onto the Port of Anchorage fill that is at the base of LF004 that can be reasonably collected for disposal, as well as debris on the bluff sloe or other low-lying areas that can be accessed and removed without hazard.	Debris removal has been conducted annually in the specified areas.
Hazardous materials encountered during each removal event (once every 3 years) will be handled according to appropriate regulations.	Any hazardous materials (e.g., asbestos -containing material and unexploded ordnance) have been disposed of in accordance with appropriate regulations.
Removal of fallen debris from LF004 is expected to continue once every 3 years for 30 years, or as long as the landfill remains subject to erosional action by tides. FYRs will assess the protectiveness of the remedial action, including an evaluation of any changed site conditions. In the event of a significant weather or seismic event, inspection and/or collection activities may occur more frequently than the 3-year schedule.	The Port of Anchorage expansion has reduced the magnitude of erosion caused by tidal action, but unvegetated and undercut areas are still subject to erosion and sloughing. FYRs were conducted in 1998, 2003, 2008, 2014, and 2018.
NFA will be required as a means of closing the LF004 landfill.	NFA has not yet been achieved.
Soil – LF004 South	
NFA is required for the soil at LF004 South.	NFA.

Table 11-2 (Cont.) OU6-LF004 Remedy Status

Key:
COC – contaminant of concern
ESD – Explanation of Significant Differences
FYR – Five-Year Review
LUC – land use control
NFA – No Further Action
ROD – Record of Decision
SVOC – semi-volatile organic compound
VOC – volatile organic compound

11.2.3 Status of Implementation

Monitoring at LF004 is conducted in accordance with the Sampling Frequency Decision Guide in the *OU6 Memorandum to the Site File* (USAF, 2003d). Current sampling requirements include sampling for COCs at Monitoring Wells OU6MW-61 (every 5 years), OU6MW-63 (every 5 years), and OU6MW-67 (annually). The next sampling events for Monitoring Wells OU6MW-61 and OU6MW-63 will be in 2020. Seep sampling is required for COCs at Seeps LF04SP-02 (quarterly) and LF04SP-02DG (annually). LUCs are in place to prevent access and exposure to contaminated groundwater and soil at the site.

In 2014, Seeps LF04SP-02 and LF04SP-02DG and Monitoring Well OU6MW-67 were sampled and analyzed for VOCs (**Figure 11-1**). Benzene exceeded the ROD cleanup level in LF04SP-02 (17.0 µg/L) and OU6MW-67 (8.22 µg/L). Seep LF04SP-02 was also analyzed for PAHs to calculate TAH and TAqH levels. The TAH and TAqH levels exceeded the 18 AAC 70 water quality standards at Seep LF04SP-02. Analytical results for LF04SP-02DG were below cleanup levels (USAF, 2015).

In 2013, Monitoring Well OU6MW-67 exhibited a benzene concentration of 5.2 µg/L after being below the cleanup level since 1999. Results from 2014 again showed an increase in benzene, at 8.22 µg/L (USAF, 2015).

In 2015, Seep LF04SP-02 and Monitoring Wells OU6MW-61 and OU6MW-67 were sampled for VOCs and MNA parameters. Samples from Seep LF04SP-02 were also analyzed for PAHs. Following recommendations from the fourth FYR, the upgradient Monitoring Well OU6MW-61 was sampled in 2015. Seep LF04SP-02DG, located at the base of the LF004 bluff and downgradient of Seep LF04SP-02, was not sampled in 2015 due to an oversight. Benzene exceeded the cleanup level (5 µg/L) for each of the quarterly sampling events at LF04SP-02 (5.9, 7.1, and 8.81 µg/L). In addition, benzene exceeded the cleanup level at Monitoring Wells OU6MW-61 (346 µg/L) and OU6MW-67 (5.7 µg/L). The TAH and TAqH levels exceeded the 18 AAC 70 water quality standards (10 and 15 µg/L, respectively) at Seep LF04SP-02 for each of the quarterly sampling events.

In 2016, Seeps LF04SP-02 and LF04SP-02DG and Monitoring Wells OU6MW-63 and OU6MW-67 were sampled for VOCs. Samples from Seeps LF04SP-02 and LF04SP-02DG were also analyzed for PAHs. Monitoring Well OU6MW-63 was also sampled for DRO and GRO, as per the fourth FYR. Due to an exceedance in surface water quality and benzene, Seep LF04SP-02 was switched to quarterly sampling in 2015 (USAF, 2018c).

All samples were analyzed for VOCs, and each of the 2016 quarterly samples collected from LF04SP-02 had concentrations of benzene (28.9, 18.3 and 15.2 µg/L, respectively) that exceeded the cleanup level (5 µg/L), except for the fourth quarter sample (**Figure 11-1**). Concentrations of all other analytes were either non-detect or below the ROD cleanup level. The fourth quarter sample results for LF04SP-02 are significantly lower than the other three quarters sample results and are not consistent with previous sample results from this location. The TAH and TAqH levels exceeded the 18 AAC 70 Alaska Water Quality Standards (10 and 15 µg/L, respectively) at Seep LF04SP-02 for each of the quarterly sampling events, except for the fourth quarter. Only benzene exceeded the cleanup level at OU6MW-67 (5.73 µg/L). Concentrations of all ROD target analytes for Monitoring Well OU6MW-63 were either non-detect or below the ROD cleanup levels. However, elevated concentrations of DRO and GRO were detected in the sample. Additionally, after the missed sample from LF04SP-02DG in 2015, results in 2016 were all non-detect or below ROD cleanup levels (USAF, 2018c).

Mann-Kendall trend tests indicated statistically significant increasing trends for benzene, ethylbenzene, and toluene in Monitoring Well OU6MW-67. Statistically significant decreasing trends were indicated for TAH and TAqH in LF04SP-02. The Mann-Kendall trend test for benzene in Seep LF04SP-02 shows no statistically significant trend (USAF, 2018c).

Benzene concentrations at Seep LF04SP-02 and Monitoring Well OU6MW-67 continue to exceed the ROD cleanup level (5 µg/L). Due to elevated benzene, ethylbenzene, and total xylenes concentrations, the TAH and TAqH levels exceeded the 18 AAC 70 Alaska Water Quality Standards at LF04SP-02. According to the fourth FYR, analyzing for DRO and GRO in an upgradient monitoring well from Seep LF04SP-02 would help predict when the seep would meet Alaska Water Quality Standards. Monitoring Well OU6MW-63 exhibited elevated concentrations of DRO and GRO, but these constituents are not used in calculating TAH and TAqH. Therefore, concentrations of DRO and GRO do not provide good information regarding the time frame for meeting Alaska Water Quality Standards (USAF, 2018c).

Erosion surveys and debris removal conducted since the previous FYR resulted in the removal of 220 pounds of material in 2014, less than 100 pounds in 2015, and 460 pounds in 2016. Materials consisted of: metal scrap, glass jars and bottles, burnt books and papers, vehicle-related debris, construction-related debris, concrete pieces, wood, particle board, an inner tube, and metal construction track matting (USAF, 2015a; 2017b;2018c). Since the Port of Anchorage expansion in 2007/2008, the quantity of debris recovered has steeply declined to levels below 0.5 tons per year, and there does not appear to be any significant erosion occurring (USAF, 2018c). The next debris survey will be conducted in 2019.

11.2.4 LUC Summary

LUCs were implemented in September 1997 to restrict access to contaminated media throughout OU6 until cleanup levels are achieved. LUCs were updated in 2010, as well as the 673d Air Base Wing Instruction 32-7003 *Land Use Control Management* and are managed and implemented in accordance with the *OU6 ESD* (USAF, 2007).

LUCs in effect at LF004 include its designation as a "restricted use area" in the Base General Plan. This designation provides for recreational use of the parcel (e.g., cross-country skiing) and for

construction of unmanned facilities (e.g., a parking lot, storage building, or taxiway), but prohibits the construction of any sort of manned facility (e.g., an office building or a residence). LUCs also include ICs on soil at LF004 North and on groundwater at LF004 South. Drilling into the shallow aquifer is also restricted by the Base General Plan to prohibit residential or agricultural use of contaminated groundwater (USAF, 2007).

In addition to these general LUCs, additional controls limiting access to soil and debris at LF004 include the following:

- Fencing at the south end of LF004 limits access to the site via the recreational trail that extends along the top of the Knik Arm Bluff. Additionally, access roads that extend from JBER-E to the Port of Anchorage are gated and locked. Signage located at the LF004 gate states that hazards exist, and unauthorized access is not allowed. Additional control limits require that authorized visitors sign in/out when accessing the area through the gate at the Knik Bluff Trail.
- Access control practices include annual inspection and maintenance of fencing and signs, patrols of the LF004 bluff area by JBER-E Security Police, and coordination with Port of Anchorage security to monitor and minimize access through the Port of Anchorage.

Compliance with LUCs applies to all soil-disturbing activities on JBER and is reviewed annually (USAF, 2018c). A GIS-based tracking system is in place to ensure that LUCs are enforced and has been incorporated into the *Base General Plan*. A copy of the LUC inspection form is provided in **Appendix E**.

11.2.5 Systems Operations / Operations and Maintenance

No active systems are currently operated as part of remediation at LF004.

11.3 PROGRESS SINCE THE LAST REVIEW

This is the fifth FYR for JBER-E. The OU6 protectiveness determination and statement from the 2014 FYR are presented in **Table 9-3**. Issues and recommendations from the 2014 FYR and the current status of those recommendations are presented in **Table 11-3**.

Table 11-3: OU6-LF004 Status of Recommendations from the 2014 FYR

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date
Review of historical data indicate no decreasing trend and an increasing trend for some COCs in the groundwater at LF004 South, WP014 (OU6MW-46), and SD015. It is not possible to predict a reliable cleanup date for these OU6 sites.	Perform remedial process optimization for LF004 South, WP014, and SD015 since it does not appear that there will be sufficient progress in the timeframe established in the ROD.	Ongoing	Remedial process optimization has not yet been performed.	Not complete
The potential exists for concentrations of 1,4-dioxane to be present in conjunction with TCE contamination at the site.	Based on USAF guidance (*Interim Air Force Guidance on Sampling and Response Actions for 1,4-Dioxane at Operational and BRAC Installations, 15 Aug 2013*), recommend a sampling event be conducted to identify if concentrations of 1,4-dioxane exist. Determine whether there is an unacceptable risk at the site.	Considered But Not Implemented	A 1,4-dioxane investigation was completed at JBER in 2017; however, no samples were collected at LF004. The LF004 South Plumes are monitored at one monitoring well (OU6MW-61 – installed in a perched aquifer) and one seep (LF04SP-02) as the groundwater plume has migrated past Monitoring Well OU6MW-63 and daylights at the seep. Monitoring Well OU6MW-63 has been below cleanup levels for COCs (benzene, ethylbenzene, toluene and 1,2-DCA) since 2011. Groundwater samples collected at OU6MW-61 are analyzed for benzene, ethylbenzene, toluene and 1,2-DCA (1,2-DCA has been ND since 2011). Seep samples are analyzed for benzene, ethylbenzene, toluene, TAH, TAqH, and 1,2-DCA at LF04SP-02 (1,2-DCA has been ND since 2014). Since 1,4-dioxane is typically associated with 1,1,1-TCA and the only other chlorinated solvent formerly in the area (1,2-DCA) is ND, it was determined that 1,4-dioxane did not need to be evaluated for these plumes (2016 Remedial Action-Operations and Monitoring for Selected CERCLA Sites Annual Report).	Not applicable

Table 11-3 (Cont.) OU6-LF004 Status of Recommendations from the 2014 FYR

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date
Continue with the plan to sample LF004 seeps for TAH and TAqH to assess whether these seeps are meeting surface water quality standards. If the seeps do not meet water quality standards, fuel-related compounds DRO and GRO in upgradient wells need to be analyzed to predict when and if the LF004 seeps will meet surface water quality standards.	Continue with the plan to sample LF004 seeps for TAH and TAqH to assess whether these seeps are meeting surface water quality standards. If the seeps do not meet water quality standards, fuel-related compounds DRO and GRO in upgradient wells need to be analyzed to predict when and if the LF004 seeps will meet surface water quality standards.	Ongoing	Benzene concentrations at Seep LF04SP-02 and Monitoring Well OU6MW-67 continue to exceed the ROD cleanup level (5 µg/L). Due to elevated benzene, ethylbenzene, and total xylenes concentrations, the TAH and TAqH levels exceeded the 18 AAC 70 AWQS at LF04SP-02. According to the fourth FYR, analyzing for DRO and GRO in an upgradient monitoring well from Seep LF04SP-02 would help predict when the seep would meet AWQS. Monitoring Well OU6MW-63 exhibited elevated concentrations of DRO and GRO, but these constituents are not used in calculating TAH and TAqH. Therefore, DRO and GRO concentrations do not provide good information regarding the time frame for meeting AWQS (USAF, 2018c).	Not complete
The LF004 CERCLA site boundary appears to extend beyond JBER-E site boundaries. *Note: this issue was specifically noted for LF004 but applied to all sites covered by the FYR.*	All CERCLA site boundaries should be reviewed for accuracy and be revised, when applicable, in a memorandum to the site file.	Completed	CERCLA site and LUC boundaries are maintained in a GIS database. At the time of this FYR, the LF004 CERCLA site boundary appears to still extend beyond JBER-E site boundary; however, the LF004 LUC boundary matches the installation boundary. The CERCLA site boundary in current documentation appears to match the site defined in the original OU6 ROD and does not appear to be incorrect. There are no other noted boundary discrepancies.	Not applicable
An in-depth description of the historical site events for each OU and DP098 was not included within Table 2-1 of this FYR.	Expand the chronology table in the next FYR to include detailed information concerning the chronology of site events for each OU and DP098.	Considered But Not Implemented	Chronology table not required in approved template for this FYR.	Not applicable

Table 11-3 (Cont.) OU6-LF004 Status of Recommendations from the 2014 FYR

Key:
µg/L – micrograms per liter
AAC – Alaska Administrative Code
AWQS – Alaska Water Quality Standards
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
COC – contaminant of concern
DCA - dichloroethane
DRO – diesel-range organics
FYR – Five-Year Review
GIS – geographic information system
GRO – gasoline range organics
JBER – Joint Base Elmendorf-Richardson
JBER-E – JBER-Elmendorf
LUC – land use control
ND – non-detect
OU – Operable Unit
ROD – Record of Decision
TAH – Total Aromatic Hydrocarbon
TAqH – Total Aqueous Hydrocarbon
TCA - trichloroethane
TCE – trichloroethylene
USAF – United States Air Force

11.4 FYR PROCESS

11.4.1 Site Interviews

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. Site interviews for JBER-E were conducted as discussed in Section 3.1. The following comments were received, specifically relating to LF004:

- LF004 landfill debris removal has been reduced from annual to every 3 years due to stabilization of the eroding bluff (*Sandra Halstead, EPA*).
- Source areas at LF004 have PFOS/PFOA contamination in groundwater at the southern and southwestern Base boundaries that may be migrating off Base in groundwater and surface water (*Louis Howard, ADEC*).

Formal interview records are provided in **Appendix C**.

11.4.2 Data Review

A summary of data since the 2014 FYR is presented in Section 11.2.3. Data collected at LF004 during the period of this FYR (2014-2018) were reviewed. Data reviewed included: 2014 through 2016 monitoring activities (USAF, 2015; 2017b; 2018c), and the Memorandum to the Site File (USAF, 2016a). Data is presented on **Figure 11-1**.

Data collected under the ERP are archived in the USAF ERPIMS database; however, not all data collected over the life of LF004 may have been archived into the system. All historical data available in ERPIMS (21 July 1993 through 20 June 2017) were reviewed to support a technical assessment of chemical-specific toxicity changes since the ROD was signed. See Section 11.5.2.

11.4.3 Site Inspection

A site inspection was conducted at LF004 on 1 August 2017. The purpose of the inspection was to assess the protectiveness of the remedy. The site was in generally good condition, with access controls preventing exposure to contaminated media, although erosion was evident on the steep western boundary of the site. A site inspection form and photographs are provided in **Appendix E**.

11.5 TECHNICAL ASSESSMENT

11.5.1 Question A – Is the remedy functioning as intended by the decision documents?

Yes. The review of documents, site data, and the results of the site inspections indicate that the remedy for LF004, which included free-product recovery, MNA, debris removal, and LUCs, is functioning as intended by the ROD. As a former landfill, LUCs on land use and the construction of manned facilities continue to be adequate and protective and will remain in place indefinitely. However, the timeframe for attaining natural attenuation of COCs, as anticipated by the ROD (14 years) was not achieved, and it does not appear that there will be sufficient progress toward

achieving cleanup levels within the 30-year ROD timeframe. It is recommended that additional studies be conducted to determine if the remedy, as is, will be able to achieve remediation goals within the estimated time frame. Other studies may include, but are not limited to site characterization, ecological assessment, focused feasibility studies, groundwater modeling, treatability studies, and/or sampling.

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

No. Revised cleanup levels have been promulgated and toxicity data has changed since the ROD was signed.

Changes in Standards:

The ROD remediation goals are the MCLs, which have not changed since the ROD was signed. The chemical-specific ARARs for groundwater listed in the ROD (USAF, 1997a) do not have any changes that affect regulatory-based cleanup levels for groundwater COCs at LF004. However, regulatory cleanup levels (18 AAC 75) have recently been revised. The new cleanup levels are human health based, and account for toxicity changes that have occurred since the ROD was signed. These changes are presented in **Table 11-4**.

Table 11-4: OU6-LF004 Comparison of ROD Final Remediation Goals to 2017 Standards

Chemical	ROD Cleanup Level	ADEC Cleanup Level[1]	Federal MCL	Historic Site Concentration	LTM Site Sample
Groundwater (µg/L)					
1,2-Dichloroethane	5	1.7	5	38.7	ND
Benzene	5	4.6	5	3,140	346
Ethylbenzene	700	15	700	1,800	36.3
Methylene Chloride	5	5	5	290	ND
Toluene	1,000	1,000	1,000	280	36.3
Soil (mg/kg)					
Exposed Landfill Debris	--	--	--	--	--

Key:
1 – ADEC cleanup levels (18 AAC 75.341(c), as amended through 7 November 2017).
-- – not applicable
µg/L – micrograms per liter
AAC – Alaska Administrative Code
ADEC – Alaska Department of Environmental Conservation
LTM – long-term monitoring
MCL - maximum contaminant level
mg/kg – milligrams per kilogram
OU – Operable Unit
ROD – Record of Decision

All available data for LF004 were evaluated against the ADEC standards (ADEC, 2017). Calculations were performed for chemicals with detections within the last 5 years above the new standards to determine exposure risk (**Appendix F**, **Tables F-1** through **F-3**). These calculations, based on maximum site concentrations and the residential exposure assumption, show a changed exposure risk for: (in groundwater) benzene, ethylbenzene, naphthalene; and (in surface water) benzene, ethylbenzene.

New toxicity data was reviewed and indicates that samples should be collected and analyzed for 1,1,2,2-PCA, 4,4-DDD, aldrin, alpha-hexachlorocyclohexane, benzene, cis-1,2-DCE, dieldrin, ethylbenzene, heptachlor epoxide, naphthalene and TCE in soil, and 4,4-DDD, aldrin, heptachlor epoxide and vanadium in groundwater, to determine if concentrations of these chemicals pose an unacceptable risk at LF004.

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

Yes. Sites within OU 6 LF004 were included in a 2016 JBER-wide investigation into the presence or absence of PFOS/PFOA (USAF, 2018).

11.6 ISSUES / RECOMMENDATIONS

Issues identified during this FYR that affect the protectiveness of the remedy are shown below.

<table>
<tr><th colspan="5">Issues and Recommendations Identified in the Five-Year Review:</th></tr>
<tr><td rowspan="3">OU(s):
OU6, Site LF004</td><td colspan="4">Issue Category: Remedy Performance</td></tr>
<tr><td colspan="4">Issue: Due to changes in toxicity data or regulatory cleanup standards, some chemicals current final remediation goals may exceed EPA human health guidance: (in groundwater) benzene, ethylbenzene, naphthalene; and (in surface water) benzene, ethylbenzene.</td></tr>
<tr><td colspan="4">Recommendation: The AF will evaluate any changes in promulgated standards and chemical toxicity characteristics in accordance with OSWER 9355.7-03B, Appendix G (June 2001) to determine if the current remedy will reduce contamination to within the acceptable CERCLA risk ranges for protectiveness. If the evaluation determines that acceptable risk will not be achieved by the current remedy, the decision document will be appropriately revised following the CERCLA process.</td></tr>
<tr><th>Affect Current Protectiveness</th><th>Affect Future Protectiveness</th><th>Party Responsible</th><th>Oversight Party</th><th>Milestone Date</th></tr>
<tr><td>No</td><td>Yes</td><td>Federal Facility</td><td>EPA/State</td><td>12/31/2023</td></tr>
</table>

OU(s): OU6, Site LF004	Issue Category: Remedy Performance			
	Issue: Limited natural attenuation of benzene in groundwater is occurring at the site, and RAOs were not achieved within the projected time frame.			
	Recommendation: Conduct additional studies to optimize an approach to achieve remediation goals. Other studies may include, but are not limited to: site characterization, ecological assessment, focused feasibility studies, groundwater modeling, treatability studies, and/or sampling. Groundwater cleanup timelines should be reestablished.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023

The following issue was identified during this FYR that does not affect the protectiveness of the remedy at LF004:

Issue No.	OU-Site	Finding/ Recommendation
1	OU6-LF004	Due to changes in toxicity data and regulatory cleanup standards, site historic data for some chemicals may exceed EPA human health guidance for risk analysis some non COCs: (in groundwater) 4,4-DDD, aldrin, heptachlor epoxide and vanadium; and (in soil) 1,1,2,2-PCA, 4,4-DDD, aldrin, alpha-hexachlorocyclohexane, benzene, cis-1,2-DCE, dieldrin, ethylbenzene, heptachlor epoxide, naphthalene, thallium, and TCE. Conduct a sampling event to identify current concentrations in groundwater and soil for these chemicals.

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12.0 OPERABLE UNIT 6 (SD015)

OU6 consists of sites LF002, LF003, LF004, SD015, SD073, SS019, and WP014. Sites LF002, LF003, LF004, SD015, and WP014 remain open in this OU.

12.1 SITE BACKGROUND

SD015 is located in a remote area of the Elmendorf End Moraine in the northeastern part of JBER-E (**Figure I-2**), just west of Talley Avenue (**Figure 12-1**). SD015 is a former sludge disposal site where four 4- to 6-inch thick concrete pads, each measuring approximately 30 by 50 feet, were formerly located. The concrete pads were used from the early 1970s until 1983 to weather fuel filters and absorbent pads, and as a disposal site for fuel tank sludge. The primary sources of contamination at this site were various spent petroleum products and solvents removed as sludge from aboveground fuel tanks, contained in filter elements, or released onto the concrete or onto the open ground surface at SD015. Two areas where concrete pads were demolished (Concrete Pads No. 2 and No. 3) are identified as source areas (**Figure 12-1**). This remote and undeveloped area was investigated as part of the OU6 ROD.

A perched groundwater aquifer and a deeper unconfined aquifer are present at the site. The deeper aquifer at SD015 is believed to correlate with the unconfined shallow aquifer underlying the outwash plain in other parts of JBER. Dense, homogenous silt clay appears to act as an aquitard at 40 feet bgs. The perched aquifer is approximately 10 to 20 feet thick and occurs at depths ranging between approximately 35 to 45 feet bgs (USAF, 2018c).

12.2 RESPONSE ACTION SUMMARY

12.2.1 Basis for Taking Action

CERCLA hazardous substances released at JBER-E resulted in soil, sediment, surface water, and groundwater contamination in various locations. The initial risk assessment at OU6 determined that the human and/or ecological risks exceeded the EPA's average or reasonable maximum exposure risk management criteria, and that remedial action must be taken.

The OU6 ROD identified 1,1,2,2-PCA, 1,1,2-TCA, 1,2-DCA, benzene, ethylbenzene, toluene, and TCE as groundwater COCs at SD015. TCE and benzene are the only COCs that currently exceed ROD cleanup levels. The OU6 ROD also identified DRO, GRO, and BTEX as COCs in shallow soils (less than 5 feet bgs), and DRO and GRO in deep soils (greater than 5 feet bgs).

Risk Summary

The OU6 ROD included the results of a baseline HHRA, conducted to estimate the risk posed to human health by source areas within OU6. Since SD015 is not currently used residentially, a current residential risk scenario was not evaluated, and only current visitor and trench worker scenarios were applied. Even though the future land use at LF004 is restricted, the future residential risk scenario was also evaluated.

The calculated risks at SD015 are based on hypothetical exposure to soil and groundwater. Groundwater risk at SD015 was calculated separately for the perched aquifer and the deeper aquifer. The shallow groundwater aquifers at SD015 are not currently used and will not be used in the future for supplying potable or non-potable water (USAF, 1997a).

Cancer risk using the residential scenario for the groundwater in the perched aquifer at SD015 exceeds 1.0×10^{-3}. Benzene is the predominant risk driver, with several solvents contributing significantly as well. Noncarcinogenic risk for the perched aquifer is 25.1, with toluene and ethylbenzene as the primary contributors. Carcinogenic risk in the deeper aquifer only slightly exceeds 1.0×10^{-6}, due exclusively to carbon tetrachloride. Noncarcinogenic risk is below 1.0 (USAF, 1997a).

Shallow soil carcinogenic risk at SD015 only slightly exceeded 1.0×10^{-6} for both the residential and visitor scenarios. Only the residential noncarcinogenic risk exceeded 1.0. No significant risk was identified under the trench worker scenario. Soil risk was 100% attributable to metals, which are believed to be at background concentrations (USAF, 1997a).

The OU6 ROD also included the results of an ERA at SD015. The ERA was performed to determine if the reported concentrations of chemicals or calculated exposures to plants and wildlife are likely to produce adverse effects. Ecological effects were evaluated quantitatively by calculating EQs. The ERA focused on evaluating potential impacts of the contamination on selected indicator species: moose, masked shrew, meadow vole, black-capped chickadee, merlin, and peregrine falcon (USAF, 1997a).

Calculated EQs exceeded 1.0 for the black-capped chickadee, shrew, and meadow vole at SD015 due to elevated levels of barium. The highest EQ equals 18,000 and is associated with barium for the black-capped chickadee, followed by 4,700 and 160, also for barium, for the masked shrew and meadow vole, respectively. The 95% upper confidence limit (UCL) for the surface soil barium concentration is influenced by two isolated, high barium results obtained during the OU7 Limited Field Investigation in 1993 (661 and 8,420 mg/kg). Such high barium concentrations were not observed in any of the samples collected during the 1994 RI. Therefore, it appears that the high barium concentrations are associated with a localized anomaly and that barium is not a significant contributor to ecological risk in the area. The EQ for the shrew was also exceeded for selenium concentrations. Three organic constituents, benzo(a)anthracene, bis(2-ethylhexyl)phthalate, and dibenz(a,h)anthracene also caused EQ exceedances for the black-capped chickadee and shrew. The highest organic EQ was 5.1 for benzo(a)anthracene in the black-capped chickadee. EQs were calculated based on surface soil contaminant concentrations. None of the calculated EQs exceeded 1.0 for the moose, peregrine falcon, or merlin at SD015 (USAF, 1997a).

12.2.2 Response Actions

Environmental investigations have been conducted at SD015 since the early 1980s. Prior to the RI conducted in 1994, the site was addressed under Phases I, II, and III of the IRP, and a Limited Field Investigation conducted at OU7. The use of SD015 for the weathering of fuel filters and pads was discontinued in 1983. Weathered fuel filters and two aboveground storage tanks in the vicinity of SD015, which could have also acted as potential contaminant sources, were removed in 1996 (USAF, 1997a).

Remedial Action Objectives

RAOs provide a general description of what the cleanup will accomplish. RAOs specified in the OU6 ROD are as follows:

- Prevent the domestic use (i.e., use resulting in ingestion and dermal contact of water and inhalation of vapors) of water in the perched aquifer having benzene; ethylbenzene; toluene; 1,1,2,2-PCA; 1,1,2-TCA; 1,2-DCA; and TCE in excess of MCLs and/or resulting in a cancer risk greater than 1.0×10^{-6} or a HI greater than 1.0.
- Prevent the possible migration of contaminants from soils having DRO, GRO, and BTEX concentrations exceeding Alaska Cleanup Matrix (ACM) Level D.

Remedy Components

The OU6 ROD-selected remedy addresses contaminated groundwater and soil within SD015 by using a combination of free-product recovery, MNA, and LUCs to prevent exposure to contaminated media. The specific components of the selected remedy and subsequent revisions (ESD [USAF, 2007]; are discussed below.

Groundwater (Perched Aquifer):

- ICs on land and water use, as specified in the Base General Plan, will restrict access to the contaminated groundwater throughout SD015. Installation of wells in the contaminated plume for residential, industrial, or agricultural use will be prohibited by the Base General Plan until cleanup levels have been achieved.
- Groundwater in the perched aquifer at SD15 will be treated by high-vacuum extraction (HVE) and MNA to remove fuel-related contaminants and halogenated volatile organic compounds (HVOCs).
- Recoverable quantities of free product found on top of the water table at SD015 will be removed through the HVE process.
- Treated water will be reinjected into the subsurface beyond the boundary of the contaminated aquifer. Reinjected water will be regularly monitored to ensure it meets cleanup and risk requirements
- Groundwater with contaminant concentrations remaining above cleanup levels will continue to be monitored and evaluated as indicated by the Decision Guide to determine contaminant migration and to track the progress of the HVE treatment, as well as to provide an early indication of unforeseen environmental or human health risk. FYRs will also assess the protectiveness of the remedial action, including an evaluation of any changed site conditions, as long as contamination remains above cleanup levels.
- HVE will be terminated when operations become ineffective. MNA will be used to reduce groundwater contaminant concentrations to below cleanup levels.
- During the final round of groundwater monitoring, samples will be collected and analyzed for all constituents that exceeded MCLs during the 1994 RI, including VOCs and arsenic. These results will be evaluated before a final decision is made that groundwater meets all cleanup requirements.
- Groundwater cleanup standards are expected to be met at all wells at SD015 by 2015.

In 2007, the cleanup goal for 1,1,2,2-PCA was modified in an ESD (USAF, 2007).

Groundwater (Deep Aquifer);

- No further action is required for the deep aquifer groundwater at SD015.

Soils:

- Shallow soils (less than 5 feet deep) with contamination above cleanup levels will be excavated, removed, and thermally treated to eliminate fuel-related contaminants. After treatment, no further action will be required for the shallow soils. Shallow soils will be included in the HVE extraction treatability study, as indicated by the 2003 Memorandum to the Site File (USAF, 2003d).
- Deep soils at SD015 will be actively treated through air stripping associated with the HVE process described for the perched aquifer groundwater.
- Soils with contamination above cleanup levels will be sampled 1 year after HVE system start up and every 3 years thereafter to evaluate contaminant migration and timely reduction of contaminant concentrations by HVE. If cleanup levels are not being achieved, further remedial action will be evaluated. This will include FYRs to assess the protectiveness of the remedial action, including an evaluation of any changed site conditions, as long as contamination remains above cleanup levels.
- HVE will be terminated when operations become ineffective. MNA will be used to reduce groundwater contaminant concentrations to below cleanup levels.
- All soils are expected to be cleaned up within 5 years.

The ROD cleanup levels for SD015 COCs are presented in **Table 12-1**. The current status of remedy components is presented in **Table 12-2**.

Table 12-1: OU6-SD015 Contaminants of Concern and ROD Cleanup Levels

Contaminant of Concern	ROD Cleanup Level	Basis for Cleanup Level[1]
Groundwater (µg/L)		
1,1,2-Trichloroethane	5	MCL
1,1,2,2-Tetrachloroethane	4	18 AAC 75.345[2]
1,2-Dichloroethane	5	MCL
Benzene	5	MCL
Ethylbenzene	700	MCL
Toluene	1,000	MCL
Trichloroethene (TCE)	5	MCL

Table 12-1 (Cont.) OU6-SD015 Contaminants of Concern and ROD Cleanup Levels

Contaminant of Concern	ROD Cleanup Level	Basis for Cleanup Level[1]
Soils (mg/kg)		
Diesel-range organics	2,000	ACM, Level D
Gasoline-range organics	1,000	ACM, Level D
Benzene, toluene, ethylbenzene, and total xylenes (BTEX)	100	ACM, Level D

Key:
1 – MCLs correspond to the values listed in 40 CFR 141.61 for federal MCLs and 18 AAC 80.070 for state standards established in the OU6 ROD (USAF, 1997a).
2 – ROD cleanup level updated in the OU6 Explanation of Significant Differences (USAF, 2007).
µg/L – micrograms per liter
AAC – Alaska Administrative Code
ACM – Alaska Cleanup Matrix Level D, promulgated under 18 AAC 78.315.
CFR – Code of Federal Regulations
MCL – maximum contaminant level
mg/kg – milligrams per kilogram
OU – Operable Unit
ROD – Record of Decision

Table 12-2: OU6-SD015 Remedy Status

Remedy Component	Status
Groundwater (Perched Aquifer)	
LUCs on land use and water use, as specified in the Base General Plan, will restrict access to the contaminated groundwater throughout SD015. Installation of wells in the contaminated plume for residential, industrial, or agricultural use will be prohibited by the Base General Plan until cleanup levels have been achieved. LUCs will be managed and implemented in accordance with the June 2007 ESD.	Implemented in September 1997. LUCs updated in the 2007 ESD and May 2011 673d Air Base Wing Instruction 32-7003 *Land Use Control Management*. No LUC breaches were identified during the period of review for this FYR.
Groundwater in the perched aquifer at SD015 will be treated by HVE and MNA to remove fuel related contaminants and HVOCs.	The HVE system was installed and began operating in 1996 and was permanently shut down in 2007 when it was no longer effectively removing contaminants. The system was decommissioned in 2008. The remedy was modified by 2007 ESD, which selected MNA as the remedy for the remaining groundwater contamination at SD015. MNA at SD015 is ongoing.

Table 12-2 (Cont.) OU6-SD015 Remedy Status

Remedy Component	Status
Groundwater (Perched Aquifer) – Cont.	
Recoverable quantities of free product found on top of the water table at SD015 will be removed through the HVE process.	The HVE system was permanently shut down in 2007 when it was no longer effectively removing contaminants.
Treated water will be reinjected into the subsurface beyond the boundary of the contaminated aquifer. Reinjected water will be regularly monitored to ensure it meets cleanup and risk requirements.	The HVE system was permanently shut down in 2007 when it was no longer effectively removing contaminants.
Groundwater with contaminant concentrations remaining above cleanup levels will continue to be monitored and evaluated as indicated by the Decision Guide to determine contaminant migration and to track the progress of the HVE treatment, as well as to provide an early indication of unforeseen environmental or human health risk. FYRs will also assess the protectiveness of the remedial action, including an evaluation of any changed site conditions, as long as contamination remains above cleanup levels.	Monitoring is ongoing to evaluate MNA. A monitoring frequencies Decision Guide was adopted in 2003. FYRs were conducted in 1998, 2003, 2008, 2014, and 2018.
HVE will be terminated when operations become ineffective. MNA will be used to reduce groundwater contaminant concentrations to below cleanup levels	The HVE system was permanently shut down in May 2007 when it was no longer effectively removing contaminants. MNA at SD015 is ongoing.
During the final round of groundwater monitoring, samples will be collected and analyzed for all constituents that exceeded MCLs during the 1994 Remedial Investigation including VOCs and arsenic. These results will be evaluated before a final decision is made that groundwater meets all cleanup requirements.	Final sampling not yet conducted, as annual monitoring results continue to exhibit contaminant concentrations above ROD cleanup levels.
Groundwater cleanup standards are expected to be met at all wells by 2015.	Groundwater cleanup is ongoing and current trends predict it will be completed in 27 years (2023) (USAF, 2014).
Groundwater (Deep Aquifer)	
No further action is required for the deep aquifer groundwater.	No Further Action.
Soils	
Shallow soils (less than 5 feet deep) with contamination above cleanup levels will be excavated, removed, and thermally treated to eliminate fuel-related contaminants. After treatment, no further action will be required for the shallow soils. Shallow soils will be included in the HVE extraction treatability study as indicated by the 2003 Memorandum to the Site File	Excavation/thermal treatment completed in 1997. Additional contaminated shallow soils were treated with HVE and soil vapor extraction. All shallow soils met ROD cleanup levels as of 2005. Additional shallow contaminated soil was encountered in 2008 and removed in 2009.

Table 12-2 (Cont.) OU6-SD015 Remedy Status

Remedy Component	Status
Soils (Cont.)	
Deep soils at SD015 will be actively treated through air stripping associated with the HVE process described for the perched aquifer groundwater.	All SD015 soils met ROD cleanup levels as of 2005. During additional investigation in 2011, contaminants were found to meet ROD cleanup levels, but exceeded state cleanup levels.
Soils with contamination above cleanup levels will be sampled one year after HVE system start up and every 3 years thereafter to evaluate contaminant migration and timely reduction of contaminant concentrations by HVE. If cleanup levels are not being achieved, further remedial action will be evaluated. This will include FYRs to assess the protectiveness of the remedial action, including an evaluation of any changed site conditions, as long as contamination remains above cleanup levels.	All SD015 soils met cleanup levels as of 2005. FYRs were conducted in 1998, 2003, 2008, 2014, and 2018. Additional shallow contaminated soil was encountered in 2008 and removed in 2009.
HVE will be terminated when operations become ineffective. MNA will be used to reduce groundwater contaminant concentrations to below cleanup levels.	The HVE system was permanently shut down in May 2007 when it was no longer effectively removing contaminants, in accordance with the 2007 ESD. The 2007 ESD selected MNA as the remedy for the remaining groundwater contamination at SD015, which is ongoing.
All soils are expected to be cleaned up within 5 years.	All soils were cleaned up in 9 years (since 2005).

Key:

ESD – Explanation of Significant Differences
FYR – Five-Year Review
HVE – high-vacuum extraction
HVOC – halogenated volatile organic compounds
LUC – land use control
MCL – maximum contaminant level
MNA – monitored natural attenuation
OU – Operable Unit
ROD – Record of Decision
VOC – volatile organic compound

12.2.3 Status of Implementation

In accordance with OU6 ROD, the remedy at SD015 included a soil vapor extraction (SVE) system and an HVE system which were designed, installed, and operated for treatment of perched groundwater at this site. By 2007, the HVE system reached the end of its lifecycle by removing virtually all recoverable contaminants. Soil sampling conducted in August 2005 confirmed that shallow and deep soil meet cleanup levels for all soil COCs at SD015 (USAF, 2014). The 2007 ESD transitioned the remedy for the SD015 perched groundwater plume to MNA (USAF, 2007), and in 2008, the HVE and SVE systems were decommissioned.

During excavation of treatment system piping in 2008, fuel-contaminated soil at SD015 was encountered along the south side of former Concrete Pad No. 2. In 2009, approximately 250 cubic yards of contaminated soil was removed from this area (USAF, 2014). An LSI was conducted in 2011, during which soil contamination from solvents (i.e., TCE) was discovered at depths from 40 to 45 feet bgs. Additionally, analytical results from the 2011 LSI exceeded the established cleanup

goals for benzene and TCE in groundwater at SD015. The extent of contamination within the vadose and smear zone soils was only partially defined during the 2011 LSI. Groundwater contamination is confined to the small, perched aquifer system (USAF, 2018c). Currently, two monitoring wells (OU6MW-17 and OU6MW-90) are located at the site (**Figure 12-1**).

Groundwater monitoring has been ongoing at SD015 since 1994. Groundwater monitoring plans are updated prior to sampling events to ensure that the program remains comprehensive and protective, and monitoring is conducted in accordance with the Sampling Frequency Decision Guide in the OU6 *Memorandum to the Site File* (USAF, 2003d). Current requirements at SD015 include annual groundwater monitoring at Monitoring Well OU6MW-17 for TCE and benzene, and an annual LUC inspection.

Groundwater monitoring results since the Fourth FYR show that TCE and benzene continue to remain above ROD cleanup levels at Monitoring Well OU6MW-17. Mann-Kendall trend tests for benzene have consistently shown no significant trends, while TCE showed a decreasing trend in 2014 (USAF, 2015) and 2015 (USAF, 2017b), but no significant trend in 2016 (USAF, 2018c). Analysis of biogeochemical indicator parameters indicate a mildly aerobic (oxidizing) environment, typical at a POL plume undergoing biodegradation as aerobic bacteria degrade the POL contaminants and consume the available oxygen. The biogeochemical environment at Monitoring Well OU6MW-17 is relatively conducive to aerobic biodegradation of benzene, and it may be occurring at a low rate (USAF, 2017b).

12.2.4 LUC Summary

LUCs were implemented in September 1997 to restrict access to contaminated media throughout OU6 until cleanup levels are achieved. LUCs were updated in 2010, as well as the 673d Air Base Wing Instruction 32-7003 *Land Use Control Management* and are managed and implemented in accordance with the *Operable Unit 6 Explanation of Significant Differences* (USAF, 2007).

LUCs in effect at SD015 include ICs on land and water use, as specified in the Base General Plan, which restrict access to the contaminated groundwater throughout SD015. Installation of wells in the contaminated plume for residential, industrial, or agricultural use will be prohibited by the Base General Plan.

Compliance with LUCs applies to all soil-disturbing activities on JBER and is reviewed annually (USAF, 2018c). A GIS-based tracking system is in place to ensure that LUCs are enforced and has been incorporated into the *Base General Plan*. A copy of the LUC inspection form is provided in **Appendix E**.

12.2.5 Systems Operations / Operations and Maintenance

No active systems are currently operated as part of remediation at SD015.

12.3 PROGRESS SINCE THE LAST REVIEW

This is the fifth FYR for JBER-E. The OU6 protectiveness determination and statement from the 2014 FYR are presented in **Table 9-3**. Issues and recommendations for Site SD015 from the 2014 FYR and the current status of those recommendations are presented in **Table 12-3**.

12.4 FYR PROCESS

12.4.1 Site Interviews

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. Site interviews for JBER-E were conducted as discussed in Section 3.1. There were no specific comments regarding SD015. Formal interview records are provided in **Appendix C**.

12.4.2 Data Review

A summary of data since the 2014 FYR is presented in Section 12.2.3 Data collected at SD015 during the period of this FYR (2014-2018) were reviewed. Data reviewed included 2014 through 2016 monitoring activities (USAF, 2015; 2017b; 2018c). Data is presented on **Figure 12-1**.

Data collected under the ERP are archived in the USAF ERPIMS database; however, not all data collected over the life of SD015 may have been archived into the system. All historical data available in ERPIMS (20 June 1993 through 12 September 2016) were reviewed to support a technical assessment of chemical-specific toxicity changes since the ROD for SD015 was signed. See Section 12.5.2.

12.4.3 Site Inspection

A site inspection was conducted at SD015 on 28 July 2017. The purpose of the inspection was to assess the protectiveness of the remedy. A site inspection form and photographs are provided in **Appendix E**. No issues were discovered that affect the current or future protectiveness of the remedy at the site.

12.5 TECHNICAL ASSESSMENT

12.5.1 Question A – Is the remedy functioning as intended by the decision documents?

Yes. The review of documents, site data, and the results of the site inspections indicate that the remedy for SD015, which included free-product recovery, MNA, and LUCs is functioning as intended by the ROD. Groundwater LUCs continue to be adequate and protective and are preventing exposures to contaminated groundwater. However, the timeframe for attaining natural attenuation of COCs, as anticipated by the ESD (2015) was not achieved. Additional studies should be conducted to optimize the remedial approach to achieve remediation goals. Other studies may include, but are not limited to site characterization, ecological assessment, focused feasibility studies, groundwater modeling, treatability studies, and/or sampling.

Table 12-3: OU6-SD015 Status of Recommendations from the 2014 FYR

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date
Review of historical data indicate no decreasing trend and an increasing trend for some COCs in the groundwater at LF004 South, WP014 (OU6MW-46), and SD015. It is not possible to predict a reliable cleanup date for these OU6 sites.	Perform remedial process optimization for LF004 South, WP014, and SD015 since it does not appear that there will be sufficient progress in the timeframe established in the Record of Decision.	Ongoing	Remedial process optimization has not yet been performed.	Not complete
The potential exists for concentrations of 1,4-dioxane to be present in conjunction with trichloroethylene (TCE) contamination at the site.	Based on USAF guidance (*Interim Air Force Guidance on Sampling and Response Actions for 1,4-Dioxane at Operational and BRAC Installations, 15 Aug 2013*), recommend a sampling event be conducted to identify if concentrations of 1,4-dioxane exist. Determine whether there is an unacceptable risk at the site.	Incomplete	A 1,4-dioxane investigation was completed at Joint Base Elmendorf-Richardson (JBER) in 2017; however, no samples were collected at SD015.	Not complete
No downgradient monitoring well exists at SD015.	Install a downgradient monitoring well at SD015 to properly delineate the site's plume boundaries.	Considered But Not Implemented	Perched aquifer; therefore, all other wells have been abandoned.	Not applicable
The LF004 CERCLA site boundary appears to extend beyond JBER-E site boundaries. *Note: this issue was specifically noted for LF004 but applied to all sites covered by the FYR.*	All CERCLA site boundaries should be reviewed for accuracy and be revised, when applicable, in a memorandum to the site file.	Completed	CERCLA site and LUC boundaries are maintained in a GIS database. At the time of this FYR, there are no noted boundary discrepancies at SD015.	Not applicable
An in-depth description of the historical site events for each OU and DP098 was not included within Table 2-1 of this FYR.	Expand the chronology table in the next FYR to include detailed information concerning the chronology of site events for each OU and DP098.	Considered But Not Implemented	Chronology table not required in approved template for this FYR.	Not applicable

Key:
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
COC – contaminant of concern
FYR – Five-Year Review
GIS – geographic information system
JBER-E – JBER-Elmendorf
LUC – land use control
OU – Operable Unit
USAF – United States Air Force

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

Revised cleanup levels have been promulgated and toxicity data has changed since the ROD was signed.

Changes in Standards

The ROD remediation goals are the MCLs, which have not changed since the ROD was signed. The chemical-specific ARARs for groundwater listed in the ROD (USAF, 1997a) do not have any changes that affect regulatory-based cleanup levels for groundwater COCs at SD015. However, regulatory cleanup levels (18 AAC 75) have recently been revised. The ADEC cleanup levels (ADEC, 2017) are human health based, and account for toxicity changes that have occurred since the ROD was signed. These changes are presented in **Table 12-4**.

Table 12-4: OU6-SD015 Comparison of ROD Final Remediation Goals to 2017 Standards

Chemical	ROD Cleanup Level	2017 ADEC Cleanup Level[1]	Federal MCL[3]	Historic Site Concentration	Recent Site Sample
Groundwater (µg/L)					
1,2-Dichloroethane	5	1.7	5	5.92	--
1,1,2,2-Tetrachloroethane	4	0.76		8.6	--
1,2-Dichloroethane	5	1.7	5	5.92	--
Benzene	5	4.6	5	1,430	92.3
Ethylbenzene	700	15	700	740	--
Toluene	1,000	1,000	1,000	3,640	--
Trichloroethylene (TCE)	5	2.8	5	151	9.34
Shallow Soil (mg/kg)					
Diesel Range Organics	2,000	2,000[2]	--	10,000	--
Gasoline Range Organics	1,000	1,000[2]	--	33,000	--
BTEX	100	--	--	168	--

Key:
1 – ADEC cleanup levels (18 AAC 75.345, Table C as amended through 7 November 2017).
2 – ADEC cleanup levels (18 AAC 75.341(c), Table A1 Part B, as amended through 7 November 2017)

-- – not applicable
µg/L – micrograms per liter
AAC – Alaska Administrative Code
ADEC – Alaska Department of Environmental Conservation
BTEX – benzene, toluene, ethylbenzene, and xylenes
MC – maximum contaminant level
ND – non detect
OU – Operable Unit
ROD – Record of Decision

All available data for SD015 were evaluated against the ADEC standards (ADEC, 2017). Calculations were performed for chemicals with detections above the new standards to determine exposure risk (**Appendix F**, **Tables F-1** through **F-3**). These calculations, based on recent site

concentrations and the residential exposure assumption, show a changed exposure risk for: (in groundwater) benzene and TCE.

A review was also conducted on chemicals with new toxicity data. No other chemicals at SD015 that required further investigation were identified. Although there are cancer risk and noncancer hazard threshold exceedances in groundwater at the site, the LUC restricting groundwater use at SD015 continues to prevent exposures to contaminated groundwater that may pose excessive risk.

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

No other information has been discovered that calls into question the protectiveness of the remedy for SD015.

12.6 ISSUES / RECOMMENDATIONS

Issues identified during this FYR that affect the protectiveness of the remedy are shown below.

<table>
<tr><th colspan="6">Issues and Recommendations Identified in the Five-Year Review:</th></tr>
<tr><td rowspan="3">OU(s):
OU6, Site SD015</td><td colspan="5">Issue Category: Remedy Performance</td></tr>
<tr><td colspan="5">Issue: Limited natural attenuation of benzene and TCE in groundwater is occurring at the site, and the anticipated date (2015) of achieving concentrations below cleanup levels was not achieved.</td></tr>
<tr><td colspan="5">Recommendation: Conduct additional studies to optimize approach to achieve remediation goals. Other studies may include, but are not limited to: site characterization, ecological assessment, focused feasibility studies, groundwater modeling, treatability studies, and/or sampling.</td></tr>
<tr><td>Affect Current Protectiveness</td><td>Affect Future Protectiveness</td><td>Party Responsible</td><td>Oversight Party</td><td colspan="2">Milestone Date</td></tr>
<tr><td>No</td><td>Yes</td><td>Federal Facility</td><td>EPA/State</td><td colspan="2">12/31/2023</td></tr>
<tr><td rowspan="3">OU(s):
OU6, Site SD015</td><td colspan="5">Issue Category: Remedy Performance</td></tr>
<tr><td colspan="5">Issue: Due to changes in toxicity data or regulatory cleanup standards, some chemicals current final remediation goals may exceed EPA human health guidance: (in groundwater) benzene and TCE.</td></tr>
<tr><td colspan="5">Recommendation: The AF will evaluate any changes in promulgated standards and chemical toxicity characteristics in accordance with OSWER 9355.7-03B, Appendix G (June 2001) to determine if the current remedy will reduce contamination to within the acceptable CERCLA risk ranges for protectiveness. If the evaluation determines that acceptable risk will not be achieved by the current remedy, the decision document will be appropriately revised following the CERCLA process.</td></tr>
<tr><td>Affect Current Protectiveness</td><td>Affect Future Protectiveness</td><td>Party Responsible</td><td>Oversight Party</td><td colspan="2">Milestone Date</td></tr>
<tr><td>No</td><td>Yes</td><td>Federal Facility</td><td>EPA/State</td><td colspan="2">12/31/2023</td></tr>
</table>

OU(s): OU6, Site SD015	**Issue Category:** Remedy Performance			
	Issue: The 2014 FYR recommended investigation for the presence of 1,4-dioxane in conjunction with TCE contamination at the site. A 1,4-dioxane investigation was conducted at JBER in 2017; however, no samples were collected at SD015.			
	Recommendation: Assess 1,4-dioxane in groundwater to address the 2014 recommendation.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023

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13.0 OPERABLE UNIT 6 (WP014)

OU6 consists of sites LF002, LF003, LF004, SD015, SD073, SS019, and WP014. Sites LF002, LF003, LF004, SD015, and WP014 remain open in this OU.

13.1 SITE BACKGROUND

WP014 is a 400- by 300-foot area located a few hundred feet east of LF004 South (**Figure I-2**). Petroleum hydrocarbon contamination at this site originated between 1964 and 1968 when the area was used for fuel tank sludge disposal generated from POL tank cleaning operations. Fuel filters and pads were also weathered on the ground surface in a broad area of vegetated soil. Local soil was reportedly used to cover the site after disposal operations ceased. Soil and groundwater contamination may also be associated with the former PL81 Valve Pit 11, which was approximately 100 feet northeast of WP014 and west-southwest of Monitoring Well 14MW-120 (**Figure 13-1**). In 2005, petroleum contaminated vadose-zone soils were excavated from the former location of PL081 Valve Pit 11 (USAF, 2018c).

Two plumes (WP014 and OU6MW-46) are managed within WP014 (**Figure 13-1**). The WP014 plume encompasses groundwater contamination derived from WP014 and PL081. The plume migrates westerly toward LF004 and discharges at two seeps overlooking Knik Arm, a distance of approximately 1,000 feet from the WP014 and PL081 source areas. The PL081 Decision Document states that all groundwater contamination attributable to PL081 will be managed by the OU6 ROD. Therefore, groundwater contamination associated with PL081 is monitored as part of the LF004 South and WP014 groundwater monitoring program.

The second WP014 plume (OU6MW-46 plume) is a smaller plume cross-gradient from the WP014 source area and is monitored with one monitoring well (OU6MW-46) in a perched groundwater aquifer (**Figure 13-1**). In 2011, an attempt was made to install a downgradient monitoring well to define the extent of the OU6MW-46 plume. During drilling activities, the same groundwater unit was not found and there was insufficient groundwater volume to install a monitoring well. It was determined that the OU6MW-46 plume is likely located within a perched aquifer and is not connected to the WP014 plume (USAF, 2018c).

13.2 RESPONSE ACTION SUMMARY

13.2.1 Basis for Taking Action

CERCLA hazardous substances released at JBER-E resulted in soil, sediment, surface water, and groundwater contamination in various locations. The initial risk assessment at OU6 determined that the human and/or ecological risks exceeded the EPA's average or reasonable maximum exposure risk management criteria, and that remedial action must be taken.

The OU6 ROD identified benzene, ethylbenzene, and toluene as groundwater COCs and is the basis for all WP014 cleanup goals. There are no soil COCs at WP014.

Risk Summary

The OU6 ROD included the results of a baseline HHRA, conducted to estimate the risk posed to human health by source areas within OU6. Since WP014 is not currently used residentially, a current residential risk scenario was not evaluated, and only current visitor and trench worker scenarios were applied. Even though the future land use at WP014 is limited as specified in the Base General Plan, the future residential risk scenario was also evaluated.

Groundwater carcinogenic risk at WP014 exceeded 1.0×10^{-3}. Benzene is the predominant risk driver, with four other constituents, including solvents, an SVOC, and toluene, as the other risk contributors. Toluene is the primary contributor to the noncarcinogenic risk, which exceeded an acceptable HI of 1.0 in the residential scenario. Soil carcinogenic risk at WP014 exceeded 1.0×10^{-6} for the residential scenario and is marginal for the visitor scenario. The noncarcinogenic risk for soils also exceeded 1.0. Risk to trench workers from deep soil is at an acceptable level. All soil risk was 100% attributable to metals contamination. The metals at WP014 are believed to be at background concentrations (USAF, 1997a).

The OU6 ROD also included the results of an ERA at WP014. The ERA was performed to determine if the reported concentrations of chemicals or calculated exposures to plants and wildlife are likely to produce adverse effects. Ecological effects were evaluated quantitatively by calculating EQs. The ERA focused on evaluating potential impacts of the contamination on selected indicator species: moose, masked shrew, meadow vole, black-capped chickadee, merlin, and peregrine falcon (USAF, 1997a).

The EQ of 1.0 was exceeded for the black-capped chickadee, meadow vole, and shrew in soil at WP014 due to selenium concentrations; however, it is likely that the data used to calculate the EQs for selenium are not representative of actual concentrations and may be biased high. Therefore, it appears that there is low potential for ecological risk due to selenium at this source area. None of the calculated EQs exceeded 1.0 for the moose, peregrine falcon, or merlin at WP014. No significant impacts to plants or animals warranting action were determined to be present based on the results of the ERA (USAF, 1997a).

13.2.2 Response Actions

Environmental investigations have been conducted at WP014 since the early 1980s. Prior to the RI conducted in 1994, the site was addressed under Phases I, II, and III of the IRP, and a RCRA Facility Assessment. The active POL line at WP014 has been tested and determined to be sound. Both inactive POL lines were reportedly drained prior to being abandoned in sections. The weathering and disposal of POL sludge has been discontinued at WP014 since 1968 (USAF, 1997a).

Remedial Action Objectives

RAOs provide a general description of what the cleanup will accomplish. RAOs specified in the OU6 ROD for groundwater at WP014 are as follows:

- Prevent the ingestion, dermal contact, and inhalation of vapors from water from the groundwater having benzene, ethylbenzene, and toluene in excess of MCLs and/or resulting in a cancer risk greater than 1.0×10^{-6} or a HI greater than 1.0.

Remedy Components

The OU6 ROD-selected remedy addresses contaminated groundwater within WP014 by using a combination of free-product recovery, MNA, and LUCs to prevent exposure to contaminated groundwater. The ROD cleanup levels for WP014 COCs are presented in **Table 13-1**. The current status of remedy components is presented in **Table 13-2**.

Table 13-1: OU6-WP014 Contaminants of Concern and ROD Cleanup Levels

Contaminant of Concern	ROD Cleanup Level	Basis for Cleanup Level[1]
Groundwater (µg/L)		
Benzene	5	MCL
Ethylbenzene	700	MCL
Toluene	1,000	MCL

Key:
1 – MCLs correspond to the values listed in 40 CFR 131 and 18 AAC 70.010a and d, 70.015 through 70.011, and 80.070.
µg/L – micrograms per liter
AAC – Alaska Administrative Code
CFR – Code of Federal Regulations
MCL – maximum contaminant level
OU – Operable Unit
ROD – Record of Decision

The specific components of the selected remedy and subsequent revisions (ESD [USAF, 2007] and Memorandum to the Site File [USAF, 2016a]) are discussed below.

Groundwater:

- ICs on land and water use, as specified in the Base General Plan, will restrict access to the contaminated groundwater throughout WP014. Installation of wells in the contaminated plume for residential, industrial, or agricultural use will be prohibited by the Base General Plan.
- Groundwater will be monitored as indicated by the Decision Guide and evaluate on an as-needed basis to determine contaminant migration and to track the progress of contaminant degradation and dispersion, as well as to provide an early indication of unforeseen environmental or human health risk. FYRs will also assess the protectiveness of the remedial action, including an evaluation of any changed site conditions, as long as contamination remains above cleanup levels.
- Recoverable quantities of free product found on top of the water table at WP014 will be regularly removed during groundwater monitoring events.

Table 13-2: OU6-WP014 Remedy Status

Remedy Component	Status
Groundwater	
Institutional controls on land and water use, as specified in the Base General Plan, will restrict access to the contaminated groundwater throughout WP014. Installation of wells in the contaminated plume for residential, industrial, or agricultural use will be prohibited by the Base General Plan.	Implemented in September 1997. LUCs updated in the 2007 ESD and May 2011 673d Air Base Wing Instruction 32-7003 *Land Use Control Management*. No LUC breaches were identified during the period of review for this FYR.
Groundwater will be monitored as indicated by the Decision Guide and evaluate on an as-needed basis to determine contaminant migration and to track the progress of contaminant degradation and dispersion, as well as to provide an early indication of unforeseen environmental or human health risk. FYRs will also assess the protectiveness of the remedial action, including an evaluation of any changed site conditions, as long as contamination remains above cleanup levels.	Monitoring is ongoing to evaluate natural attenuation. A monitoring frequency decision guide was adopted in 2003. FYRs were conducted in 1998, 2003, 2008, 2014, and 2018.
Recoverable quantities of free product found on top of the water table at WP014 will be regularly removed during groundwater monitoring events	Ongoing.
Groundwater monitoring will be discontinued if contaminant levels are below cleanup levels during two consecutive monitoring events. In that case, no further action for groundwater will be required.	Ongoing.
During the final round of monitoring, samples will be collected and analyzed for all constituents that exceeded MCLs during the 1994 investigation including VOCs, SVOCs, and metals. These results will be evaluated before a final determination is made that groundwater meets all cleanup requirements.	Final sampling not yet conducted, as annual monitoring results continue to exhibit contaminant concentrations above ROD cleanup levels.
All groundwater is expected to be cleaned up within 14 years (2011).	Ongoing.
Soil	
No further action is required for soils at WP014.	No Further Action.

Key:
ESD – Explanation of Significant Differences
FYR – Five-Year Review
LUC – land use control
MCL – maximum contaminant level
OU – Operable Unit
ROD – Record of Decision
SVOC – semi-volatile organic compound
VOC – volatile organic compound

- Groundwater monitoring will be discontinued if contaminant levels are below cleanup levels during two consecutive monitoring events. In that case, no further action for groundwater will be required.
- During the final round of monitoring, samples will be collected and analyzed for all constituents that exceeded MCLs during the 1994 investigation, including VOCs, SVOCs, and metals. These results will be evaluated before a final determination is made that groundwater meets all cleanup requirements.
- All groundwater is expected to be cleaned up within 14 years (2011).

In 2003, the OU6 *Memorandum to the Site File* modified the sampling frequency at WP014 (USAF, 2003d).

Soil

- No further action will be required for soil at WP014.

13.2.3 Status of Implementation

Groundwater monitoring has been ongoing at WP014 since 1994. Groundwater monitoring plans are updated annually to ensure that the program remains comprehensive and protective, and monitoring is conducted in accordance with the Sampling Frequency Decision Guide in the OU6 *Memorandum to the Site File* (USAF, 2003d). Current groundwater sampling is required for the site COCs at: Monitoring Wells OU6MW-46 (every 2 years), 14MW-120 (every 5 years), 14MW-121 (every 5 years), OU6MW-13 (every 5 years), OU6MW-91 (every 2 years), OU6MW-92 (annually), and OU6MW-93 (annually). Quarterly seep sampling is required at Seeps LF04SP-03 and LF04SP-04. Annual LUC inspections are also conducted at WP014.

Groundwater monitoring results since the Fourth FYR show that benzene continues to remain above the ROD cleanup level, and that results are consistent with the plume in the shallow aquifer extending from the WP014 site to discharge at Seeps LF04SP-03 and LF04SP-04 on the bluff overlooking Knik Arm (**Figure 13-1**). Dissolved benzene concentrations are likely maintained by ongoing dissolution of residual product in the smear zone and will continue to be present until the residual product attenuates (USAF, 2015; 2017b; 2018c). Free product was observed in Monitoring Wells OU6MW-91 and OU6MW-77 in 2015 and 2016.

Downgradient of the WP014 Plume, COCs in Seep LF04SP-03 show variability over time. Seep LF04SP-04 has been sampled quarterly since 2013 as the benzene concentrations continue to exceed the OU6 ROD cleanup goal of 5 µg/L. TAH and TAqH levels exceeded their respective Alaska Water Quality Standards at Seep LF04SP-04. TAH and TAqH levels in Seep LF04SP-03 did not exceed either standard (USAF, 2018c).

The remaining contaminants appear to have moved past Monitoring Well 14MW-120 in 2007, suggesting it is on the upgradient edge of the plume. Current observations are consistent with the hypothesis that product remains in the contaminated smear zone at residual saturation and is now generally immobile, degrading, and dissolving in place. Contaminant fluctuations in the in-plume monitoring wells will continue, because varying water levels control the degree of interaction with the contaminated smear zone, and minor mobility of residual product can lead to the accumulation

of free product in monitoring wells – as shown by the recent measurement of free product in OU6MW-91 and OU6 MW-77 (USAF, 2018c).

In 2016, Monitoring Wells OU6MW-12, OU6MW-13, OU6MW-92, OU6MW-93, and OU6MW-94 were also sampled for 2-methylnapthalene to determine if current concentrations present an unacceptable risk as per the Fourth FYR. All concentrations of 2-methylnapthalene (4.66 to 24.2 µg/L) detected in groundwater were below the ADEC cleanup level.

The Mann-Kendall trend tests for benzene and ethylbenzene in Monitoring Well OU6MW-92 indicated no statistically significant trend, and ethylbenzene concentrations are considered stable. Statistically significant decreasing trends were identified for ethylbenzene in OU6MW-46 and benzene in Seep LF04SP-03. No statistically significant trend for benzene was identified in Seep LF04SP-04 (USAF, 2018c).

An LSI was conducted at WP014 in 2017; findings were not available at the time of this FYR.

13.2.4 LUC Summary

LUCs were implemented in September 1997 to restrict access to contaminated media throughout OU6 until cleanup levels are achieved. LUCs were updated in 2010, as well as the 673d Air Base Wing Instruction 32-7003 *Land Use Control Management* and are managed and implemented in accordance with the *Operable Unit 6 Explanation of Significant Differences* (USAF, 2007).

LUCs in place at WP014 include ICs on land use and water use, as specified in the Base General Plan, which restricts access to the contaminated groundwater throughout WP014. Installation of wells in the contaminated plume for residential, industrial, and agricultural use is prohibited by the Base General Plan (USAF, 2007OU6).

Compliance with LUCs applies to all soil-disturbing activities on JBER and is reviewed annually (USAF, 2018c). A GIS-based tracking system is in place to ensure that LUCs are enforced and has been incorporated into the *Base General Plan*. A copy of the LUC inspection form is provided in **Appendix E**.

13.2.5 Systems Operations / Operations and Maintenance

No active systems are currently operated as part of remediation at WP014.

13.3 PROGRESS SINCE THE LAST REVIEW

This is the fifth FYR for JBER-E. The OU6 protectiveness determination and statement from the 2014 FYR are presented in **Table 9-3**. Issues and recommendations from the 2014 FYR and the current status of those recommendations are presented in **Table 13-3**.

Table 13-3: OU6-WP014 Status of Recommendations from the 2014 FYR

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date
Review of historical data indicate no decreasing trend and an increasing trend for some COCs in the groundwater at LF004 South, WP014 (OU6MW-46), and SD015. It is not possible to predict a reliable cleanup date for these OU6 sites.	Perform remedial process optimization for LF004 South, WP014, and SD015 since it does not appear that there will be sufficient progress in the timeframe established in the ROD.	Ongoing	Remedial process optimization has not yet been performed.	Not applicable
Based on the maximum concentration of 2-methylnaphthalene identified in the groundwater at WP014 during the time of the ROD (630 µg/L) the calculated risk exceeds the hazard quotient threshold for non-cancer chemicals.	Based on the potential risk associated with the maximum concentration of 2-methylnaphthalene detected in the groundwater at WP014 during the time of the ROD, the analyte should be re-sampled for to determine the concentration present at the site and to determine if current concentrations present an unacceptable risk.	Completed	Monitoring Wells OU6MW-12, OU6MW-13, OU6MW-92, OU6MW-93, and OU6MW-94 were sampled for 2-methylnapthalene in 2016. All results were below the Alaska Department of Environmental Conservation (ADEC) cleanup level.	2016
The LF004 CERCLA site boundary appears to extend beyond JBER-E site boundaries. *Note: this issue was specifically noted for LF004 but applied to all sites covered by the FYR.*	All CERCLA site boundaries should be reviewed for accuracy and be revised, when applicable, in a memorandum to the site file.	Completed	CERCLA site and LUC boundaries are maintained in a GIS database. At the time of this FYR, there are no noted boundary discrepancies at WP014.	Not applicable
An in-depth description of the historical site events for each OU and DP098 was not included within Table 2-1 of this FYR.	Expand the chronology table in the next five-year review to include detailed information concerning the chronology of site events for each OU and DP098.	Considered But Not Implemented	Chronology table not required in approved template for this FYR.	Not applicable

Key:
µg/L – micrograms per liter
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act –
COC – contaminant of concern
FYR – Five-Year Review
GIS – geographic information system
JBER – Joint Base Elmendorf-Richardson
JBER-E – JBER- Elmendorf
LUC – land use control
OU – Operable Unit
ROD – Record of Decision

13.4 FYR PROCESS

13.4.1 Site Interviews

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. Site interviews for JBER-E were conducted as discussed in Section 3.1. There were no specific comments regarding WP014. Formal interview records are provided in **Appendix C**.

13.4.2 Data Review

A summary of data since the 2014 FYR is presented in Section 13.2.3. Data collected at WP014 during the period of this FYR (2014-2018) were reviewed. Data reviewed included 2014 through 2016 monitoring activities (USAF, 2015; 2017b; 2018c). Data is presented on **Figure 13-1**.

Data collected under the ERP are archived in the USAF ERPIMS database; however, not all data collected over the life of WP014 may have been archived into the system. All historical data available in ERPIMS (31 May 1993 through 27 July 2017) were reviewed to support a technical assessment of chemical-specific toxicity changes since the ROD was signed. See Section 13.5.2.

13.4.3 Site Inspection

A site inspection was conducted at WP014 on 1 August 2017. The purpose of the inspection was to assess the protectiveness of the remedy. A site inspection form and photographs are provided in **Appendix E**. No issues were discovered that affect the current or future protectiveness of the remedy at the site.

13.5 TECHNICAL ASSESSMENT

13.5.1 Question A – Is the remedy functioning as intended by the decision documents?

Yes. The review of documents, site data, and the results of the site inspections indicate that the remedy for WP014, which included free-product recovery, MNA, and LUCs is functioning as intended by the ROD. Land use and groundwater LUCs continue to be adequate and protective, and are preventing exposures to contaminated media that remain at the site. However, the timeframe for attaining natural attenuation of groundwater COCs, as anticipated by the ROD (2011) was not achieved. It is recommended that additional studies be conducted to determine if the remedy, as is, will be able to achieve remediation goals within the estimated time frame. Other studies may include, but are not limited to: site characterization, ecological assessment, focused feasibilities studies, groundwater modeling, treatability studies, and/or sampling.

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

No. Revised cleanup levels have been promulgated and toxicity data has changed since the ROD was signed.

Changes in Standards:

The ROD remediation goals are the MCLs, which have not changed since the ROD was signed. The chemical-specific ARARs for groundwater listed in the ROD (USAF, 1997a) do not have any changes that affect regulatory-based cleanup levels for groundwater COCs at WP014. However, regulatory cleanup levels (18 AAC 75) have recently been revised and these changes are presented in **Table 13-4**. The ADEC cleanup levels (ADEC, 2017) are human health based, and account for toxicity changes that have occurred since the ROD was signed.

Table 13-4: OU6-WP014 Comparison of ROD Final Remediation Goals to 2017 Standards

Chemical	ROD Cleanup Level	ADEC Cleanup Level[1]	Federal MCL	Historic Site Concentration	LTM Site Sample
Groundwater (µg/L)					
Benzene	5	4.6	5	1,390	137
Ethylbenzene	700	15	700	1,200	440
Toluene	1,000	1,000	1,000	3,100	85.5

Key:
1 – ADEC cleanup levels (18 AAC 75.341(c), as amended through 7 November 2017).
µg/L – micrograms per liter
AAC – Alaska Administrative Code
ADEC – Alaska Department of Environmental Conservation
LTM – long-term monitoring
MCL – maximum contaminant level
ND – non-detect
OU – Operable Unit
ROD – Record of Decision

All available data for WP014 were evaluated against the ADEC standards (ADEC, 2017). Calculations were performed for chemicals with detections within the last 5 years above the new standards to determine exposure risk (**Appendix F**, **Tables F-1** through **F-3**). These calculations, based on recent site concentrations and the residential exposure assumption, show a changed exposure risk for TCE in groundwater.

A review was also conducted on chemicals with new toxicity data. This did not identify any other chemicals at WP014 that required further investigation.

Although there are cancer risk and noncancer hazard threshold exceedances groundwater and soil, the LUCs restricting land use, the construction of manned facilities, and groundwater use at WP014 continue to prevent exposures to contaminated media that may pose excessive risk.

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

No other information has been discovered that calls into question the protectiveness of the remedy for WP014.

13.6 ISSUES / RECOMMENDATIONS

Issues identified during this FYR that affect the protectiveness of the remedy are shown below.

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): OU6, Site WP014	**Issue Category:** Remedy Performance			
	Issue: Due to changes in toxicity data or regulatory cleanup standards, some chemicals current final remediation goals may exceed EPA human health guidance: (in groundwater) TCE.			
	Recommendation: The AF will evaluate any changes in promulgated standards and chemical toxicity characteristics in accordance with OSWER 9355.7-03B, Appendix G (June 2001) to determine if the current remedy will reduce contamination to within the acceptable CERCLA risk ranges for protectiveness. If the evaluation determines that acceptable risk will not be achieved by the current remedy, the decision document will be appropriately revised following the CERCLA process.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023
OU(s): OU6, Site WP014	**Issue Category:** Remedy Performance			
	Issue: Limited natural attenuation of COCs in groundwater is occurring at the site, and the anticipated date (2011) of achieving concentrations below cleanup levels was not achieved.			
	Recommendation: Conduct additional studies to determine if the remedy, as is, will be able to achieve remediation goals within the estimated time frame. Other studies may include, but are not limited to, site characterization, ecological assessment, focused feasibilities studies, groundwater modeling, treatability studies, and/or sampling. Groundwater cleanup timelines should be reestablished.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023

The following issue was identified during this FYR that does not affect the protectiveness of the remedy at WP014

14.0 DP098

14.1 SITE BACKGROUND

Site DP098 is a 27-acre site located in the northwest of JBER-E (**Figure I-2**), just west of Fairchild Avenue (**Figure 14-1**). Two primary buildings are associated with the site: Building 18224, which served as a vehicle maintenance facility during the 1950s and 1960s and now supports site operations; and Building 18220 (now designated as Building 18216), an office building. Petroleum hydrocarbons were first discovered at DP098 in 1995 during the replacement of a 3,000-gallon UST located at the southwest corner of Building 18224 (**Figure 14-1**). Chlorinated aliphatic hydrocarbons and their degradation products (collectively referred to as CAHs) were detected in soil at DP098 and groundwater during field investigations between 1997 and 1999. Petroleum hydrocarbon contamination is interpreted to be the result of petroleum-related light non-aqueous phase liquid (LNAPL) releases from former USTs that serviced Building 18224. As-built documents indicate that building drain systems at the site were connected to six discharge lines. Each drain tile system consisted of a floor drain connected to perforated piping that drained liquids away from the building. This disposal method was a standard practice in the past.

CAH contamination is thought to have been primarily associated with the floor drainage system of Building 18224, which received liquids, including chlorinated solvents, during maintenance and cleaning operations, and subsequently discharged to the drain tile northwest of the building. As-built documents indicate two drain tiles associated with Building 18224: one that discharged north of the building, and one that discharged northwest of the building. Four drain tiles are associated with historical Building 18220: one discharged to the east of the building, another to the south of the west end of the building, one to the northwest of the west end of the building, and the fourth discharged southwest of the northwest corner (now designated as Building 18216). Commingling of these two contaminant types occurs down to about 30 feet bgs. CAHs are dissolved into the petroleum LNAPL, which acts as a source for this shallow CAH contamination. CAHs without petroleum hydrocarbons are present below 30 feet bgs, and no source for these deeper CAHs has been identified (USAF, 2018a).

14.2 RESPONSE ACTION SUMMARY

14.2.1 Basis for Taking Action

CERCLA hazardous substances released at JBER-E resulted in soil, sediment, surface water, and groundwater contamination in various locations. The initial risk assessment at DP098 determined that the human and/or ecological risks exceeded the EPA's average or reasonable maximum exposure risk management criteria, and that remedial action must be taken.

The DP098 ROD selected groundwater COCs through the HHRA and soil and sediment COCs through state regulatory standards. DP098 COCs identified in the ROD include the following: (in soil) 1,1-DCE, cis-1,2-DCE, PCE, and TCE; (in sediment) cis-1,2-DCE and TCE; and (in groundwater) 1,1-DCE, cis-1,2-DCE, TCE, PCE, and VC (USAF, 2004b).

Risk Summary

The 2004 ROD included the results of a baseline HHRA, which provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action.

Risks and hazards were evaluated for chemicals of potential concern (COPCs) for RME and central tendency (CT) exposure conditions. RME hazard/risk estimates are based on the maximum exposure that is reasonably expected to occur at a site, while CT hazard/risk estimates are designed to represent the average of typical exposures at a site. Risks and hazards were evaluated under current exposure scenarios, as well as a hypothetical, future residential scenario (USAF, 2004b).

The results of the risk characterization in the DP098 HHRA indicate that future exposures to contaminants in groundwater could pose an unacceptable threat of cancer and noncancer effects, particularly due to TCE in groundwater. No contaminants were identified as COCs in any media other than groundwater. TCE is not a concern for wetland surface water or sediment, because the RME cumulative cancer risk and noncancer HI were below the EPA and ADEC target health goals (USAF, 2004b).

Under the current exposure scenario, four contaminants were identified as COCs in groundwater at DP098: TCE via indoor air inhalation and cis-1,2-DCE, TCE, and PCA via tap water ingestion. Cancer risks and noncancer hazards associated with groundwater were greatest for civilian building workers. For the building worker scenario (both military and civilian), TCE was the greatest contributor to total risks and hazards, contributing 92% and 68%, respectively. TCE was identified as a COC in groundwater through the drinking water pathway and was the only contaminant identified as a COC through the inhalation of groundwater vapors in the indoor air pathway. However, recent air sampling conducted in Building 18224 identified no significant health risk to personnel based on the building's current usage. If the use of Building 18224 increases in the future, additional air sampling may be required to ensure that levels of indoor air remain safe for building occupants (USAF, 2004b).

TCE was the only contaminant identified for the construction worker exposures to groundwater, based on exceedances of both the target cancer risk goals and noncancer health goals. Construction worker exposures to soil did not exceed any health goals. Thus, no contaminants were identified as COCs in soil at DP098 for current exposures (USAF, 2004b).

Under the future residential exposure scenario, four chemicals were identified as COCs in groundwater: PCE, TCE, and VC via domestic use of tap water; and TCE via direct contact. As was the case for the building worker scenario, TCE was identified as the greatest contributor to total risks and hazards. TCE is responsible for approximately 97% of the total cancer risks and approximately 50% of the total noncancer hazards associated with groundwater. Residential exposures to soil did not exceed any health goals. Thus, no contaminants were identified as COCs in soil at DP098 for future residential exposures (USAF, 2004b).

Future neighborhood recreational cancer risks and noncancer hazards were well below target health goals; therefore, no contaminants were identified as COCs in sediment and surface water at DP098 (USAF, 2004b).

The 2004 ROD also included the results of an ERA at DP098. The ERA was performed to determine if the reported concentrations of chemicals or calculated exposures to plants and wildlife are likely to produce adverse effects. Several complete exposure pathways have been identified for the site, including for terrestrial ecological receptors exposed to contaminants in surface soil and surface water, and aquatic receptors exposed to site contaminants in surface water and sediments (USAF, 2004b).

All freshwater aquatic invertebrates residing in the water column, phytoplankton, and macrophytes were selected as target ecological receptors for exposure to surface water contaminants. The tadpole life stage of the wood frog (*Rana sylvatica*) also was a target ecological receptor. Rooted macrophytes and benthic invertebrates were selected as the primary target ecological receptors exposed to contaminants in sediment (USAF, 2004b).

The terrestrial ecological receptors chosen for this assessment at DP098 included: terrestrial plants, terrestrial invertebrates, the dark-eyed junco, the American robin, the common snipe, the meadow vole, the masked shrew, the least weasel, and the wood frog. With the exception of plants, which represent the primary producers at the site, all terrestrial ecological receptors were intended to be representative of a functional feeding group of animals present at the site (USAF, 2004b).

No contaminants of potential ecological concern (COPECs) for soil were identified as posing a significant ecological risk to wildlife. HQs developed for sediment COPECs show that no detected concentrations of contaminants exceed acceptable ecological benchmarks.

Although the soil and sediment contaminants identified during the RI may not pose a risk to human health or ecological receptors, as determined during the risk assessments, some of the contaminants still exceed chemical-specific ARARs and are, therefore, identified as COCs (USAF, 2004b).

14.2.2 Response Actions

The early phases of sampling at DP098 focused on defining the extent of fuel contamination in the shallow aquifer associated with the two USTs. Eventually, the presence of chlorinated solvents was detected through passive soil gas sampling, and investigation efforts expanded to define the nature and extent of fuels and chlorinated compounds in the shallow aquifer. During this investigation, the USAF installed groundwater monitoring wells, groundwater monitoring/air-injection wells, and soil gas monitoring arrays. Soil, soil gas, and groundwater were sampled for fuel-related compounds (USAF, 2004b).

Investigations in 2000 and 2002 located the source of the chlorinated compounds and defined the lateral and vertical extent of contamination. The 2002 work also investigated the relationship between the shallowest water-bearing unit and a deeper water-bearing unit. The 2002 RI defined the northwestern extent of groundwater contamination at the site and determined that contaminants had not reached a lower unit of the aquifer beneath DP098 (USAF, 2004b).

Remedial Action Objectives

RAOs provide a general description of what the cleanup will accomplish. RAOs specified in the DP098 ROD are as follows (USAF, 2004b):

- Reduce chlorinated solvent concentrations in soil, sediment, and groundwater to chemical-specific ARARs.
- Select remedial action alternatives that will minimize the damage to the wetland ecology.
- Prevent exposure (via ingestion, inhalation, and/or dermal contact) to groundwater until such time as the federal and state drinking water standards are met.
- Restrict excavations and the installation of water wells to reduce the possibility of exposure to contaminants and contaminant migration from the contaminated aquifer to the uncontaminated aquifers.
- Maintain current land use designations at this site.

Remedy Components

The DP098 ROD-selected remedy included components for source material removal, MNA, and LUCs. Cleanup levels for DP098 COCs are presented in **Table 14-1**.

Table 14-1: DP098 Contaminants of Concern and ROD Cleanup Levels

Contaminant of Concern	ROD Cleanup Level	Basis for Cleanup Level[1]
Soil (mg/kg)		
1,1-dichloroethene	0.03	18 AAC 75.341
Cis-1,2-dichloroethene	0.2	18 AAC 75.341
Tetrachloroethene (PCE)	0.03	18 AAC 75.341
Trichloroethene (TCE)	0.027	18 AAC 75.341
Sediment (mg/kg)		
Cis-1,2-dichloroethene	0.2	18 AAC 75.341
Trichloroethene (TCE)	0.027	18 AAC 75.341
Groundwater (µg/L)		
1,1-Dichloroethene	7	MCL
Cis-1,2-dichloroethene	70	MCL
Trichloroethene (TCE)	5	MCL
Tetrachloroethene (PCE)	5	MCL
Vinyl chloride	2	MCL

Key:
1 – MCLs correspond to the values listed in 40 Code of Federal Regulations 141.61.
µg/L – micrograms per liter
AAC – Alaska Administrative Code
MCL – maximum contaminant level
mg/kg – milligrams per kilogram
ROD – Record of Decision

The remedy includes the major components discussed below.

Source Material Removal:

- Source material removal, completed in 2005, was limited to soil within a 25-foot radius of historical soil Boring DP098-SB01, where the greatest TCE concentrations were detected, adjacent to the end of the drain tile northwest of Building 18224.

Monitored Natural Attenuation:

The MNA component of the remedy has three sub-components to assess the effectiveness of MNA: 1) natural attenuation of contaminants in groundwater, soil, and sediment; 2) a treatability study to determine the effectiveness of the natural attenuation at/around the 190-foot topographic contour; and 3) an evaluation/compilation of groundwater data collected during the first 5 years of monitoring, as follows:

- Natural attenuation is the remedy for low concentration contaminants remaining at DP098 after the limited soil removal is completed. The USAF will monitor the actual performance of the natural attenuation remedy in accordance with the following monitoring guidelines:
  - Frequencies for groundwater and seep monitoring will be based on the sampling guidelines in the DP098 ROD.
  - Surface water samples will be collected from the kettle pond annually as a point of compliance and sampled for the same sampling suite as the groundwater COCs.
  - The analytical testing of water samples will monitor concentrations of the COCs, daughter products, and other analytes, as appropriate. In addition, field-testing will monitor changes in site conditions. Analytes and field parameters will be measured to track changes in contaminant migration, as well as to monitor the progress of natural attenuation.
  - Natural attenuation in soil would not be monitored prior to collecting confirmation samples. Confirmation sampling will be conducted to confirm effectiveness of the natural attenuation of soil and sediment only after groundwater chemical-specific ARARs have been achieved.
- After completion of the source removal, a treatability study will be undertaken in the area of the 190-foot topographic contour to evaluate the effectiveness of natural attenuation in this area. The objectives of this treatability study are:
  - To assess the feasibility of enhancing the natural attenuation process by evaluating the impact of adding an additional nutrient source.
  - To determine if this "enhanced" natural attenuation would significantly reduce the predicted cleanup time frames.
  - To fill data gaps from the RI and evaluate the possible presence of dense, non-aqueous phase liquids (DNAPL).
  - To evaluate MNA in groundwater. Trends of decreasing COCs and predictive groundwater modeling will be used as lines of evidence to indicate that MNA is successfully remediating groundwater. The treatability study will be conducted within 1 year of implementing the selected remedy.
- After the first 5 years of groundwater monitoring, the USAF will evaluate the progress of MNA. This evaluation will compile, analyze, and review all data collected, including

information from the RI/FS, and the natural attenuation and treatability study remedy components described above. Additional groundwater modeling will be completed to provide updated estimates for the time frames to meet the cleanup goals. If, during this evaluation, the data indicates contaminant concentrations in groundwater are not decreasing as estimated, the USAF, EPA, and ADEC may reconsider the remedy decision. One or more of the following observations could lead to re-consideration of the remedy, and trigger implementation of enhanced MNA:

  - Increase in parent contaminant concentrations indicating that other sources may be present.
  - Concentrations of parent contaminants and/or daughter products may indicate that the estimated cleanup time frames may not be reached.
  - Plume of primary contaminants and/or daughter products increases significantly in areal or vertical extent and/or volume from that predicted by modeling estimates.

- Under the selected remedy, MNA will continue until groundwater contamination is no longer a threat to human health and the environment, verified by 2 years of consecutive sampling events where analytical results show that the COCs are less than the chemical-specific ARARs. Sampling for individual groundwater COCs may be discontinued at any time two sampling events show concentrations are below chemical-specific ARARs. However, during the final two rounds of groundwater monitoring, samples will be collected and analyzed for all the COCs. Surface water that is downgradient of the site and is believed to be in contact with groundwater from the site will be monitored until such time as all groundwater COCs meet chemical-specific ARARS.
- Once it has been verified the groundwater COCs are below chemical-specific ARARs, conformational sampling will be conducted to verify that soil and sediment COCs are below associated chemical-specific ARARs.
- It is estimated natural attenuation will clean up groundwater within 35 to 75 years and soil outside the excavated source area within 18 to 48 years.

<u>Land Use Controls:</u>

- LUCs were designed to prevent activities that could affect the performance of the other components of the selected remedy, prevent the migration of contaminants in groundwater, and maintain current land uses at DP098 to protect human health and the environment. Specific LUCs at DP098 are as follows:
  - Excavating, digging, or drilling in the area shown on **Figure 14-1** is restricted to reduce the possibility of migration or exposure to contaminants that exceed the chemical-specific ARARs. If contaminated soil that exceeds chemical-specific ARARs is excavated, it cannot be transported to or disposed of at another location on Base. Excavated soil will be transported to a disposal facility in the lower 48 states, which is acceptable for disposal of CERCLA waste under the Off-site Disposal Rule (40 CFR 300.440). No dewatering of excavations or trenches will be allowed unless contaminated water is treated prior to use or disposal. Any excavations or drilling greater than 10 feet bgs will require engineering controls to prevent downward migration of contamination and to protect the groundwater aquifer.

- The use of contaminated groundwater throughout DP098 for any purpose including, but not limited to, drinking, irrigation, fire control, dust control, or any other activity, is prohibited.
- The current land use will be maintained to reduce the possibility of exposure to contaminants.

The current status of remedy components is presented in **Table 14-2**.

14.2.3 Status of Implementation

The ROD selected remedy is:

- Source material removal (completed).
- MNA – includes: 1) natural attenuation of contaminants in groundwater, soil, and sediment, and groundwater (ongoing); 2) a treatability study to determine the effectiveness of the natural attenuation at/around the 190-foot topographic contour (completed); and 3) an evaluation /compilation of groundwater data collected during the first 5 years of monitoring (completed).
- LUCs (ongoing).

Current monitoring requirements at DP098 include periodic groundwater and surface water sampling and an annual LUC inspection. Groundwater sampling is required for the COCs at Monitoring Wells: 41755WL-01 (every 5 years), 41755WL-02 (annual), 41755WL-03 (annual), 41755WL-04 (annual), 41755WL-05 (annual), 41755WL-07 (annual), 41755WL-08 (semiannual), 41755WL-09 (annual), 41755WL-12 (every 5 years), 41755WL-15 (every 2 years), 41755WL-16 (every 2 years), 41755WL-17 (every 5 years), 41755WL-23 (every 2 years), and DP098INJ-02 (annual). Annual surface water sampling is required for the COCs at DP098SW-01.

Under anaerobic conditions, reductive dechlorination will occur at DP098. In general, reductive dechlorination occurs by sequential dechlorination from PCE to TCE to DCE to VC to ethene. Reductive dechlorination of chlorinated solvent compounds is associated with the accumulation of daughter products and an increase in the concentration of chloride. Evaluation of MNA parameters indicated reducing conditions in the in-plume monitoring wells (USAF, 2017b).

Evaluation of monitoring data since the Fourth FYR indicates that COC concentrations at DP098 continue to exceed cleanup goals. Mann-Kendall trends are decreasing for TCE and DCE in monitoring wells located in the center of the plume (41755WL-02 and 41755WL-04). Mann-Kendall trends are increasing for TCE and DCE at the leading edge of the plume at Monitoring Well 41755WL-08. The Mann-Kendall trend for VC is increasing and the cis-1,2-DCE trend is decreasing in DP098INJ-02 where an emulsified vegetable oil injection treatability study was performed in 2007. This indicates an ongoing delayed effect from the injection of emulsified vegetable oil that is driving reductive dechlorination in this area. The trends at the leading edge of the plume indicate slower progress toward reaching cleanup goals. COCs in Monitoring Wells 41755WL-07 and 41755WL-09 were both non-detect or below the ROD cleanup levels (USAF, 2018c).

Table 14-2: DP098 Remedy Status

Remedy Component	Status
Source Material Removal	
Source material removal was limited to soil within a 25-foot radius of historical soil Boring DP098-SB01, where the greatest trichloroethene (TCE) concentrations were detected, adjacent to the end of the drain tile northwest of Building 18224.	Completed in 2005.
Monitored Natural Attenuation	
The MNA component of the remedy has three sub-components to assess the effectiveness of MNA: 1) natural attenuation of contaminants in groundwater, soil, and sediment; 2) a treatability study to determine the effectiveness of the natural attenuation at/around the 190-foot topographic contour; and 3) an evaluation/compilation of groundwater data collected during the first 5 years of monitoring.	Ongoing.
Natural attenuation is the remedy for low concentration contaminants remaining at DP098 after the limited soil removal is completed. The USAF will monitor the actual performance of the natural attenuation remedy in accordance with the following monitoring guidelines: • Frequencies for groundwater and seep monitoring will be based on the sampling guidelines in the DP098 ROD. • Surface water samples will be collected from the kettle pond annually as a point of compliance and sampled for the same sampling suite as the groundwater COCs. • The analytical testing of water samples will monitor concentrations of the COCs, daughter products, and other analytes, as appropriate. In addition, field-testing will monitor changes in site conditions. Analytes and field parameters will be measured to track changes in contaminant migration, as well as to monitor the progress of natural attenuation. • Natural attenuation in soil would not be monitored prior to collecting confirmation samples. Confirmation sampling will be conducted to confirm effectiveness of the natural attenuation of soil and sediment only after groundwater chemical-specific ARARs have been achieved.	Ongoing.

Table 14-2 (Cont.): DP098 Remedy Status

Remedy Component	Status
Monitored Natural Attenuation (Cont.)	
After completion of the source removal, a treatability study will be undertaken in the area of the 190-foot topographic contour to evaluate the effectiveness of natural attenuation in this area. The objectives of this treatability study are: • To assess the feasibility of enhancing the natural attenuation process by evaluating the impact of adding an additional nutrient source. • To determine if this "enhanced" natural attenuation would significantly reduce the predicted cleanup time frames. • To fill data gaps from the RI and evaluate the possible presence of dense, nonaqueous phase liquids (DNAPL). • To evaluate MNA in groundwater. Trends of decreasing COCs and predictive groundwater modeling will be used as lines of evidence to indicate that MNA is successfully remediating groundwater. The treatability study will be conducted within 1 year of implementing the selected remedy.	Treatability studies completed in 2007 and 2010.
After the first 5 years of groundwater monitoring, the USAF will evaluate the progress of MNA. This evaluation will compile, analyze, and review all data collected, including information from the Remedial Investigation/Feasibility Study, and the natural attenuation and treatability study remedy components described above. Additional groundwater modeling will be completed to provide updated estimates for the time frames to meet the cleanup goals. If, during this evaluation, the data indicates contaminant concentrations in groundwater are not decreasing as estimated, the USAF, EPA, and ADEC may reconsider the remedy decision. One or more of the following observations could lead to re-consideration of the remedy, and trigger implementation of enhanced MNA: • Increase in parent contaminant concentrations indicating that other sources may be present. • Concentrations of parent contaminants and/or daughter products may indicate that the estimated cleanup time frames may not be reached. • Plume of primary contaminants and/or daughter products increases significantly in areal or vertical extent and/or volume from that predicted by modeling estimates.	Completed in 2008.
Under the selected remedy, MNA will continue until groundwater contamination is no longer a threat to human health and the environment, verified by 2 years of consecutive sampling events where analytical results show that the COCs are less than the chemical-specific ARARs. Sampling for individual groundwater COCs may be discontinued at any time two sampling events show concentrations are below chemical-specific ARARs. However, during the final two rounds of groundwater monitoring, samples will be collected and analyzed for all of the COCs. Surface water that is downgradient of the site and is believed to be in contact with groundwater from the site will be monitored until such time as all groundwater COCs meet chemical-specific ARARS.	Ongoing.

Table 14-2 (Cont.) DP098 Remedy Status

Remedy Component	Status
Monitored Natural Attenuation (Cont.)	
Once it has been verified the groundwater COCs are below chemical-specific ARARs, conformational sampling will be conducted to verify that soil and sediment COCs are below associated chemical-specific ARARs.	Groundwater COC chemical-specific ARARs have not yet been achieved; therefore, confirmation sampling in sediment has not yet been conducted.
It is estimated natural attenuation will clean up groundwater within 35 to 75 years and soil outside the excavated source area within 18 to 48 years.	MNA is ongoing.
Land Use Controls	
LUCs were designed to prevent activities that could affect the performance of the other components of the selected remedy, prevent the migration of contaminants in groundwater, and maintain current land uses at DP098 to protect human health and the environment. Specific LUCs at DP098 are as follows: • Excavating, digging, or drilling is restricted to reduce the possibility of migration or exposure to contaminants that exceed the chemical-specific ARARs. If contaminated soil that exceeds chemical-specific ARARs is excavated, it cannot be transported to or disposed of at another location on base. Excavated soil will be transported to a disposal facility in the lower 48 states, which is acceptable for disposal of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) waste under the Off-site Disposal Rule (40 CFR 300.440). No dewatering of excavations or trenches will be allowed unless contaminated water is treated prior to use or disposal. Any excavations or drilling greater than 10 feet bgs will require engineering controls to prevent downward migration of contamination and to protect the groundwater aquifer. • The use of contaminated groundwater throughout DP098 for any purpose including, but not limited to, drinking, irrigation, fire control, dust control or any other activity, is prohibited. • The current land use will be maintained to reduce the possibility of exposure to contaminants	Implemented in May 2002. Updated in May 2011 673d Air Base Wing Instruction 32-7003 *Land Use Control Management*. No LUC breaches were identified during the period of review for this FYR.

Key:
ADEC – Alaska Department of Environmental Conservation
ARAR – applicable or relevant and appropriate requirement
COC – contaminant of concern
CFR – Code of Federal Regulations
EPA – United States Environmental Protection Agency
FYR – Five-Year Review
LUC – land use control
MNA – monitored natural attenuation
ROD – Record of Decision
USAF – United States Air Force

A vapor intrusion study was conducted from 2016 to 2017 at JBER and included Buildings 18220 and 18224 at DP098. The study concluded that the vapor intrusion pathway is considered potentially complete at both buildings. A vapor intrusion pathway was considered potentially complete if soil gas COC concentrations were greater than indoor air concentrations, but outdoor or non-vapor intrusion sources could not be ruled out. The numerical results were identical for both buildings: based on the maximum detected indoor air results, the total HI was below 1 at 0.02 and the cumulative cancer risk was 7×10^{-8} for an indoor worker at Buildings 18220 and 18224 (USAF, 2018b).

A 1,4-dioxane investigation was completed at JBER in 2017. No sample results from any DP098 groundwater monitoring wells exceeded the EPA Region 9 RSL for residential tapwater (0.46 µg/L) or the current ADEC cleanup level of 4.6 µg/L (USAF, 2017c).

In 2017, in an effort to optimize the exit strategy for DP098, a DNAPL evaluation was conducted. Soil sampling was conducted, and two monitoring wells (DP098MW-07 and DP098MW-08) were installed in the vicinity of the drain tile outfall northwest of Building 18224. Groundwater analytical results from DP098MW-07 indicate concentrations of DCE and TCE above ROD cleanup levels, and GRO concentrations were above 18 AAC 75 cleanup level. Analytical results from DP098MW-08 were below cleanup levels (USAF, 2018).

Results from soil sampling indicate DRO and GRO contamination are present in soils at DP098 from about 165 to 196 feet above mean sea level (amsl). Soil contamination remains above cleanup levels for DCE, PCE, and TCE, with maximum concentrations of 1.8, 41, and 94 mg/kg, respectively. The deepest contamination above ROD cleanup levels was TCE encountered in 15DP098-SB-01 at 68.5 feet bgs (about 128 feet amsl). Detections of TCE in the saturated soils below the LNAPL contamination depth limit of about 165 feet amsl indicate the existence of a deeper, independent CAH source; however, no deep CAH DNAPL source was encountered between 40 and 80 feet bgs (158 to 118 feet amsl). While it is likely that DNAPL is present below the LNAPL, it is not practicable to precisely identify the source location and extent (USAF, 2018).

The highest soil concentrations of TCE found at DP098 were present within the petroleum hydrocarbon contaminated zone at 14DP098-SB-03 at 29 to 29.5 feet bgs (approximately 169.5 feet amsl). The combined TCE and petroleum concentration is approximately 250 mg/kg. While the presence of a non-aqueous phase liquid (NAPL) mixture is indicated at low concentrations, it is insufficient to saturate the soil matrix pore spaces, would only be present as disconnected blobs or ganglia within the pore spaces, and would not be expected to flow horizontally or vertically (USAF, 2018a).

Previous treatability studies to reduce dissolved phase TCE concentrations at DP098 have indicated that, between the four methods tested, the injection of a mixture of hematite, gypsum, and emulsified vegetable oil within the TCE plume area was the most successful. Bioaugmentation could be a viable option to enhance emulsified vegetable oil injection (USAF, 2018a).

14.2.4 LUC Summary

LUCs at DP098 are designed to prevent activities that could affect the performance of the other components of the selected remedy, prevent the migration of contaminants in groundwater, and

maintain current land uses at DP098 to protect human health and the environment. LUCs were implemented in May 2002, and administrative procedures per the 673d Air Base Wing Instruction 32-7003 *Land Use Control Management* are in effect. Specific LUCs at DP098 include the following:

- Excavating, digging, or drilling is restricted to reduce the possibility of migration or exposure to contaminants that exceed the chemical-specific ARARs. If contaminated soil that exceeds chemical-specific ARARs is excavated, it cannot be transported to or disposed of at another location on Base. Excavated soil will be transported to a disposal facility in the lower 48 states, which is acceptable for disposal of CERCLA waste under the Off-site Disposal Rule (40 CFR 300.440). No dewatering of excavations or trenches will be allowed unless contaminated water is treated prior to use or disposal. Any excavations or drilling greater than 10 feet bgs will require engineering controls to prevent downward migration of contamination and to protect the groundwater aquifer.
- The use of contaminated groundwater throughout DP098 for any purpose including, but not limited to, drinking, irrigation, fire control, dust control, or any other activity, is prohibited.
- The current land use will be maintained to reduce the possibility of exposure to contaminants.

Compliance with LUCs applies to all soil-disturbing activities on JBER and is reviewed annually (USAF, 2018c). A GIS-based tracking system is in place to ensure that LUCs are enforced and has been incorporated into the *Base General Plan*. A copy of the LUC inspection form is provided in **Appendix E**.

14.2.5 Systems Operations / Operations and Maintenance

No active systems are currently operated as part of remediation at DP098.

14.3 PROGRESS SINCE THE LAST REVIEW

This is the fifth FYR for JBER-E. The protectiveness determination and statement for DP098 from the 2014 FYR are presented in **Table 14-3**. Issues and recommendations from the 2014 FYR and the current status of those recommendations are presented in **Table 14-4**.

Table 14-3: DP098 Protectiveness Determination/Statement from the 2014 FYR

Site	Protectiveness Determination	Protectiveness Statement
DP098	Protectiveness Deferred	Protectiveness determination of the remedy at DP098 is deferred until the potential impacts associated with the vapor intrusion pathway at the site are evaluated. The vapor intrusion assessment is expected to be performed in 2016. Vapor intrusion evaluations will be conducted prioritizing buildings with the most vulnerable populations (schools, day cares, offices, and residences).

Key:
FYR – Five-Year Review

Table 14-4: DP098 Status of Recommendations from the 2014 FYR

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date
Indoor air sampling at DP098 appears to indicate that no unacceptable risk is occurring. However, the historical efforts do not meet the current standard of multiple lines of evidence.	A vapor intrusion evaluation that provides multiple lines of evidence should be conducted in accordance with EPA guidance for each occupied facility that is in proximity to the TCE plumes at DP098. Vapor intrusion evaluations should be conducted prioritizing buildings with the most vulnerable populations (schools, day cares, offices, and residences).	Completed	A vapor intrusion study was conducted from 2016 to 2017 at JBER and included Buildings 18220 and 18224 at DP098. The study concluded that the vapor intrusion pathway is considered potentially complete at both buildings. The numerical results were identical for both buildings: based on the maximum detected indoor air results, the total HI was below 1 at 0.02 and the cumulative cancer risk was 7×10^{-8} for an indoor worker at Buildings 18220 and 18224 (USAF, 2018b).	2017
The potential exists for concentrations of 1,4-dioxane to be present in conjunction with TCE contamination at the site.	Based on USAF guidance (*Interim Air Force Guidance on Sampling and Response Actions for 1,4-Dioxane at Operational and BRAC Installations, 15 Aug 2013*), recommend a sampling event be conducted to identify if concentrations of 1,4-dioxane exist. Determine whether there is an unacceptable risk at the site.	Completed	A 1,4-dioxane investigation was completed at JBER in 2017. No sample results from any DP098 groundwater monitoring wells exceeded the EPA Region 9 Regional Screening Level for residential tap water (0.46 µg/L) or the current ADEC cleanup level of 4.6 µg/L (USAF, 2017c).	2017
Groundwater COC data indicates variable conditions favorable to reductive dechlorination at DP098.	Conduct sampling at DP098 for MNA parameters [nitrate/nitrite, manganese (II), iron (II), sulfate, and methane] prior to the next FYR to identify where variably favorable conditions that support reductive dechlorination are present. Although the timeframe to meet RAOs (35 to 75 years) at DP098 are decades away, a more detailed understanding of aquifer conditions will be needed for future remedy evaluations.	Completed	Samples were collected during the 2015 monitoring event. Evaluation of MNA parameters indicated reducing conditions in the in-plume monitoring wells (USAF, 2017b).	2015

Table 14-4 (Cont.) DP098 Status of Recommendations from the 2014 FYR

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date
The LF004 CERCLA site boundary appears to extend beyond JBER-E site boundaries. *Note: this issue was specifically noted for LF004 but applied to all sites covered by the FYR.*	All CERCLA site boundaries should be reviewed for accuracy and be revised, when applicable, in a memorandum to the site file.	Completed	CERCLA site and LUC boundaries are maintained in a GIS database. At the time of this FYR, there are no noted boundary discrepancies at DP098.	Not applicable
An in-depth description of the historical site events for each OU and DP098 was not included within Table 2-1 of this FYR.	Expand the chronology table in the next FYR to include detailed information concerning the chronology of site events for each OU and DP098.	Considered But Not Implemented	Chronology table not required in approved template for this FYR.	Not applicable

Key:
µg/L – micrograms per liter
ADEC – Alaska Department of Environmental Conservation
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
COC – contaminant of concern
EPA – United States Environmental Protection Agency
FYR – Five-Year Review
GIS – geographic information system
HI – hazard index
JBER – Joint Base Elmendorf-Richardson
JBER-E – JBER-Elmendorf
LUC – land use control
MNA – monitored natural attenuation
OU – Operable Unit
RAO – remedial action objective
TCE – trichloroethylene
USAF – United States Air Force

14.4 FYR PROCESS

14.4.1 Site Interviews

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. Site interviews for JBER-E were conducted as discussed in Section 3.1. There were no specific comments regarding DP098. Formal interview records are provided in **Appendix C**.

14.4.2 Data Review

A summary of data since the 2014 FYR is presented in Section 14.2.3. Data collected at DP098 during the period of this FYR (2014-2018) were reviewed. Data reviewed included: 2014 through 2016 monitoring activities (USAF, 2015; 2017b; 2018c), 1,4-dioxane sampling (USAF, 2017c), the vapor intrusion study results (USAF, 2018b), and the DP098 DNAPL evaluation (USAF, 2018a). Data is presented in **Figure 14-1**.

Data collected under the ERP are archived in the USAF ERPIMS database; however, not all data collected over the life of DP098 may have been archived into the system. All historical data available in ERPIMS (29 August 2000 through 7 July 2017) were reviewed to support a technical assessment of chemical-specific toxicity changes since the ROD was signed. See Section 14.5.2.

14.4.3 Site Inspection

A site inspection was conducted at DP098 on 16 August 2017. The purpose of the inspection was to assess the protectiveness of the remedy. Due to facility security, no site photographs were taken. A site inspection form is provided in **Appendix E**. No issues were discovered that affect the current or future protectiveness of the remedy at the site.

14.5 TECHNICAL ASSESSMENT

14.5.1 Question A – Is the remedy functioning as intended by the decision documents?

Yes. The review of documents, site data, and the results of the site inspections indicate that the remedy for DP098, which included source material removal, MNA, and LUCs is functioning as intended by the ROD. Land use, soil use, and groundwater LUCs continue to be adequate and protective, and are preventing exposures to contaminated media that remain at the site.

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

No. Revised cleanup levels have been promulgated and toxicity data has changed since the ROD was signed.

Changes in Standards:

The chemical-specific ARARs for groundwater listed in the ROD (USAF, 2004b) do not have any changes that affect regulatory-based cleanup levels for groundwater COCs at DP098. However,

regulatory cleanup levels (18 AAC 75) have recently been revised and these changes are presented in **Table 14-5**. The new cleanup levels are human health based, and account for toxicity changes that have occurred since the ROD was signed.

Table 14-5: DP098 Comparison of ROD Final Remediation Goals to 2017 Standards

Chemical	ROD Cleanup Level	ADEC Cleanup Level[1]	Federal MCL[2]	Historic Site Concentration	LTM Site Sample
Soil (mg/kg)					
1,1-Dichloroethane	0.03	0.092	--		
cis-1,2-Dichloroethylene	0.2	0.12	--	1.8	--
Tetrachloroethene (PCE)	0.03	0.19	--		
Trichloroethylene (TCE)	0.027	0.011	--	94	--
Sediment (mg/kg)					
cis-1,2-Dichloroethylene	0.2	0.12	--	0.26	--
Trichloroethylene (TCE)	0.027	0.011	--	0.037	--
Groundwater (µg/L)					
1,1-Dichloroethane	7	4.6	7		
cis-1,2-Dichloroethylene	70	36	70	11,900	310
Trichloroethylene (TCE)	5	2.8	5	5,600	277
Tetrachloroethene (PCE)	5				
Vinyl Chloride	2	0.19	2	2,960	1.45

Key:
1 – ADEC cleanup levels (18 AAC 75, as amended through 7 November 2017).
-- – not applicable
µg/L – micrograms per liter
AAC – Alaska Administrative Code
ADEC – Alaska Department of Environmental Conservation
COC – contaminant of concern
LTM – long-term monitoring
MCL – maximum contaminant level
mg/kg – milligrams per kilogram
ROD – Record of Decision

All available data for DP098 were evaluated against the ADEC standards (ADEC, 2017). Calculations were performed for chemicals with detections above the new standards to determine exposure risk (**Appendix F**, **Tables F-1** through **F-3**). These calculations, based on maximum site concentrations and the residential exposure assumption, show a changed exposure risk for: (in groundwater) cis-1,2-DCE, TCE, and vinyl chloride.

A review was also conducted on chemicals with new toxicity data. No other chemicals at DP098 that required further investigation were identified. Although there are cancer risk and noncancer

hazard threshold exceedances at DP098, the LUCs restricting land use, soil use, and groundwater use continue to prevent exposures to contaminated media that may pose excessive risk.

Changes in Exposure Pathways

Manned facilities are present at DP098, and the vapor intrusion pathway was found to be potentially complete at Buildings 18220 and 18224. LUCs currently in place restricting the use of groundwater at the site are preventing exposures, and the vapor intrusion study concluded that no risk or hazard thresholds were exceeded.

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

No other information has been discovered that calls into question the protectiveness of the remedy for DP098.

14.6 ISSUES / RECOMMENDATIONS

Issues identified during this FYR that affect the protectiveness of the remedy are shown below.

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): DP098	**Issue Category:** Remedy Performance			
	Issue: Due to changes in toxicity data or regulatory cleanup standards, some chemicals current final remediation goals may exceed EPA human health guidance: (in groundwater) cis-1,2-DCE, TCE, and vinyl chloride.			
	Recommendation: The AF will evaluate any changes in promulgated standards and chemical toxicity characteristics in accordance with OSWER 9355.7-03B, Appendix G (June 2001) to determine if the current remedy will reduce contamination to within the acceptable CERCLA risk ranges for protectiveness. If the evaluation determines that acceptable risk will not be achieved by the current remedy, the decision document will be appropriately revised following the CERCLA process.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023

OU(s): DP098	Issue Category: Remedy Performance			
	Issue: Site COCs (TCE and cis-1,2-DCE) are increasing in concentration, downgradient of the plume.			
	Recommendation: The groundwater plume should be investigated and modeled, to determine if source areas are controlled and the plume boundary revised regularly. New treatment technologies to address the plume migration should be explored.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	12/31/2023

III. NEXT REVIEW

The next FYR report for JBER-E CERCLA sites is required is due no later than 5 years after the USAF signature date of the previous Five-Year Review.

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FIGURES

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Legend:

- JBER-Elmendorf Military Installation
- JBER-Richardson Military Inslallation

Note:
All locations are approximate.



Source:
USAF, 2014. Joint Base Elmendorf-Richardson, Alaska, Environmental Restoration Program, 2012 Land-Use Control Compliance Report. Final. April.

SCALE IN MILES
0 1.5

UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

FIFTH FIVE-YEAR REVIEW FOR CERCLA SITES, JBER-E, ALASKA

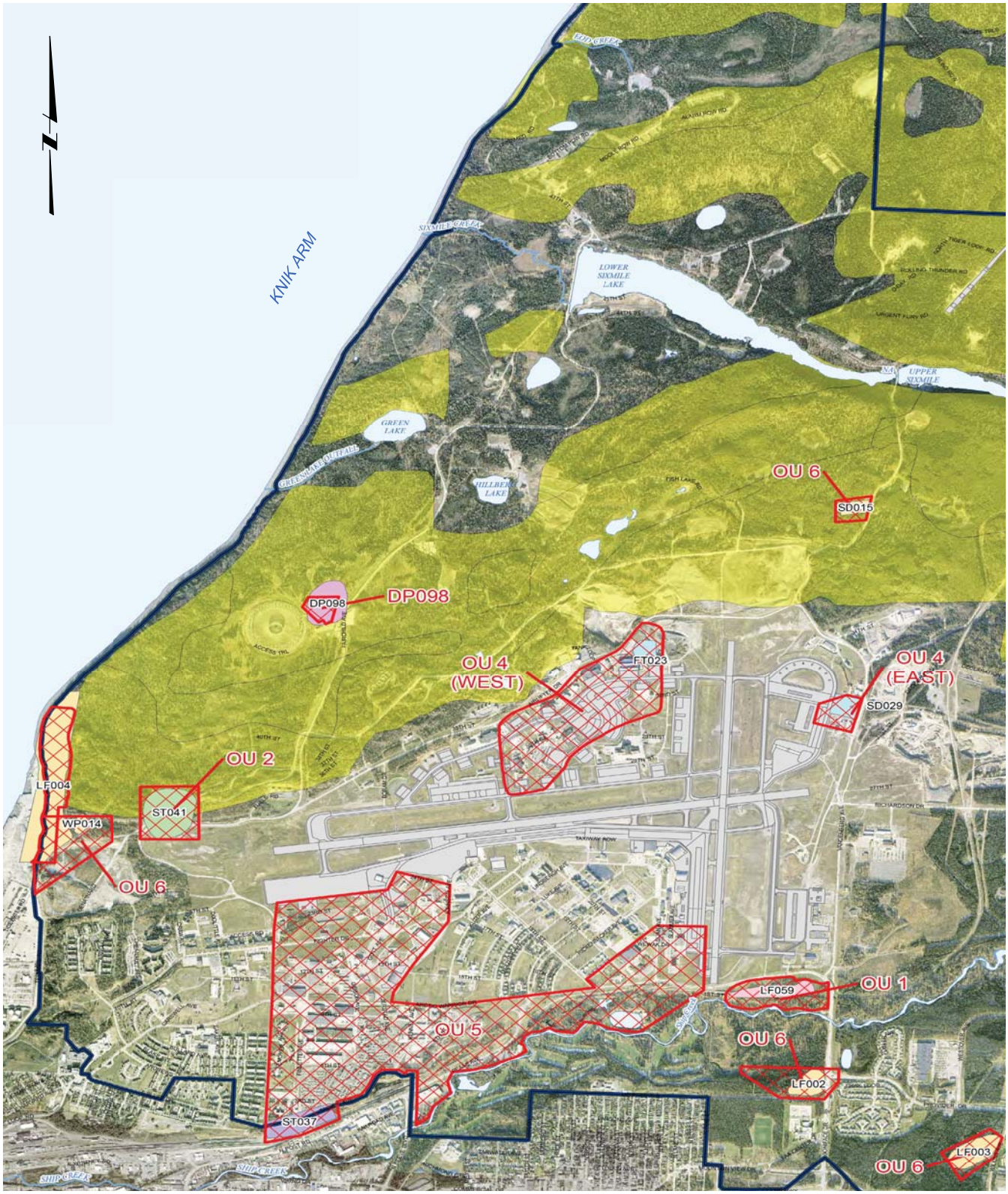
JBER - E
LOCATION AND VICINITY MAP

FIGURE
I-1

185750836.
100.69030401

FILE: C:\D\CAD\Proj\Stantec Cardno Baker JV\2017-2019 JBER_fyr_CERCLA site_185750836\2018-2019 Fifth Five-Year Cercla Sites\5-July 2019\fig I-1 Location map.dgn

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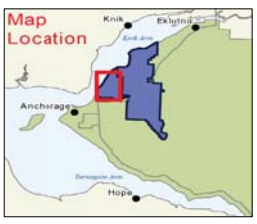


Note:
All locations are approximate.

Source:
USAF, 2014. United States Air Force, Joint Base Elmendorf-Richardson, Alaska. Environmental Restoration Program. Fourth CERCLA Five-Year Review Report. JBER-Elmendorf, Alaska. Final. March.

Legend:

- OU 1
- OU 2
- OU 4
- OU 5
- OU 6
- DP098
- LUC BOUNDARY
- HYDROGRAPHY
- AIRFIELD
- JBER-ELMENDORF BOUNDARY
- ELMENDORF MORAINE



SCALE IN FEET
0 1,600

UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

FIFTH FIVE-YEAR REVIEW FOR CERCLA SITES, JBER-E, ALASKA

JBER-E
FIVE-YEAR REVIEW SITE LOCATIONS

FIGURE
I-2

185750836.
100.69030401

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SCALE IN FEET
0 400

UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

FIFTH FIVE-YEAR REVIEW FOR CERCLA SITES,
JBER-E, ALASKA

OU1 - LF059
SITE LOCATION

FIGURE
4-1

185750836.
100.69030401

LF59MW-03	
Date	TCE
9/25/92	6.2
9/25/92	6
5/25/95	8
10/30/95	7.4
10/30/95	7.4
5/9/96	8.8
5/9/96	8.5
5/14/97	9.9
5/14/97	9.8
8/22/97	7.6
6/9/98	9.9
6/9/98	9.9
8/26/98	10.1
6/16/99	11
8/20/99	8.4
6/14/00	9
8/22/00	9.9
6/20/01	9
6/12/02	9.9
6/25/03	10
6/25/03	9.5
7/6/04	8.8
7/6/04	8.9
7/14/05	8.2
7/5/06	8
6/13/07	6.9
6/13/07	6.6
6/13/08	ND (0.22)
2/23/09	6.8
6/1/10	8.1
8/27/11	9.3 J
8/8/12	8.8
8/7/13	6.2
9/12/14	4.37
9/9/16	5.24

OU1LF-19	
Date	TCE
10/14/06	26
1/19/07	27
4/1/07	26
8/1/07	23
12/1/07	22
1/22/08	20
4/1/08	15
8/1/08	15
12/1/08	14
1/1/09	13
4/1/09	17
8/1/09	15
12/1/09	12
1/1/10	12
4/1/10	12
8/1/10	8.7
12/1/10	11
1/1/11	8.4
4/1/11	8.9
8/1/11	8.6
12/1/11	1

LF59MW-02	
Date	TCE
6/23/09	6.4
6/1/10	6.3
8/27/11	6.4 J
8/9/12	6.8
8/7/13	7.1
9/15/14	5.26
9/9/16	5.15

LF59MW-06R	
Date	TCE
9/26/01	0.57
6/12/02	0.31
6/16/03	ND (0.12)
7/7/04	0.34
7/21/05	0.37
7/21/05	0.37
6/29/06	0.35
6/18/07	0.46
6/13/08	0.27 F

LF59-09SEEP-SE	
Date	TCE
9/11/14	2.29

LF59MW-03	
Date	TCE
10/6/86	2.3
8/9/88	3
9/9/91	8.2
6/26/92	3.7
10/2/92	6
5/23/95	5.8
10/25/95	7.9
5/10/96	4.6
9/11/96	3.8
5/8/97	2.6
8/18/97	1.8
1/1/06	15
4/1/06	16
8/1/06	13
10/12/06	12
1/19/07	13
4/1/07	11
8/1/07	8.8
12/1/07	7.7
1/21/08	6.8
4/1/08	6.1
8/1/08	5.4
12/1/08	5.7
1/1/09	4.7
4/1/09	6.7
8/1/09	5.5
12/1/09	6.4
1/1/10	5
4/1/10	5.2
8/1/10	4.7
12/1/10	5.9
1/1/11	4.4
4/1/11	4.4
8/1/11	4.7
12/1/11	5.9



Legend:
- SEEP SAMPLE LOCATION
- NON-PROGRAM MONITORING WELL
- PROGRAM MONITORING WELL
- INFERRED GROUNDWATER PLUME (SOLVENTS)
- CLOSED CERCLA SITE
- OPEN CERCLA SITE
- LAND USE CONTROL BOUNDARY
- JBER BOUNDARY

Notes:
1. All groundwater results are in micrograms/liter [µ/L].
2. Red results exceed cleanup criteria.
TCE = Trichloroethylene
Cleanup Criteria = [5 µ/L]
ND = Not Detected (Detection Limit)
FLAGS:
F - Result in between the method detection limit and the reporting limit.
J - Analyte was positively identified, but result is estimated.

Note:
All locations are approximate.

Source:
- USAF, 2014. United States Air Force, Joint Base Elmendorf-Richardson, Alaska. Environmental Restoration Program. Fourth CERCLA Five-Year Review Report. JBER-Elmendorf, Alaska. Final. March.
- USAF, 2018c. 2016 Annual Remedial Action-Operations and Monitoring Report for Select CERCLA Sites. May.

SCALE IN FEET
0 250

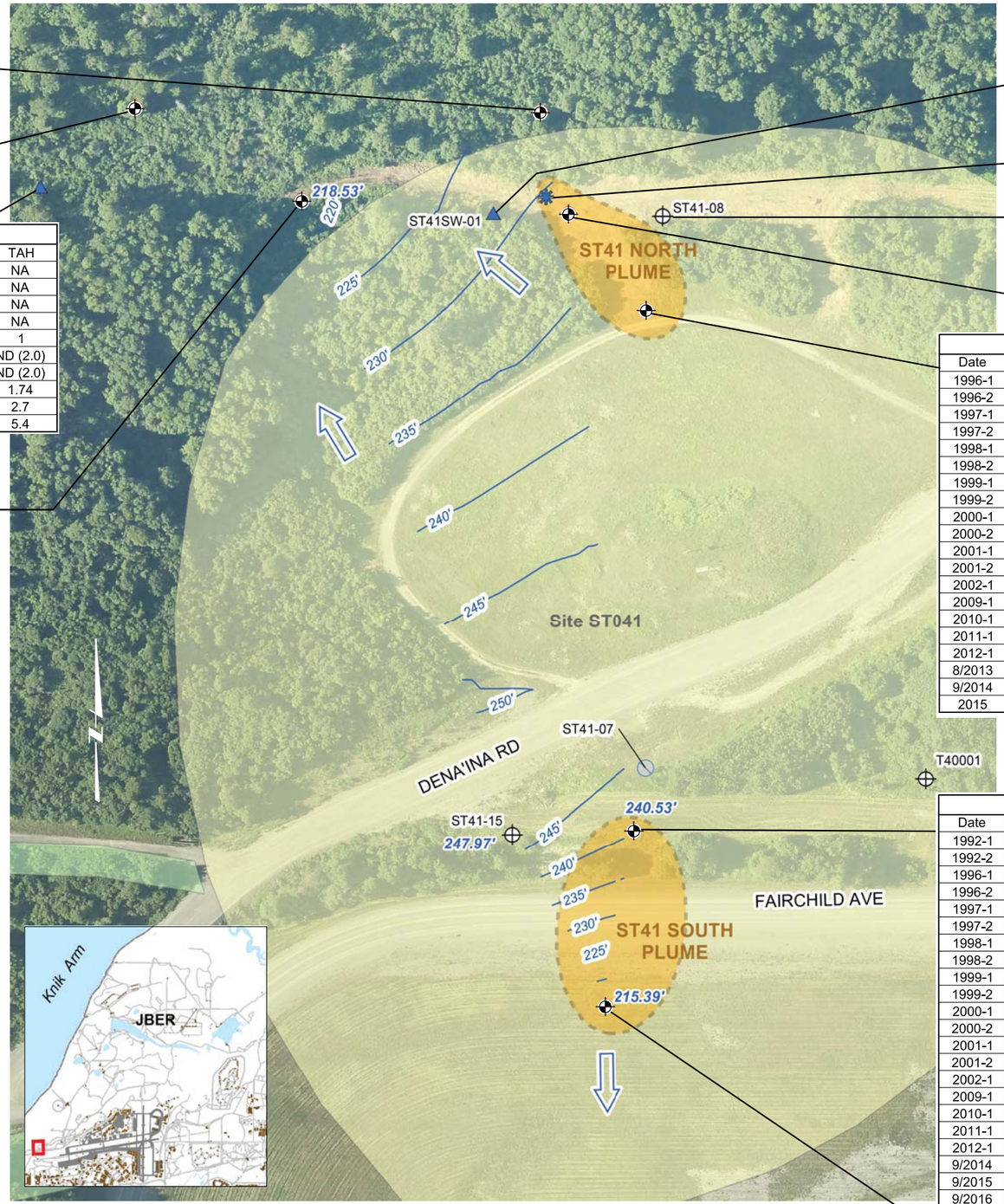
UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

FIFTH FIVE-YEAR REVIEW FOR CERCLA SITES, JBER-E, ALASKA

OU1 - LF059
SITE LAYOUT AND HISTORICAL DATA

FIGURE
4-2
185750836.100.69030401

FILE: C:\D\CAD\Proj\Stantec Cardno Baker JV\2017-2019 JBER_fy_CERCLA site_185750836\2018-2019 Fifth Five-Year Cercla Sites\5-July 2019\fig 4-2 LF059_data.dgn
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ST41-30

Date	Benzene	Ethylbenzene	Toluene	Xylene
8/2012	ND (0.2)	ND (0.2)	ND (0.4)	ND (1.2)

ST41-34

Date	Benzene	Ethylbenzene	Toluene	Xylene
8/2012	ND (0.45)	ND (0.45)	ND (0.45)	NA

ST41SW-13

Date	Benzene	Ethylbenzene	Toluene	Xylene	TAH
1999-1	ND (0.1)	ND (0.1)	ND (0.2)	NA	NA
2000-1	27.7	35.6	4.4	NA	NA
2008-1	ND (0.12)	ND (0.31)	ND (0.31)	NA	NA
2009-1	ND (1)	ND (1)	ND (2)	NA	NA
2010-1	ND (0.15)	ND (0.15)	0.2	0.5	1
2011-1	ND (0.2)	ND (0.2)	ND (0.4)	ND (1.2)	ND (2.0)
2012-1	ND (0.2)	ND (0.2)	ND (0.4)	ND (1.2)	ND (2.0)
9/2014	ND (0.2)	ND (0.5)	ND (0.5)	ND (1.5)	1.74
8/2015	ND (0.2)	ND (0.5)	ND (0.5)	ND (1.5)	2.7
9/2016	ND (0.4)	ND (1)	ND (1)	ND (3)	5.4

ST41-20

Date	Benzene	Ethylbenzene	Toluene	Xylene
8/2012	ND (0.2)	ND (0.2)	ND (0.4)	ND (1.2)

ST41SW-01

Date	Benzene	Ethylbenzene	Toluene
2005-1	180	180	6.5
2006-1	167	147	4.75
2007-1	93.1	69.2	2.29

ST41SP-01

Date	Benzene	Ethylbenzene	Toluene	Xylene
2005-1	93	49	1.2 J	NA
2006-1	121	30.9	0.94 J	NA
2007-1	100	42.5	0.72	NA
2012-1	140	140	ND (0.2)	252
8/2012	140	140	ND (0.2)	282

ST41-08

Date	Benzene	Ethylbenzene	Toluene	Xylene
1992-1	ND (0.45)	ND (0.58)	ND (0.27)	ND (0.41)
1992-2	ND (0.45)	ND (0.58)	ND (0.27)	ND (0.41)
2009-1	ND (1)	ND (1)	ND (1)	ND (2)

ST41-28

Date	Benzene	Ethylbenzene	Toluene	Xylene
1996-1	651	1,470	2,270	6,370
1996-2	737	1,360	2,730	35
1997-1	460	1,100	1,700	NA
1997-2	540	1,200	1,900	NA
1998-1	367	809	311	2,760
1998-2	356	754	870	3,450
1999-1	310	1,000	170	NA
1999-2	270	700	180	NA
2000-1	270	680	160	NA
2000-2	300	950	230	NA
2001-1	190	510	63	NA
2001-2	260	770	81	NA
2002-1	270	830	76	NA
2009-1	170	600	10	1,680
2010-1	130	530	8	1,275
2011-1	130	490	ND (4)	1,157
2012-1	80	440	0.94	NA
8/2013	32	420	4.9	1,430
9/2014	102	766	41.0 J	2,190
2015	0.34 ft of Product in well, no sample			

ST41-10R

Date	Benzene	Ethylbenzene	Toluene	Xylene
1991-2	64	130	7.7	20
1992-1	82	100	ND (2.7)	26
1992-2	18	7.7	ND (0.27)	ND (0.41)
1996-1	330	415	119	1,310
1996-2	261	263	112	NA
1997-1	240	420	190	NA
1997-2	200	240	93	NA
1998-1	311	428	67.2	1,710
1998-2	152	56.5	2.03	291
1999-1	310	440	19	NA
1999-2	210	370	65	NA
2000-1	130	350	20	NA
2000-2	130	210	2.6	NA
2001-1	120	270	3.5	NA
2001-2	130	170	2.5	NA
2002-1	90	210	9.2	NA
2003-1	82	180	NA	NA
2004-1	72	240	NA	NA
2005-1	41	180	NA	NA
2006-1	45	129	ND (3.1)	NA
2007-1	23.5	101	ND (0.31)	NA
2009	51	78	0.61 J	340
8/2012	54	170	ND (8)	806.4
9/2014	49	144	1.27	308

ST41-16

Date	Benzene	Ethylbenzene	Toluene	Xylene
1992-1	30,000	6,100	18,000	21,000
1992-2	18,000	4,700	20,000	15,000
1996-1	15,100	1,960	14,700	9,040
1996-2	13,500	1,660	13,600	6,500
1997-1	14,000	2,700	15,000	NA
1997-2	16,000	2,600	16,000	NA
1998-1	13,600	2,480	16,300	8,930
1998-2	17,600	1,840	18,900	7,740
1999-1	17,000	23,000	ND (1100)	NA
1999-2	13,000	1,600	13,000	NA
2000-1	13,000	2,700	17,000	NA
2000-2	16,000	2,200	19,000	NA
2001-1	14,000	1,800	17,000	NA
2001-2	11,000	1,500	12,000	NA
2002-1	13,000	1,700	16,000	NA
2009-1	12,000	2,200	16,000	8,800
2010-1	8,000	1,500	11,000	7,500
2011-1	7,700	1,600	9,400	7,100
2012-1	5,300	1,400	7,200	7,800
9/2014	5,950	1,760	7,190	8,890
9/2015	6,090	1,350	4,760	6,490
9/2016	6,300	1,840	5,780	8,240

ST41-25

Date	Benzene	Ethylbenzene	Toluene	Xylene
1991-2	ND (0.5)	660	ND (1)	460
1992-1	120	1,100	27	1,500
1992-2	40	820	ND (2.7)	670
1996-1	80.1	648	20.6	368
1996-2	73.4	733	18.3	373
1997-1	94	860	4.9	NA
1997-2	190	800	5.8	NA
1998-1	154	845	10	453
1998-2	118	682	6.88	369
1999-1	54	690	ND (5)	NA
1999-2	48	600	9	NA
2000-1	34	600	6	NA
2000-2	110	960	250	NA
2001-1	27	630	6.4	NA
2001-2	33	590	7.2	NA
2002-1	8	66	0.99	NA
2006-1	53	240	4.5 J	NA
2007-1	24.9	195	3.6	NA
2009-1	20	190	4.2	32
2010-1	11	95	4.6	19.5
2011-1	18	74	ND (20)	32
2012-1	ND (20)	57 J	ND (40)	ND (120)
9/2014	24.3	39	3.9	10.6
9/2015	19.5	48.2 J	2.59	6.82
9/2016	28.6	47.6	4.11	10.46

Notes:

1. All groundwater results are in micrograms per liter (ug/L).
2. Red results exceed cleanup criteria.

Benzene (5 ug/L*) (10 ug/L**)
Ethylbenzene (700 ug/L*) (10 ug/L**)
Toluene (1,000 ug/L*) (10 ug/L**)
Xylene (10,000 ug/L*)

TAH	Total Aromatic Hydrocarbons (10 ug/L*)
NA	Not Analyzed
AMSL	Above mean sea level
ND	Not Detected [LOD]
LOD	Limit of Detection
*	Analyte Cleanup Criteria
**	Surface Water Cleanup Criteria

FLAGS:
J - Analyte was positively identified, but result is estimated.

Legend:

- PROGRAM MONITORING WELL
- NON-PROGRAM MONITORING WELL
- ABANDONED MONITORING WELL
- SEEP SAMPLE LOCATION
- SURFACE WATER SAMPLE LOCATION
- GROUNDWATER PLUME - FUELS (DASHED WHERE INFERRED)
- CERCLA SITES
- GROUNDWATER CONTOUR (AMSL FEET - 5 FT. INTERVAL) (SYNOPTIC WATER LEVELS MEASURED JUNE 2015)
- GENERAL GROUNDWATER FLOW DIRECTION (APPROXIMATE)
- 164.82' GROUNDWATER ELEVATION (FEET AMSL) (SYNOPTIC WATER LEVELS MEASURED JUNE 2015)

Source:
- USAF, 2017c. United States Air Force, Joint Base Elmendorf-Richardson, Alaska. Environmental Restoration Program. 2016 Annual Remedial Action-Operations and Monitoring Report for Select CERCLA Sites. Draft. December.
- USAF, 2018c. 2016 Annual Remedial Action-Operations and Monitoring Report for Select CERCLA Sites. May.

Note:
All locations are approximate.

SCALE IN FEET
0 80

UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

FIFTH FIVE-YEAR REVIEW FOR CERCLA SITES, JBER-E, ALASKA

OU2 - ST041
SITE LAYOUT AND HISTORICAL DATA

FIGURE
5-1

185750836.
100.69030401

TIME: 07-AUG-2019 16:03 FILE: C:\D\CAD\Proj\Stantec Cardno Baker JV\2017-2019 JBER_Ivy_CERCLA site_185750836\2018-2019 Fifth Five-Year Cercla Sites\5-July 2019\fig 5-1 ST041_ data.dgn

TIME: 02-AUG-2019 13:10 FILE: C:\D\CAD\Proj\Stantec Cardno Baker JV\2017-2019 JBER_fyr_CERCLA site_185750836\2018-2019 Fifth Five-Year Cercla Sites\5-July 2019\fig 6-1 OU4_site.dgn



Legend:

- LUC Boundary
- Site Boudary
- General Groundwater Flow Direction

LUC Land Use Control Boundary

Source:
USAF, 2015b. United States Air Force, Joint Base Elmendorf-Richardson, Alaska. Environmental Restoration Program. Interim Remedial Action Completion Report, Site SD024. Final. August.

SCALE IN FEET
0 700

UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

FIFTH FIVE-YEAR REVIEW FOR CERCLA SITES,
JBER-E, ALASKA

OU4
SITE LOCATIONS

FIGURE
6-1

185750836.
100.69030401

FP-56				
Date	Benzene	TCE	PCE	cis-1,2-DCE
7/4/88	250	ND (50)	ND (50)	NA
5/30/93	268	35	2	20.7
5/30/93	193	45	4.1	29.7
7/31/93	139	39	4	28.2
7/31/93	180	37	ND (0.89)	26.1
8/25/93	398	75	7.4	46.6
8/25/93	325	63	5.9	39.7
6/7/95	137	27	2.8	14.5
6/7/95	93	NA	NA	NA
9/12/95	174	31	4.2	20.1
9/12/95	116	35	3.4	21.3
9/12/95	94	NA	NA	NA
9/12/95	117	NA	NA	NA
6/5/96	62	12	1.5	53.4
6/5/96	84	15	2.1	63
6/5/96	79	NA	NA	NA
6/5/96	102	NA	NA	NA
10/3/96	75	11	1.5	31
10/3/96	58	NA	NA	NA
5/22/97	51	18	4	36
8/29/97	47	12	1.3	47
5/26/98	17	7.3	1.1	14
5/26/98	17	7.2	1	13.8
5/26/98	17	NA	NA	NA
5/26/98	17	NA	NA	NA
8/11/98	15	7.5	1.3	12.2
8/11/98	16	NA	NA	NA
6/6/99	8.7	6.1	0.81	9.2
6/3/00	12	6.5	1.3	16
8/8/00	13	7.1	1.1	16
6/11/01	8.7	7.2	0.85	14
6/11/01	8.5	7.1	0.7	13
8/21/01	7.2	9.9	0.85	12
6/25/02	3.5	8	0.62	9.4
8/21/02	4.2	8.6	0.72	13
8/21/02	3.7	7.7	0.66	13
6/19/03	6.3	6.1	1	23
7/8/04	5.5	4.8	0.78	20
7/11/05	0.95	8.4	1.3	11
7/10/06	3.1	6.9	0.71	20
6/19/07	3.3	5.1	0.6	8.6
9/19/07	3.9	NA	NA	NA
6/13/08	0.81	5.1	0.6	8.6
6/16/09	0.76	4.5	0.49 F	8.3
6/16/10	ND (0.2)	0.76 F	ND (0.2)	1.1
9/15/11	0.55 J	1.4	0.19 J	4.1

W-15				
Date	Benzene	TCE	PCE	cis-1,2-DCE
7/30/93	ND (0.3)	1.2	ND (0.04)	0.203
8/29/93	0.38	0.2	ND (0.10)	ND (0.06)
6/13/08	ND (0.12)	1	ND (0.10)	0.51 F

GW-5A				
Date	Benzene	TCE	PCE	cis-1,2-DCE
10/9/86	ND (0.25)	NA	NA	NA
5/25/93	0.95	46	2.2	20
7/31/93	20.5	16	1.2	9.7
6/13/08	0.8	49	4.1	20
6/16/08	ND (0.12)	31	2.7	41
6/19/09	ND (0.12)	29	2.2	32
9/18/14	0.59	33.2	3.1	38.4
9/15/16	ND (0.4)	35.9	3.43	28

OU4MW-11				
Date	Benzene	TCE	PCE	cis-1,2-DCE
7/28/93	142	33	78	741
8/19/93	ND (1.8)	NA	NA	NA
8/30/93	104	25	41	476
6/7/95	192	56	52	904
6/7/95	136	NA	NA	NA
9/12/95	35	65	44	241
9/12/95	29	NA	NA	NA
6/5/96	22	12	21	462
6/5/96	28	NA	NA	NA
10/2/96	13	37	21	182
10/2/96	12	28	20	195
10/2/96	13	NA	NA	NA
10/2/96	13	NA	NA	NA
5/22/97	22	28	50	470
8/29/97	15	45	27	170
5/28/98	20	77	56	247
5/28/98	19	78	56	239
5/28/98	18	NA	NA	NA
5/28/98	19	NA	NA	NA
8/13/98	10	94	50	125
8/13/98	11	NA	NA	NA
6/6/99	11	68	43	260
8/12/99	6.1	48	29	400
6/3/00	ND (11)	96	53	340
8/8/00	6.3	59	43	320
8/8/00	7.5	75	52	460
6/11/01	4.3	78	38	400
6/11/01	4.4	73	41	410
8/21/01	ND (1.1)	37	30	360
6/25/02	3.8	53	33	390
6/25/02	3.8	49	33	400
8/21/02	3.2	20	22	340
8/21/02	3.4	24	24	360
8/21/02	3.2	19	21	330
6/16/03	3.3	12	17	410
7/13/04	3.1	11	12	340
7/13/04	3.4	11	11	350
7/11/05	2.1	15	16	200
7/11/05	2.2	13	15	210
7/10/06	2.2	7.3	5.7	220
7/10/06	2.4	6.8	5.8	230
6/19/07	3.5	NA	NA	NA
6/19/07	1.7	30	26	140
6/13/08	2.6	12	13	160
6/16/09	2.1	13	14	140
8/1/12	0.88 J	6.7	7.7	81
9/12/13	0.96 J	22	16	73
9/18/14	1.23	15	18	110

407MW-01				
Date	Benzene	TCE	PCE	cis-1,2-DCE
6/23/09	1	1.5	0.19 F	1.7
6/11/10	ND (0.2)	1	ND (0.2)	1.5
9/15/11	0.24 J	1.5	ND (0.2)	1.6
8/9/12	ND (0.2)	0.91 J	ND (0.2)	ND (0.4)
9/13/13	ND (0.2)	0.63 J	ND (0.2)	0.62 J
10/1/15	ND (0.2)	1.14	ND (0.5)	4.77

Former Fire Training Pit (bermed)
AIRLIFTER DR
AIRDROP AVE
FP-52 168.58'
FP-56 168.54'
Surface Fire Training Stand
BV-1C
OU4W-11 168.96'
168.6'
33RD ST
W-15
168.55'
168.5'
168.47'
168.45'
168.41'
Former 50,000 g
17534
Former Buried Drums and Debris Pile (Location is approximate)
7508

LEGEND

- Program Monitoring Well
- Non-Program Monitoring Well
- Abandoned Monitoring Well
- Soil Vapor Monitoring Point
- Groundwater Contour (feet AMSL) (Water level measured NOV 2014)
- General Groundwater Flow Direction (Approximate)
- 164.82' Groundwater Elevation (feet AMSL) (2014 Sampling Event)
- Groundwater Plume - Fuels & Solvents
- Source Area (Approximate)

NOTES:
1. All groundwater results are in micrograms per liter (ug/L).
2. **Bold** italicized results exceed cleanup criteria.

Benzene	Benzene (5 ug/L*)
TCE	Trichloroethene (5 ug/L*)
PCE	Tetrachloroethene (5 ug/L*)
cis-1,2 DCE	cis-1,2 Dichloroethene (70 ug/L*)
ND	Not Detected [Detection Limit]
NA	Not Analyzed
*	Analyte Cleanup Criteria

FLAGS:
F - Result is between the method detection limit and the reporting limit.
J - Analyte was positively identified, but result is estimated.

Source:
- USAF, 2014. United States Air Force, Joint Base Elmendorf-Richardson, Alaska. Environmental Restoration Program. Fourth CERCLA Five-Year Review Report. JBER-Elmendorf, Alaska. Final. March.
- USAF, 2015a. 2014 Annual Field Activities Report, CERCLA Sites. December.
- USAF, 2018c. 2016 Annual Remedial Action-Operations and Monitoring Report for Select CERCLA Sites. May.

SCALE IN FEET
0 50

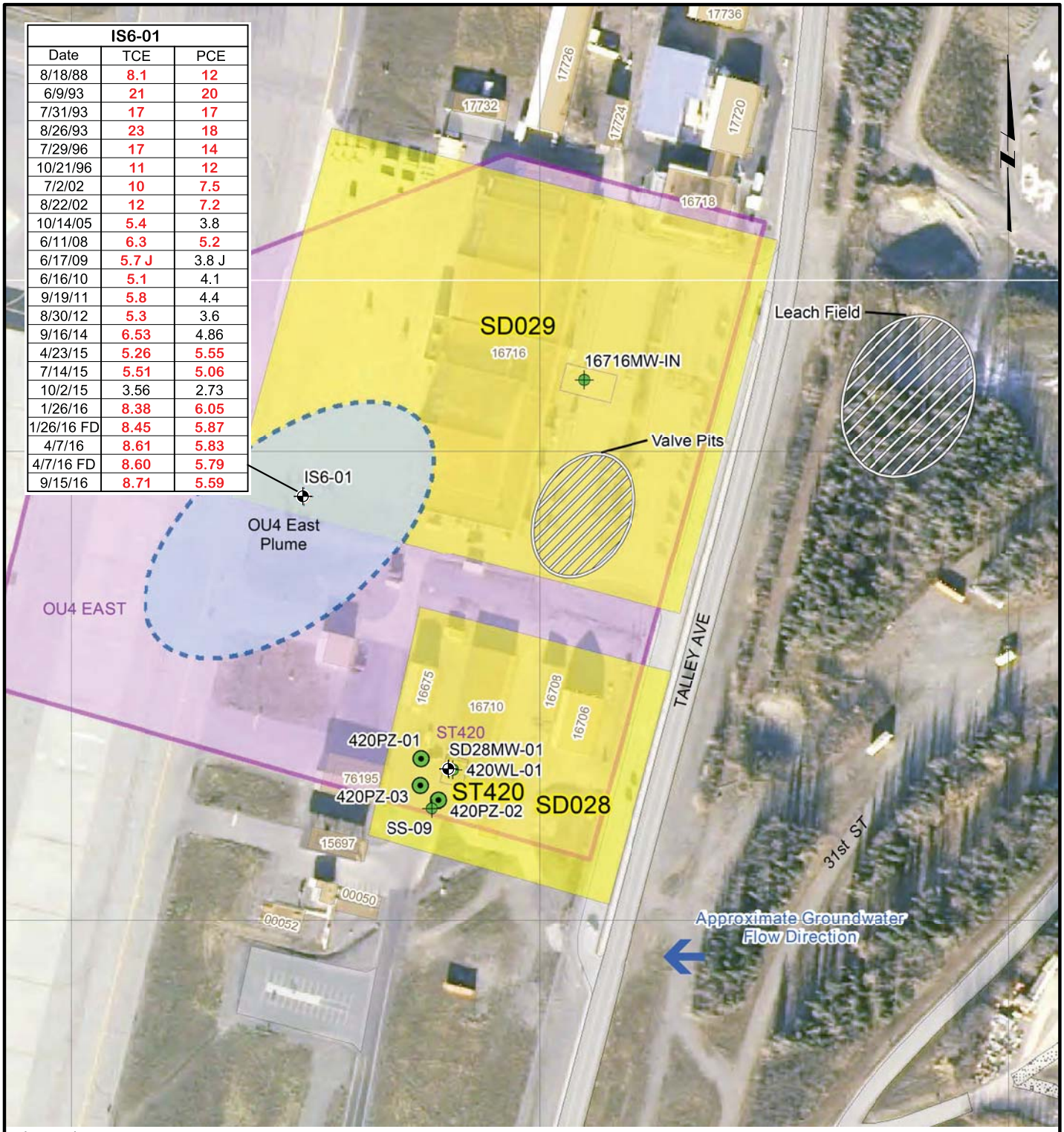
UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

FIFTH FIVE-YEAR REVIEW FOR CERCLA SITES, JBER-E, ALASKA

OU4 - FT023
SITE LAYOUT AND HISTORICAL DATA

FIGURE
6-2
185750836.100.69030401

FILE: C:\D\CAD\Proj\Stantec Cardno Baker JV\2017-2019 JBER 5yr_CERCLA site_185750836\2018-2019 Fifth Five-Year Cercla Sites\5-July 2019\fig 6-2 FT023_data.dgn
TIME: 07-AUG-2019 15:56



Legend:

- PROGRAM MONITORING WELL
- NON-PROGRAM MONITORING WELL
- PIEZOMETER WELL
- SOURCE AREA
- INFERRED GROUNDWATER PLUME (FUELS & SOLVENTS)
- CERCLA SITE BOUNDARY
- LAND USE CONTROL BOUNDARY
- BUILDING

Note:
All locations are approximate.

Sources:

- USAF, 2014. United States Air Force, Joint Base Elmendorf-Richardson, Alaska. Environmental Restoration Program. Fourth CERCLA Five-Year Review Report. JBER-Elmendorf, Alaska. Final. March.
- USAF, 2018c. 2016 Annual Remedial Action-Operations and Monitoring Report for Select CERCLA Sites. May.

Notes

1. All groundwater results are in micrograms/liter [µg/L].
2. Red results exceed cleanup criteria.
TCE (Trichloroethene) cleanup criteria = [5 µg/L]
PCE (Tetrachloroethene) cleanup criteria = [5 µg/L]
Flags:
J - Analyte was positively identified, but result is estimated.

SCALE IN FEET
0 100

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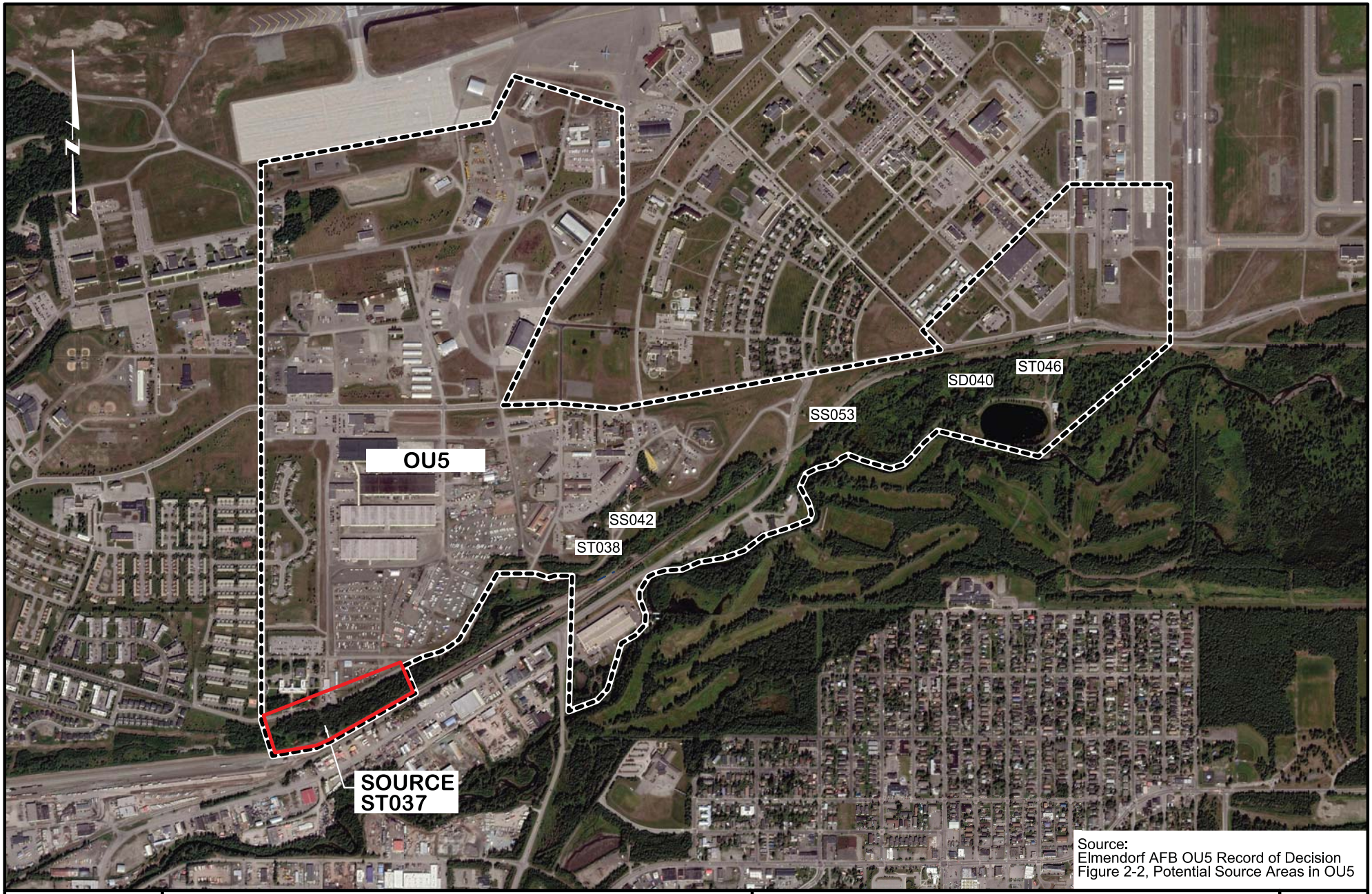
FIFTH FIVE-YEAR REVIEW FOR CERCLA SITES, JBER-E, ALASKA

OU4 - SD029
SITE LAYOUT AND HISTORICAL DATA

FIGURE
7-1
185750836.
100.69030401

FILE: C:\D\CAD\Pro\Stantec Cardno Baker JV\2017-2019 JBER_fyr_CERCLA site_185750836\2018-2019 Fifth Five-Year Cercla Sites\5-July 2019\fig 7-1 SD029_data.dgn
TIME: 07-AUG-2019 15:47

TIME: 08-AUG-2019 17:22 FILE: C:\D\CAD\Proj\Stantec Cardno Baker JV\2017-2019 JBER_fyr_CERCLA site_185750836\2018-2019 Fifth Five-Year Cercla Sites\5-July 2019\fig 8-1 OU5_plumes.dgn



Source:
Elmendorf AFB OU5 Record of Decision
Figure 2-2, Potential Source Areas in OU5

APPROXIMATE
SCALE IN FEET
0 700

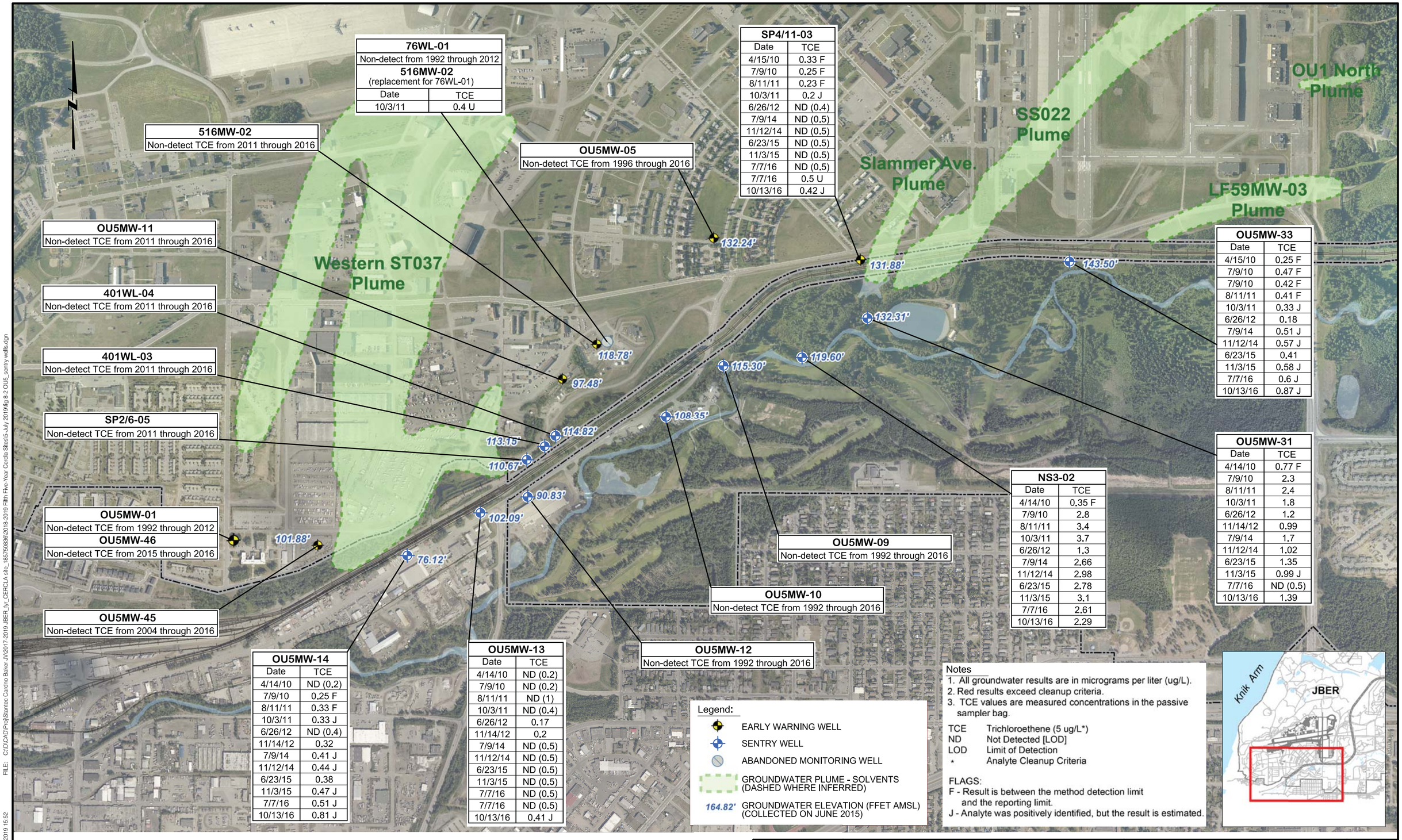
UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

FIFTH FIVE-YEAR REVIEW FOR CERCLA SITES,
JBER-E, ALASKA

OU5
SITE LOCATIONS

FIGURE
8-1

185750836.
100.69030401



Source:
USAF, 2017c. United States Air Force, Joint Base Elmendorf-Richardson, Alaska. Environmental Restoration Program. 2016 Annual Remedial Action-Operations and Monitoring Report for Select CERCLA Sites. Draft. December.

SCALE IN FEET
0 500

UNITED STATES AIR FORCE
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FIFTH FIVE-YEAR REVIEW FOR CERCLA SITES, JBER-E, ALASKA

OU5 EARLY WARNING AND SENTRY WELLS SITE MAP WITH HISTORICAL DATA

FIGURE
8-2

185750836.
100.69030401

FILE: C:\D\CAD\Proj\Stantec Cardno Baker JV\2017-2019 JBER_5yr_CERCLA site_185750836\2018-2019 Fifth Five-Year Cercla Sites\5-July 2019\fig 8-2 OU5_sentry wells.dgn
TIME: 07-AUG-2019 15:52

TIME: 03-AUG-2019 19:54 FILE: C:\D\CAD\Proj\Stantec Cardno Baker JV\2017-2019 JBER_fyr_CERCLA site_185750836\2018-2019 Fifth Five-Year Cercla Sites\5-July 2019\fig 8-3 OU5_ship creek.dgn



Source:
USAF, 2017c. United States Air Force, Joint Base Elmendorf-Richardson, Alaska. Environmental Restoration Program. 2016 Annual Remedial Action-Operations and Monitoring Report for Select CERCLA Sites. Draft. December.

Notes
1. All groundwater results are in micrograms per liter (ug/L).
2. Red results exceed cleanup criteria.

TCE	Trichloroethene (5 ug/L*)
ND	Not Detected [LOD]
LOD	Limit of Detection
*	Analyte Cleanup Criteria

Legend:
- SURFACE WATER SAMPLE LOCATION
- GROUNDWATER PLUME - SOLVENTS (DASHED WHERE INFERRED)
- GROUNDWATER PLUME - FUELS (DASHED WHERE INFERRED)

SCALE IN FEET
0 1,000

UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

FIFTH FIVE-YEAR REVIEW FOR CERCLA SITES, JBER-E, ALASKA

OU5 SHIP CREEK
SITE MAP WITH HISTORICAL DATA

FIGURE
8-3

185750836.
100.69030401

BPSW-01				
Date	Benzene	TAH	TAqH	TCE
3/10/14	ND (0.2)	2.00	2.19	0.67 J, B
7/8/14	ND (0.2)	2.70	3.10	1.07
9/9/14	ND (0.2)	4.20	4.65	ND (0.5)
12/16/14	ND (0.2)	2.70	3.20	0.77 J
3/17/15	ND (0.4)	5.40	6.50	0.56 F
6/10/15	ND (0.2)	2.70	3.21	0.56 J
9/11/15	ND (0.2)	2.52	3.03	0.56 J
12/1/15	ND (0.2)	2.70	3.22	0.79 J
3/29/16	ND (0.4)	5.40	6.33	0.56 J
6/23/16	ND (0.2)	2.70	3.10	0.65 J
9/14/16	ND (0.4)	5.40	6.25	0.63 J
12/6/16	ND (0.2)	2.70	3.12	0.52 J
12/6/16 FD	ND (0.2)	2.70	3.13	0.44 J

Notes

1. All groundwater results are in micrograms per liter (ug/L).
2. Red results exceed cleanup criteria.

Benzene (5 ug/L*)
TCE Trichloroethene (5 ug/L*)
TAH Total Aromatic Hydrocarbon (10 ug/L*)
TAqH Total Aqueos Hydrocarbon (15 ug/L*)
ND Not Detected [LOD]
LOD Limit of Detection
FD Field Duplicate
Q Quarter (Yearly)
* Analyte Cleanup Criteria

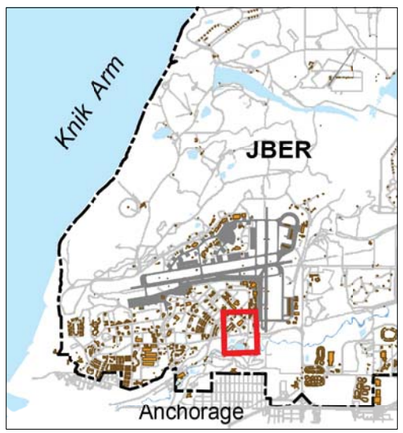
FLAGS:
F - Result is between the method detection limit and the reporting limit.
J - Analyte was positively identified, but result is estimated.

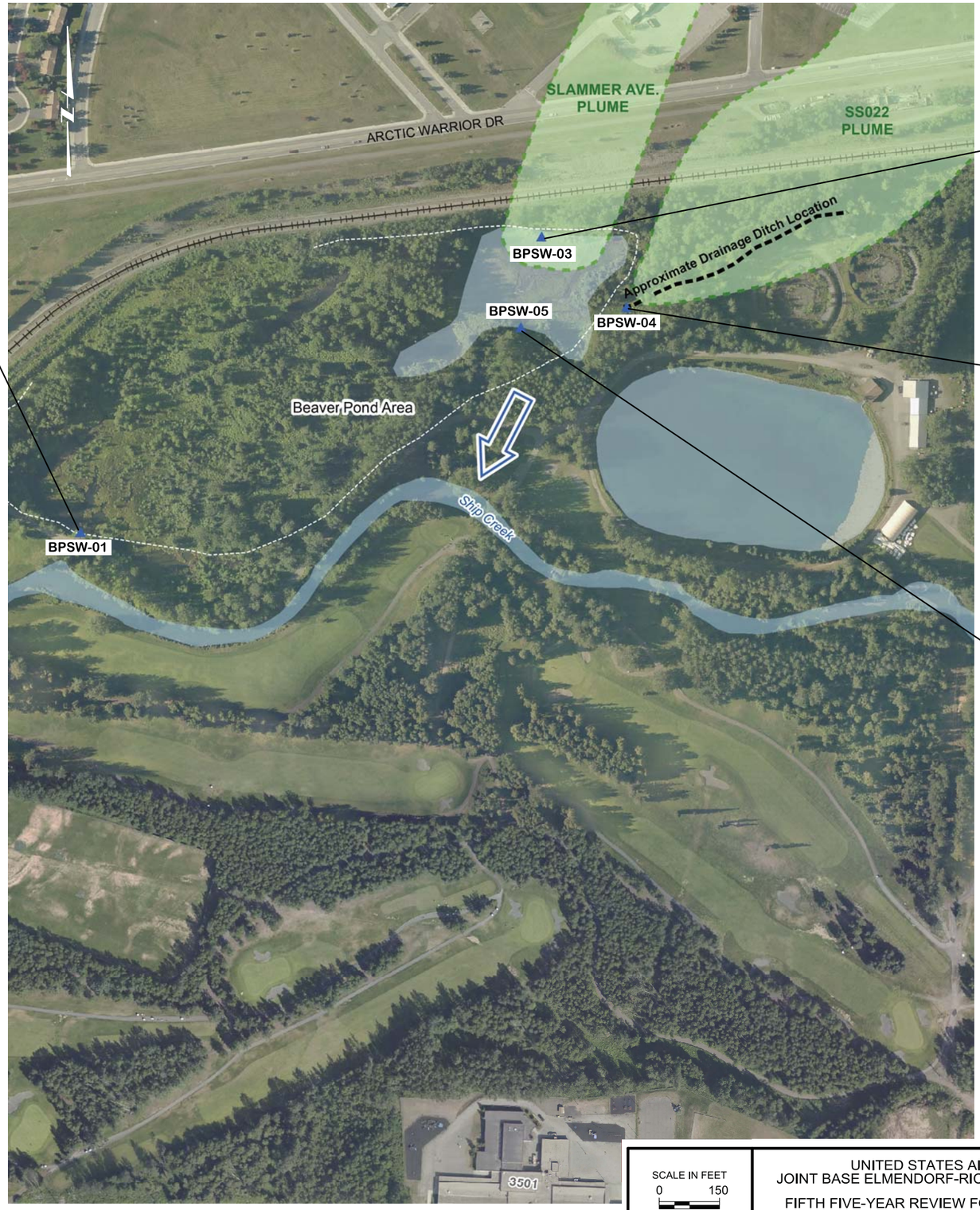
Legend:

SURFACE WATER SAMPLE LOCATION

GROUNDWATER PLUME - SOLVENTS

GENERAL GROUNDWATER FLOW DIRECTION (APPROXIMATE)





BPSW-03				
Date	Benzene	TAH	TAqH	TCE
3/10/14	0.18 J	1.98	2.24	1.8
7/8/14	ND (0.2)	2.70	3.10	1.88
9/9/14	ND (0.2)	4.20	4.65	ND (0.5)
12/16/14	Frozen, not sampled			
3/17/15	ND (0.4)	5.40	6.37	ND (1)
6/10/15	ND (0.2)	2.70	3.23	ND (0.5)
2015 Q3	No sample following approved WP			
12/1/15	0.27 J	2.70	4.11	3.37
3/29/16	ND (0.4)	5.40	6.46	ND (1)
6/23/16	ND (0.2)	2.70	3.47	1.11
9/16/16	0.31 J	5.31	14.7	1.26
9/16/16 FD	0.18 J	5.18	29.6	0.87 J
2016 Q4	Frozen, not sampled			

BPSW-04				
Date	Benzene	TAH	TAqH	TCE
3/10/14	ND (0.2)	2.00	2.18	5.6
7/8/14	ND (0.2)	2.70	3.10	8.96
9/9/14	ND (0.2)	4.20	4.64	6.87
12/16/14	ND (0.2)	2.70	3.17	7.61
3/17/15	ND (0.4)	5.40	6.39	9.57
6/10/15	ND (0.2)	2.70	3.20	9.13
2015 Q3	No sample following approved WP			
12/1/15	ND (0.2)	2.70	3.20	9.4
3/29/16	ND (0.4)	5.40	6.46	9.7
3/29/16 FD	ND (0.4)	5.40	6.32	9.94
6/22/16	ND (0.2)	2.70	3.13	9.56
9/15/16	ND (0.4)	5.40	6.26	11.3
12/10/16	ND (0.2)	2.70	3.11	7.29

BPSW-05				
Date	Benzene	TAH	TAqH	TCE
3/10/14	ND (0.2)	2.00	2.18	7.3
7/8/14	ND (0.2)	2.70	3.10	7.18
9/9/14	ND (0.2)	4.20	4.644	8.31
12/16/14	ND (0.2)	2.70	3.17	5.98
3/17/15	ND (0.4)	5.40	6.38	7.54
6/10/15	ND (0.2)	2.70	3.21	7.02
2015 Q3	No sample following approved WP			
12/1/15	ND (0.2)	2.70	3.20	5.31
3/29/16	ND (0.4)	5.40	6.30	7.93
6/22/16	ND (0.2)	2.70	3.15	6.89
9/15/16	ND (0.4)	5.40	6.25	8.71
12/10/16	ND (0.2)	2.70	3.11	4.96

Source:
USAF, 2017c. United States Air Force, Joint Base Elmendorf-Richardson, Alaska. Environmental Restoration Program. 2016 Annual Remedial Action-Operations and Monitoring Report for Select CERCLA Sites. Draft. December.

SCALE IN FEET
0 150

UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

FIFTH FIVE-YEAR REVIEW FOR CERCLA SITES, JBER-E, ALASKA

OU5 - ST037
BEAVER POND SURFACE WATER SAMPLE LOCATIONS AND HISTORICAL DATA

FIGURE
8-4
185750836.100.69030401

FILE: C:\DI\CAD\Proj\Stantec Cardno Baker JV\2017-2019 JBER_fyr_CERCLA site_185750836\2018-2019 Fifth Five-Year Cercla Sites\5-July 2019\fig 8-4_ST037_beaver-data.dgn
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OU5SP-07				
Date	Benzene	TAH	TAqH	TCE
8/12/03	NS	NS	NS	3.6
7/8/04	NS	NS	NS	4
7/27/05	NS	NS	NS	6.1
7/26/06	NS	NS	NS	5.3
3/25/09	ND (0.12)	0.19 M	0.19 M	4.4
6/2/09	ND (0.12)	ND	ND	5.3
9/25/09	ND (0.2)	ND	ND	4.7
9/25/09	ND (0.2)	ND	ND	4.4
12/14/09	ND (0.2)	ND	ND	5.7
3/15/10	ND (0.2)	ND	ND	4.6
6/5/10	ND (0.2)	ND	ND	5
9/8/10	ND (0.2)	0.55 F	0.55 F	4.2
12/2/10	ND (0.2)	ND	ND	5.4
3/15/11	ND	ND	ND	6.2
6/27/11	ND (0.2)	ND	ND	4.9
Q3 2011	NS	NS	NS	NS
1/11/12	ND (0.2)	ND	0.08	5.4
3/27/12	ND (0.2)	2	2.19	3.6
6/25/12	ND (0.2)	2	2.2	7.7
8/16/12	ND (0.45)	1.8	1.98	4.5
3/10/14	ND (0.2)	2.00	2.18	1.8
7/8/14	ND (0.2)	2.70	3.20	3.65
9/9/14	ND (0.2)	4.20	4.68	ND (0.5)
12/16/14	ND (0.2)	2.70	3.15	1.92
3/18/15	ND (0.4)	5.40	6.37	2.77
6/10/15	ND (0.2)	2.70	3.20	3.29
9/2/15	0.27 J	3.84	4.33	4.62
12/1/15	ND (0.2)	2.70	3.22	3.97
3/29/16	ND (0.4)	5.40	6.38	3.26
3/29/16 FD	ND (0.4)	5.40	6.36	3.95
6/22/16	ND (0.2)	2.70	3.13	5.63
9/14/16	ND (0.4)	5.40	6.24	2.83
12/8/06	ND (0.2)	2.70	3.11	5.44

OU5SP-18				
Date	Benzene	TAH	TAqH	TCE
1/15/03	NS	NS	NS	2.6
10/6/04	NS	NS	NS	2.2
1/26/05	NS	NS	NS	3.7
10/25/06	NS	NS	NS	2.9
4/24/07	NS	NS	NS	2.1
6/2/09	ND (0.12)	ND	ND	0.94 F
6/5/10	ND (0.2)	ND	ND	0.56 F
8/16/12	ND (0.45)	1.8	2.16	0.64 J
9/9/14	ND (0.20)	4.20	4.64	ND (0.5)
6/10/15	ND (0.20)	2.70	3.16	0.4 J
9/14/16	0.4 U	5.40	5.99	0.54 J

OU5SP-17				
Date	Benzene	TAH	TAqH	TCE
1/15/03	NS	NS	NS	5.3
10/6/04	NS	NS	NS	4.9
1/26/05	NS	NS	NS	6.3
7/26/06	NS	NS	NS	5.2
12/4/07	NS	NS	NS	4.6
6/2/09	ND (0.12)	ND	0.48 F	2.9
6/5/10	ND (0.2)	ND	ND	2.7
8/16/12	ND (0.45)	1.8	1.98	2.5
9/9/14	ND (0.20)	4.20	4.67	ND (0.5)
6/10/15	ND (0.20)	2.74	3.23	1.44
9/14/16	0.4 U	5.40	6.23	ND (1)

WCSD-09 (ug/kg)		
Date	Benzene	TCE
9/16/14[1]	0.83 J	ND (1.2)
9/16/14[2]	ND (34,4)	ND (34,4)
9/10/15[1]	ND (9,3)	ND (9,3)
9/10/15[2]	3.4 J	1.1 J
10/17/16[1]	ND (0,0064)	ND (0.0064)
10/17/16[1]FD	ND (0.01)	ND (0.01)
9/21/16[2]	ND (0.044)	ND (0.044)
9/21/16[2]FD	ND (0.095)	ND (0.095)

OU5SP-01				
Date	Benzene	TAH	TAqH	TCE
8/12/03	NS	NS	NS	ND (0.2)
7/14/04	NS	NS	NS	ND (0.2)
7/27/05	NS	NS	NS	ND (0.3)
5/2/06	NS	NS	NS	ND (0.3)
4/23/07	NS	NS	NS	0.77
6/2/09	0.29 F	0.29	0.89	ND (0.22)
6/6/10	5.6 J	116	135	ND (0.2)
12/2/10	0.27 F	0.27 F	0.27 F	ND (0.2)
6/24/11	4.4	149.06	174.06	ND (0.4)
6/26/12	4	131.87	147.18	ND (0.4)
8/16/12	4.1	12.73	76.17	ND (0.45)
3/10/14	3.2	120	154	ND (0.5)
7/8/14	3.38	141	146	ND (0.5)
9/9/14	2.77	222	234	ND (0.5)
12/16/14	3.8	140	157	ND (0.5)
2015 Q1	Frozen not sampled			
6/10/15	1.73	61.1	143	ND (0.5)
9/10/15	3.83	140	161	ND (0.5)
2015 Q4	Frozen not sampled			
3/30/16	3.5	97.1	119	ND (1)
6/22/16	4.06	160	163	ND (0.5)
9/14/16	3.73	109	111	ND (1)
2016 Q4	Frozen not sampled			

OU5SP-09				
Date	Benzene	TAH	TAqH	TCE
10/14/03	NS	NS	NS	17
7/8/04	NS	NS	NS	7.4
10/18/05	NS	NS	NS	21
1/24/06	NS	NS	NS	22
4/24/07	NS	NS	NS	13
3/21/08	NS	NS	NS	7.8
6/24/08	NS	NS	NS	8.3
6/24/08	NS	NS	NS	8.2
9/18/08	NS	NS	NS	3.9
9/18/08	NS	NS	NS	3.7
12/10/08	NS	NS	NS	2.6
3/25/09	ND (0.12)	ND	ND	1.9
6/2/09	ND (0.12)	ND	0.12 F	2.2
9/25/09	ND (0.2)	ND	ND	3
12/14/09	ND (0.2)	ND	ND	2.9
3/15/10	ND (0.2)	ND	ND	2.6
6/5/10	0.21 F	0.21 F	0.21 F	3.4
8/16/12	0.15 J	1.5	1.68	2
9/9/14	ND (0.20)	4.20	4.652	1.75
6/10/15	ND (0.20)	2.70	3.21	1.5
9/14/16	0.21 J	5.21	6.04	1.67

OU5SP-04				
Date	Benzene	TAH	TAqH	TCE
8/13/03	NS	NS	NS	ND (0.2)
7/9/04	NS	NS	NS	ND (0.2)
7/27/05	NS	NS	NS	ND (0.3)
5/2/06	NS	NS	NS	ND (0.3)
4/23/07	NS	NS	NS	0.62
6/2/09	0.65	0.65	0.68	1.2

OU5SP-11A				
Date	Benzene	TAH	TAqH	TCE
6/10/15	ND (0.2)	2.70	3.20	11.7
10/23/15	ND (0.2)	NA	NA	10.7

OU5SP-10				
Date	Benzene	TAH	TAqH	TCE
10/14/03	NS	NS	NS	17
3/22/04	NS	NS	NS	8.4
11/16/05	NS	NS	NS	11
7/26/06	NS	NS	NS	12
9/26/07	NS	NS	NS	8.3
3/21/08	NS	NS	NS	6.8
6/24/08	NS	NS	NS	7.6
9/18/08	NS	NS	NS	7.2
12/10/08	NS	NS	NS	6.4
3/25/09	ND (0.12)	ND	ND	7.2
6/2/09	ND (0.12)	ND	ND	6.8
6/2/09	ND (0.12)	ND	0.02 F	7.1
9/25/09	ND (0.2)	ND	ND	8.9
12/14/09	ND (0.2)	ND	ND	9.3
3/15/10	ND (0.2)	ND	ND	6.2
6/5/10	ND (0.2)	ND	ND	8.2
9/7/10	ND (0.2)	0.68 F	0.68 F	6.6
12/2/10	ND (0.2)	ND	ND	8.8
3/15/11	ND	ND	ND	9.1
6/24/11	ND (0.2)	ND	ND	6.6
2011 Q3	NS	NS	NS	NS
1/11/12	ND (0.2)	ND	0.01	7.4
1/11/12	ND (0.2)	ND	0.01	7.4
3/27/12	ND (0.2)	2	2.19	7.5
6/25/12	ND (0.2)	2	2.19	7.7
8/16/12	ND (0.45)	1.8	2.2	8.5
3/10/14	Frozen not sampled			
7/8/14	ND (0.2)	2.70	3.10	7.86
9/9/14	ND (0.2)	4.20	4.644	6.62
12/16/14	ND (0.2)	2.70	3.15	6.42
3/17/15	ND (0.4)	5.40	6.41	8.27
6/10/15	0.15 J	2.70	3.19	5.56
9/2/15	ND (0.2)	3.17	3.61	6.83
2015 Q4	Frozen not sampled			
3/29/16	ND (0.4)	5.40	6.36	6.37
6/22/16	ND (0.2)	2.70	3.14	8.39
9/14/16	ND (0.4)	5.40	6.25	10.2
2016 Q4	Frozen not sampled			

OU5SP-03				
Date	Benzene	TAH	TAqH	TCE
8/12/03	NS	NS	NS	0.67
7/14/04	NS	NS	NS	0.8
1/26/05	NS	NS	NS	0.93
7/26/06	NS	NS	NS	1.2
4/23/07	NS	NS	NS	1.5
6/2/09	0.65	0.65	0.68	1.2
6/5/10	0.7	0.7	0.7	1.2
8/16/12	0.49 J	1.84	2.12	1.5
9/9/14	ND (0.20)	4.20	4.64	ND (0.5)
6/10/15	0.43	2.95	3.48	1.93
9/14/16	0.45	5.45	6.27	2.08
9/14/16 FD	0.46	5.46	6.21	2.12

OU5SP-02				
Date	Benzene	TAH	TAqH	TCE
1/15/03	10	187.3	213.7	ND (0.1)
8/12/03	12	133.9	133.9	ND (0.2)
10/6/04	8.6	256.9	256.9	ND (0.2)
4/19/05	9.2	254.3	254.3	ND (0.2)
7/27/05	11	202.3	229.8	ND (0.2)
5/2/06	8.2	163.5	180.7	ND (0.2)
4/23/07	8.8	170.5	170.5	0.65
4/23/07	8.1	NA	NA	1.7
12/4/07	7.3	169.4	198.4	ND (0.2)
3/25/09	7.6	176	192	ND (0.22)
6/2/09	6.4	133	146	ND (0.22)
9/25/09	12 J	149	169	ND (0.2)
12/14/09	16	134	151	ND (0.2)
3/15/10	18 J	166	181	ND (0.2)
6/6/10	18 J	156	170	ND (0.2)
9/8/10	22	109	122	ND (0.2)
12/2/10	23 J	130 J	146	ND (0.2)
4/4/11	12	131	145	ND (0.2)
6/24/11	21	109.98	123.98	0.4 U
6/24/11	19	135.49	156.49	0.4 U
2011 Q3	NS	NS	NS	NS
1/11/12	13	128.9	143.96	ND (0.4)
3/27/12	15	132.73	157	ND (0.2)
6/26/12	26	163.79	186.82	ND (0.4)
8/16/12	16	22.42	53.2	ND (0.45)
3/10/14	Frozen not sampled			
7/8/14	20.8	123	134	ND (0.5)
9/9/14	18.6	188	199	ND (0.5)
12/16/14	18.8	111	121	ND (0.5)
2015 Q1	Frozen not sampled			
6/10/15	18.0	95.3	112	ND (0.5)
9/10/15	18.9	98.4	113	ND (0.5)
12/1/15	16.8	90.4	112	ND (0.5)
3/30/16	20.1	111	126	ND (1)
6/22/16	16.5	96.7	107	ND (0.5)
9/14/16	18.9	92.7	107	ND (1)
2016 Q4	Frozen not sampled			

OU5SP-15				
Date	Benzene	TAH	TAqH	TCE
9/25/02	NS	NS	NS	ND (0.12)
8/12/03	NS	NS	NS	ND (0.18)
7/14/04	NS	NS	NS	ND (0.18)
7/27/05	NS	NS	NS	ND (0.31)
7/26/06	NS	NS	NS	ND (0.22)
6/11/07	NS	NS	NS	0.29
6/24/08	NS	NS	NS	ND (0.22)
6/2/09	1.7	2.2	2.2	ND (0.22)
6/5/10	0.99	2	2	ND (0.2)
8/26/12	0.31 J	1.66	1.91	ND (0.45)
9/9/14	ND (0.20)	4.20	4.656	ND (0.5)
6/10/15	ND (0.20)	3.43	3.91	ND (0.5)
9/21/16	ND (0.4)	5.40	6.19	ND (1)

OU5CP-01				
Date	Benzene	TAH	TAqH	TCE
3/10/14	Frozen not sampled			
7/8/14	1.03	14.0	17.4	ND (0.5)
9/9/14	ND (0.2)	12.4	14.5	ND (0.5)
12/16/14	0.18 J	2.75	3.41	ND (0.5)
2015 Q1	Frozen not sampled			
6/10/15	0.80	4.23	4.67	ND (0.5)
9/2/15	0.18 J	2.68	3.57	ND (0.5)
2015 Q4	Frozen not sampled			
3/30/16	ND (0.4)	5.40	6.36	ND (1)
6/22/16	0.32 J	11.2	11.9	ND (0.5)
6/22/16 FD	0.31 J	10.9	11.7	ND (0.5)
9/14/16	ND (0.4)	3.90	4.80	ND (1)
2016 Q4	Frozen not sampled			

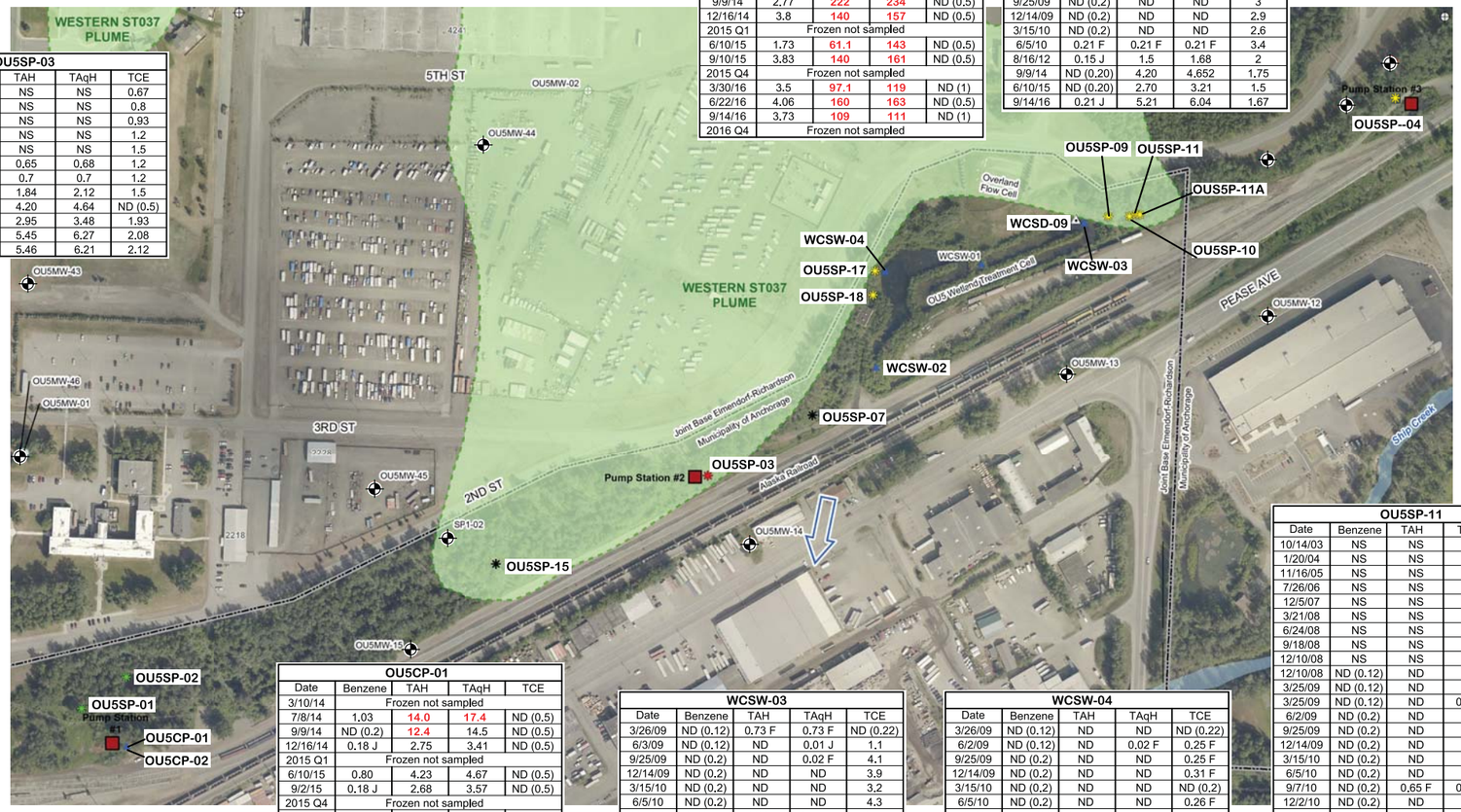
OU5CP-02				
Date	Benzene	TAH	TAqH	TCE
3/10/14	ND (0.2)	1.41	1.77	ND (0.40)
7/8/14	0.28 J	4.90	6.10	ND (0.5)
9/9/14	ND (0.2)	3.94	4.80	ND (0.5)
12/16/14	0.23 J	3.44	4.47	ND (0.5)
3/18/15	0.56	8.92	12.2	ND (1)
6/10/15	0.22 J	2.51	3.34	ND (0.5)
9/2/15	ND (0.2)	2.70	3.36	ND (0.5)
12/1/15	0.38 J	4.30	5.28	ND (0.5)
3/30/16	0.35 J	5.38	7.25	ND (1)
6/22/16	0.19 J	12.1	13.0	ND (0.5)
9/14/16	0.3 J	4.97	6.13	ND (1)
12/6/16	0.8	8.31	9.50	ND (0.5)

WCSW-03				
Date	Benzene	TAH	TAqH	TCE
3/26/09	ND (0.12)	0.73 F	0.73 F	ND (0.22)
6/3/09	ND (0.12)	ND	0.01 J	1.1
9/25/09	ND (0.2)	ND	0.02 F	4.1
12/14/09	ND (0.2)	ND	ND	3.9
3/15/10	ND (0.2)	ND	ND	3.2
6/5/10	ND (0.2)	ND	ND	4.3
9/7/10	ND (0.2)	0.42 F	0.42 F	2.6
12/2/10	ND (0.2)	ND	0.13 F	4.2
3/15/11	ND	ND	ND	2.6
6/24/11	ND (0.2)	ND	ND	4.6
9/23/11	ND (0.2)	ND	ND	4.4
1/11/12	ND (0.2)	ND	0.03	7.5
3/27/12	ND (0.2)	2	2.2	4.5
6/25/12	ND (0.2)	2	2.19	0.67
8/16/12	ND (0.45)	1.8	2.01	ND (0.45)
3/10/14	ND (0.2)	2.00	2.19	2
7/8/14	ND (0.2)	2.70	3.10	0.37 J
9/9/14	ND (0.2)	4.20	4.64	ND (0.5)
12/16/14	ND (0.2)	2.70	3.13	0.42
3/17/15	ND (0.4)	5.40	6.40	ND (0.1)
6/10/15	ND (0.2)	2.70	3.20	4.83
9/8/15	ND (0.2)	2.70	3.49	ND (0.5)
12/1/15	ND (0.2)	2.70	3.19	4.75
3/29/16	ND (0.4)	5.40	6.32	4.8
6/22/16	ND (0.2)	2.60	3.03	3.45
9/14/16	ND (0.4)	5.40	6.22	4.88
12/6/16	ND (0.2)	2.70	3.13	4.3

WCSW-04				
Date	Benzene	TAH	TAqH	TCE
3/26/09	ND (0.12)	ND	ND	ND (0.22)
6/2/09	ND (0.12)	ND	0.02 F	0.25 F
9/25/09	ND (0.2)	ND	ND	0.25 F
12/14/09	ND (0.2)	ND	ND	0.31 F
3/15/10	ND (0.2)	ND	ND	ND (0.2)
6/5/10	ND (0.2)	ND	ND	0.26 F
9/8/10	ND (0.2)	0.38 F	0.38 F	0.39 F
12/2/10	ND (0.2)	ND	ND	ND (0.2)
3/15/11	ND	ND	ND	ND
6/24/11	ND (0.2)	ND	0.0066 F	0.4 F
9/23/11	ND (0.2)	ND	0.018 J	0.39 J
1/11/12	ND (0.2)	ND	0.03	0.27 J
3/27/12	ND (0.2)	2	2.22	0.28
6/25/12	ND	2	2.19	0.67
8/16/12	ND (0.45)	1.8	2	0.46 J
3/10/14	ND (0.2)	2.00	2.19	0.43 J
7/8/14	ND (0.2)	2.70	3.10	0.5 J
9/9/14	ND (0.2)	4.20	4.64	ND (0.5)
12/16/14	ND (0.2)	2.70	3.16	ND (0.5)
3/17/15	ND (0.4)	4.75	5.68	ND (1)
6/10/15	ND (0.2)	2.70	3.20	ND (0.5)
9/8/15	ND (0.2)	2.70	3.25	ND (0.5)
12/1/15	ND (0.2)	2.70	3.19	ND (0.5)
3/29/16	ND (0.4)	5.40	6.35	ND (1)
6/22/16	ND (0.2)	2.70	3.13	ND (0.5)
9/14/16	ND (0.4)	5.40	6.23	ND (1)
12/6/16	ND (0.2)	2.70	3.17	ND (0.5)

OU5SP-11				
Date	Benzene	TAH	TAqH	TCE
10/14/03	NS	NS	NS	14
1/20/04	NS	NS	NS	10
11/16/05	NS	NS	NS	11
7/26/06	NS	NS	NS	11
12/5/07	NS	NS	NS	7.6
3/21/08	NS	NS	NS	7.6
6/24/08	NS	NS	NS	7.8
9/18/08	NS	NS	NS	7.6
12/10/08	NS	NS	NS	7.2
12/10/08	ND (0.12)	ND	ND	7.3
3/25/09	ND (0.12)	ND	ND	8.8
3/25/09	ND (0.12)	ND	0.02 F	9.4
6/2/09	ND (0.2)	ND	ND	9.4
9/25/09	ND (0.2)	ND	ND	7.8
12/14/09	ND (0.2)	ND	ND	7.6
3/15/10	ND (0.2)	ND	ND	6.4
6/5/10	ND (0.2)	ND	ND	8.2
9/7/10	ND (0.2)	0.65 F	0.65 F	6.9
12/2/10	ND (0.2)	ND	ND	9
3/15/11	ND	ND	ND	9.8
6/24/11	ND (0.2)	ND	ND	8.5
2011 Q3	NS	NS	NS	NS
1/11/12	ND (0.2)	ND	0.02	9.9
3/27/12	ND (0.2)	2	2.2	9
6/25/12	ND (0.2)	2	2.19	9.8
8/16/12	ND (0.45)	1.8	2	9.2
3/10/14	ND (0.2)	2.00	2.19	7.8
7/8/14	ND (0.2)	2.70	3.10	9.63
9/9/14	ND (0.2)	4.20	4.65	8.56
12/16/14	ND (0.2)	2.70	3.13	9.7
3/17/15	ND (0.4)	5.40	6.40	4.17
6/10/15	ND (0.2)	2.70	3.20	9.94
9/2/15	0.27 J	3.72	4.20	9.82
12/1/15	ND (0.2)	2.70	3.21	11.4
3/29/16	ND (0.4)	5.40	6.30	12
6/22/16	ND (0.2)	2.70	3.13	10.3
6/22/16 FD	ND (0.2)	2.86	3.29	10
9/14/16	ND (0.4)	5.40	6.21	12
9/14/16 FD	ND (0.4)	5.40	6.27	11.3
12/8/16	ND (0.2)	2.70	3.13	8.74

WCSW-02				
Date	Benzene	TAH	TAqH	TCE
3/26/09	ND (0.12)	ND	ND	0.36 F
4/20/09	ND (0.12)	ND	0..01 J	0.42 F
4/27/09	ND (0.12)	ND	0.02 F	ND (0.22)
5/4/09	ND (0.12)	ND	ND	ND (0.22)
5/11/09	ND (0.12)	ND	ND	ND (0.22)
5/26/09	ND (0.12)	ND	ND	ND (0.22)
6/2/09	ND (0.12)	ND	ND	ND (0.22)
6/8/09	ND (0.12)	ND	0.21 F	ND (0.22)
6/22/09	ND (0.12)	ND	ND	ND (0.22)
7/6/09	ND (0.12)	ND	0.29 J	ND (0.22)
7/20/09	ND (0.12)	ND	0.43 F	0.59 F
8/3/09	ND (0.12)	ND	0.02 F	0.32 F
8/10/09	ND (0.12)	ND	0.03 F	ND (0.22)
8/17/09	ND (0.12)	ND	0.28 F	0.35 F
8/24/09	ND (0.12)	ND	0.28 J	ND (0.22)
9/22/09	ND (0.2)	ND	ND	ND (0.2)
9/25/09	ND (0.2)	ND	ND	0.30 F
10/5/09	ND (0.2)	0.25 F	0.25 F	ND (0.2)
10/19/09	ND (0.2)	0.23 F	0.82	0.36 F
1019/09	ND (0.2)	ND	0.12 F	1.5
11/16/09	ND (0.2)	0.23 F	0.23 F	0.36 F
12/14/09	ND (0.2)	0.33 F	0.33 F	1.3
1/19/10	ND (0.2)	0.51 F	0.51 F	0.31 F
2/16/10	ND (0.2)	ND	ND	0.34 F
3/15/10	ND (0.2)	ND	ND	0.25 F
3/15/10	ND (0.2)	ND	ND	0.23 F
5/3/10	ND (0.2)	ND	0.13 F	ND (0.2)
6/5/10	ND (0.2)	ND		ND (0.2)
9/8/10	ND (0.2)	0.44 F	0.44 F	ND (0.2)
12/2/10	ND (0.2)	ND	0.19	0.36 F
12/2/10	ND (0.2)	ND	ND	0.41 F
3/15/11	ND	ND	ND	0.59 F
6/24/11	ND (0.2)	ND	0.2552	0.40 U
9/23/11	ND (0.2)	ND	0.0179 J	0.15 J
1/11/12	ND (0.2)	ND	0.07	0.79 J
3/27/12	ND (0.2)	1.9	2.2	ND (0.4)
6/25/12	ND (0.2)	1.93	2.11	ND (0.4)
8/16/12	ND (0.45)	2.2	2	0.55 B
3/10/14	ND (0.2)	2.00	2.19	0.55 J
7/8/14	ND (0.2)	2.70	3.10	ND (0.5)
9/9/14	ND (0.2)	4.20	4.64	ND (0.5)
9/9/14	ND (0.2)	2.70	3.17	ND (0.5)
3/18/15	ND (0.4)	5.40	6.50	ND (0.1)
6/10/15	ND (0.2)	2.70	3.20	ND (0.5)
9/8/15	ND (0.2)	2.66	3.17	ND (0.5)
12/1/15	ND (0.2)	2.70	3.20	0.96 J
3/29/16	ND (0.4)	5.40	6.35	1.18
6/22/16	ND (0.2)	2.70	3.13	ND (0.4)
9/14/16	ND (0.4)	5.40	6.24	0.34 J
12/6/16	ND (0.2)	2.70	3.11	1.08



Notes

1. All groundwater results are in micrograms per liter (ug/L).
2. Red results exceed cleanup criteria.
3. Sediment samples units are micrograms per kilogram (µg/kg).

[1]Sample analyzed using low-level VOC method.
[2]Sample analyzed using medium level (methanol preserved) VOC method.

Benzene (5 ug/L*)
TCE Trichloroethene (5 ug/L*)
TAH Total Aromatic Hydrocarbon (10 ug/L*)
TAqH Total Aqueous Hydrocarbon (15 ug/L*)
ND Not Detected [LOD]
LOD Limit of Detection
VOC Volatile Organic Compound
FD Field Duplicate
NS Not Sampled
Q Quarter (Yearly)
NA Not Analyzed
* Analyte Cleanup Criteria

FLAGS:
F - Result is between the method detection limit and the reporting limit.
J - Analyte was positively identified, but result is estimated.

Legend:

- Program Monitoring Well
- Non-Program Monitoring Well
- Abandoned Monitoring Well
- Seep Not Routed to Wetland
- Seep Routed to Wetland Until April 2009
- Seep Routed to Wetland Until August 2009
- Seep Currently Routed to Wetland
- Surface Water Sample Location
- Sediment Sample Location
- General Groundwater Flow Direction (Approximate)
- Groundwater Plume - Solvents

Source:
USAF, 2017c, United States Air Force, Joint Base Elmendorf-Richardson, Alaska, Environmental Restoration Program. 2016 Annual Remedial Action-Operations and Monitoring Report for Select CERCLA Sites. Draft. December.

SCALE IN FEET
0 200

UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

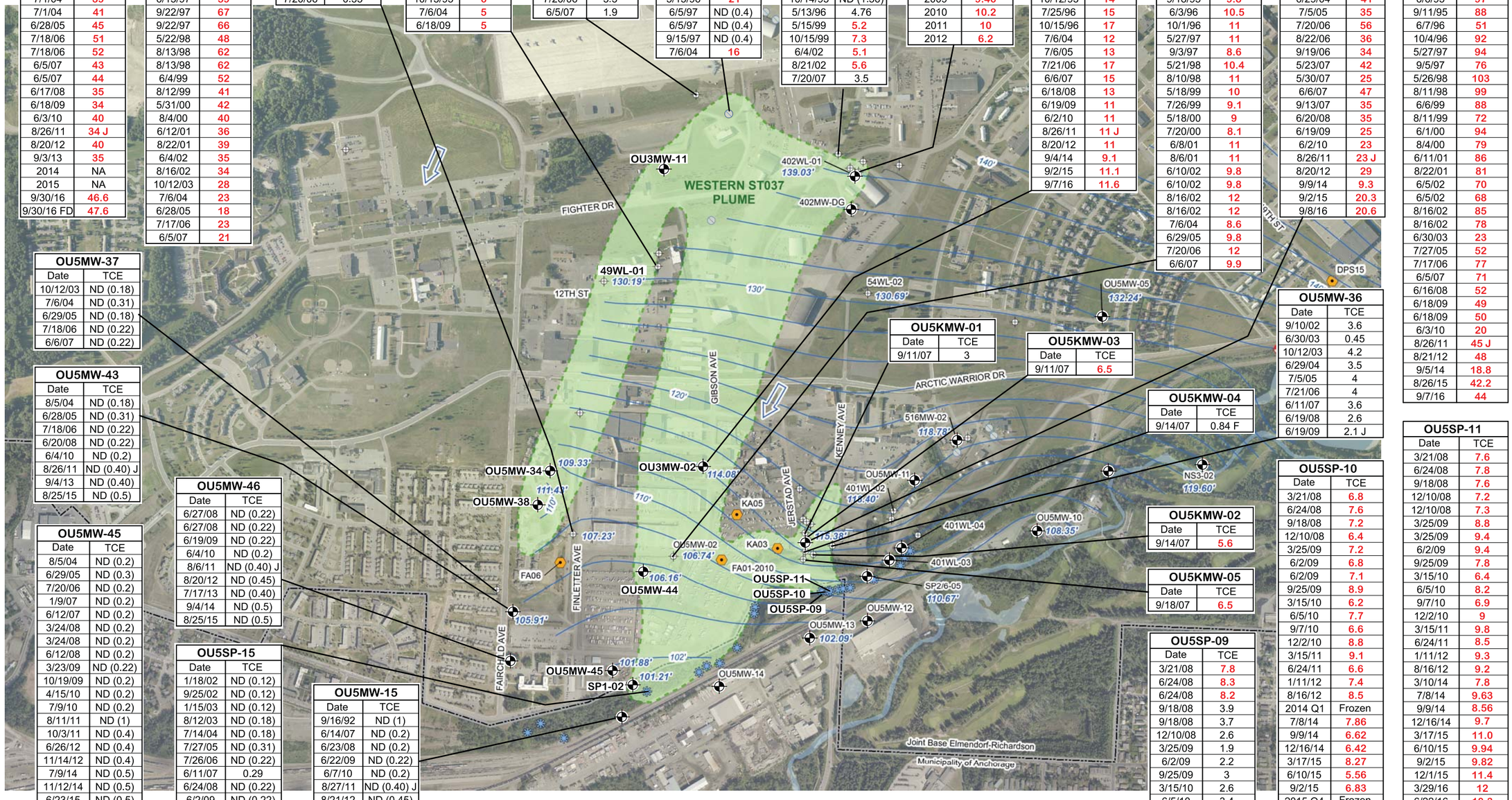
FIFTH FIVE-YEAR REVIEW FOR CERCLA SITES, JBER-E, ALASKA

OU5 - ST037
WETLAND REMEDIATION SITE MAP WITH SEEP AND SURFACE WATER ANALYTICAL DATA

FIGURE
8-5

185750836.100.69030401

FILE: C:\DCAD\Proj\Stantec Cardno Baker JV\2017-2019 JBER_fyr_CERCLA site_185750836\2018-2019 Fifth Five-Year Cercla Sites\5-July 2019\fig 8-5 ST037_wetland-data.dgn
TIME: 08-AUG-2019 14:20



OU5MW-38

Date	TCE
7/1/04	8.5
6/29/05	11
7/18/06	13
6/6/07	11
6/16/08	11
6/18/09	11 J
6/3/10	12
8/26/11	13 J
8/20/12	13
9/4/14	10.9
8/25/15	13
9/7/16	14
9/7/16 FD	13.9

OU5MW-44

Date	TCE
8/5/04	26
7/6/05	25
7/21/06	35
7/21/06	35
6/7/07	30
6/18/08	27
6/23/09	22
6/23/09	22 J
6/4/10	24
6/4/10	23
9/28/11	23
8/21/12	25
9/8/14	21.8
9/9/15	22.4
9/6/16	25.6

SP1-02

Date	TCE
8/10/92	33
6/21/95	33
9/19/95	49
5/30/96	50
10/1/96	34
5/30/97	30
9/8/97	21
5/15/98	17
5/15/98	17
8/7/98	22
5/18/99	20
7/27/99	18
5/17/00	19
7/21/00	30
6/7/01	21
6/7/01	ND (0.12)
8/1/01	16
6/11/02	16
8/20/02	12
6/30/03	64
10/12/03	22
7/1/04	16
12/15/04	22
6/29/05	33
7/21/06	25
6/13/07	19
6/20/08	16
6/23/09	9.1
6/7/10	7
8/26/11	6.2 J
8/21/12	5.4
7/6/14	9.0
8/26/15	8.81
9/9/16	7.03

OU5MW-34

Date	TCE
9/10/02	42
9/10/02	42
10/13/03	44
7/1/04	39
7/1/04	41
6/28/05	45
7/18/06	51
7/18/06	52
6/5/07	43
6/5/07	44
6/17/08	35
6/18/09	34
6/3/10	40
8/26/11	34 J
8/20/12	40
9/3/13	35
2014	NA
2015	NA
9/30/16	46.6
9/30/16 FD	47.6

49WL-01

Date	TCE
9/26/95	45
5/7/96	43
9/23/96	59
6/13/97	59
9/22/97	67
9/22/97	66
5/22/98	48
8/13/98	62
8/13/98	62
6/4/99	52
8/12/99	41
5/31/00	42
8/4/00	40
6/12/01	36
8/22/01	39
6/4/02	35
8/16/02	34
10/12/03	28
7/6/04	23
6/28/05	18
7/17/06	23
6/5/07	21

OU5MW-40

Date	TCE
10/12/03	ND (0.18)
7/1/04	ND (0.31)
6/28/05	0.35
7/20/06	0.33

OU3MW-05

Date	TCE
9/7/93	5.6
9/7/93	5.3
10/13/93	6.2
10/13/93	6
7/6/04	5
6/18/09	5

OU5MW-39

Date	TCE
10/13/03	5.5
7/29/04	2.7
7/6/05	2.7
7/20/06	3.3
6/5/07	1.9

OU3MW-13

Date	TCE
5/31/93	9.9
9/9/93	270
10/14/93	26
5/13/96	21
6/5/97	ND (0.4)
6/5/97	ND (0.4)
9/15/97	ND (0.4)
7/6/04	16

OU3MW-25

Date	TCE
9/13/93	6.26
9/13/93	5.26
10/14/93	5.94
10/14/93	ND (1.56)
5/13/96	4.76
5/15/99	5.2
10/15/99	7.3
6/4/02	5.1
8/21/02	5.6
7/20/07	3.5

402WL-02

Date	TCE
2006	6.41
2007	13
2008	10.7
2009	9.46
2010	10.2
2011	10
2012	6.2

OU3MW-02

Date	TCE
9/7/93	17
9/7/93	17
10/12/93	20
10/12/93	14
7/25/96	15
10/15/96	17
7/6/04	12
7/6/05	13
7/21/06	17
6/6/07	15
6/18/08	13
6/19/09	11
6/2/10	11
8/26/11	11 J
8/20/12	11
9/4/14	9.1
9/2/15	11.1
9/7/16	11.6

OU5MW-02

Date	TCE
8/27/92	0.5
9/3/92	5.2
6/22/95	9.7
9/18/95	9.8
6/3/96	10.5
10/1/96	11
5/27/97	11
9/3/97	8.6
5/21/98	10.4
8/10/98	11
5/18/99	10
7/26/99	9.1
5/18/00	9
7/20/00	8.1
6/8/01	11
8/6/01	11
6/10/02	9.8
6/10/02	9.8
8/16/02	12
8/16/02	12
7/6/04	8.6
6/29/05	9.8
7/20/06	12
6/6/07	9.9

403WL-01

Date	TCE
Summer 2001	66
6/3/02	53
10/12/03	44
6/29/04	41
7/5/05	35
7/20/06	56
8/22/06	36
9/19/06	34
5/23/07	42
5/30/07	25
6/6/07	47
9/13/07	35
6/20/08	35
6/19/09	25
6/2/10	23
8/26/11	23 J
8/20/12	29
9/9/14	9.3
9/2/15	20.3
9/8/16	20.6

OU3MW-11

Date	TCE
9/9/93	140
10/14/93	100
6/6/95	98
6/6/95	97
9/11/95	88
6/7/96	51
10/4/96	92
5/27/97	94
9/5/97	76
5/26/98	103
8/11/98	99
6/6/99	88
8/11/99	72
6/1/00	94
8/4/00	79
6/11/01	86
8/22/01	81
6/5/02	70
6/5/02	68
8/16/02	85
8/16/02	78
6/30/03	23
7/27/05	52
7/17/06	77
6/5/07	71
6/16/08	52
6/18/09	49
6/18/09	50
6/3/10	20
8/26/11	45 J
8/21/12	48
9/5/14	18.8
8/26/15	42.2
9/7/16	44

OU5MW-37

Date	TCE
10/12/03	ND (0.18)
7/6/04	ND (0.31)
6/29/05	ND (0.18)
7/18/06	ND (0.22)
6/6/07	ND (0.22)

OU5MW-43

Date	TCE
8/5/04	ND (0.18)
6/28/05	ND (0.31)
7/18/06	ND (0.22)
6/20/08	ND (0.22)
6/4/10	ND (0.2)
8/26/11	ND (0.40) J
9/4/13	ND (0.40)
8/25/15	ND (0.5)

OU5MW-46

Date	TCE
6/27/08	ND (0.22)
6/27/08	ND (0.22)
6/19/09	ND (0.22)
6/4/10	ND (0.2)
8/6/11	ND (0.40) J
8/20/12	ND (0.45)
7/17/13	ND (0.40)
9/4/14	ND (0.5)
8/25/15	ND (0.5)

OU5MW-45

Date	TCE
8/5/04	ND (0.2)
6/29/05	ND (0.3)
7/20/06	ND (0.2)
1/9/07	ND (0.2)
6/12/07	ND (0.2)
3/24/08	ND (0.2)
3/24/08	ND (0.2)
6/12/08	ND (0.2)
3/23/09	ND (0.22)
10/19/09	ND (0.2)
4/15/10	ND (0.2)
7/9/10	ND (0.2)
8/11/11	ND (1)
10/3/11	ND (0.4)
6/26/12	ND (0.4)
11/14/12	ND (0.4)
7/9/14	ND (0.5)
11/12/14	ND (0.5)
6/23/15	ND (0.5)
11/3/05	ND (0.5)
7/7/16	ND (0.5)
10/13/16	ND (0.5)

OU5SP-15

Date	TCE
1/18/02	ND (0.12)
9/25/02	ND (0.12)
1/15/03	ND (0.12)
8/12/03	ND (0.18)
7/14/04	ND (0.18)
7/27/05	ND (0.31)
7/26/06	ND (0.22)
6/11/07	0.29
6/24/08	ND (0.22)
6/2/09	ND (0.22)
6/2/09	ND (0.2)
6/5/10	ND (0.2)
8/21/12	ND (0.45)

OU5MW-15

Date	TCE
9/16/92	ND (1)
6/14/07	ND (0.2)
6/23/08	ND (0.2)
6/22/09	ND (0.22)
6/7/10	ND (0.2)
8/27/11	ND (0.40) J
8/21/12	ND (0.45)
9/8/14	ND (0.5)
8/26/15	ND (0.5)
9/8/16	ND (1)

OU5KMW-01

Date	TCE
9/11/07	3

OU5KMW-03

Date	TCE
9/11/07	6.5

OU5KMW-04

Date	TCE
9/14/07	0.84 F

OU5KMW-02

Date	TCE
9/14/07	5.6

OU5KMW-05

Date	TCE
9/18/07	6.5

OU5SP-09

Date	TCE
3/21/08	7.8
6/24/08	8.3
6/24/08	8.2
9/18/08	3.9
9/18/08	3.7
12/10/08	2.6
3/25/09	1.9
6/2/09	2.2
9/25/09	3
3/15/10	2.6
6/5/10	3.4
8/16/12	2
9/9/14	1.75
6/10/15	1.50
9/14/16	1.67

OU5MW-36

Date	TCE
9/10/02	3.6
6/30/03	0.45
10/12/03	4.2
6/29/04	3.5
7/5/05	4
7/21/06	4
6/11/07	3.6
6/19/08	2.6
6/19/09	2.1 J

OU5SP-10

Date	TCE
3/21/08	6.8
6/24/08	7.6
9/18/08	7.2
12/10/08	6.4
3/25/09	7.2
6/2/09	6.8
6/2/09	7.1
9/25/09	8.9
3/15/10	6.2
6/5/10	7.7
9/7/10	6.6
12/2/10	8.8
3/15/11	9.1
6/24/11	6.6
1/11/12	7.4
8/16/12	8.5
2014 Q1	Frozen
7/8/14	7.86
9/9/14	6.62
12/16/14	6.42
3/17/15	8.27
6/10/15	5.56
9/2/15	6.83
2015 Q4	Frozen
3/29/16	6.37
6/22/16	8.39
9/14/16	10.2
2016 Q4	Frozen

OU5SP-11

Date	TCE
3/21/08	7.6
6/24/08	7.8
9/18/08	7.6
12/10/08	7.2
12/10/08	7.3
3/25/09	8.8
3/25/09	9.4
6/2/09	9.4
9/25/09	7.8
3/15/10	6.4
6/5/10	8.2
9/7/10	6.9
12/2/10	9
3/15/11	9.8
6/24/11	8.5
1/11/12	9.3
8/16/12	9.2
3/10/14	7.8
7/8/14	9.63
9/9/14	8.56
12/16/14	9.7
3/17/15	11.0
6/10/15	9.94
9/2/15	9.82
12/1/15	11.4
3/29/16	12
6/22/16	10.3
6/22/16 FD	10
9/14/16	12
9/14/16 FD	11.3
12/8/16	8.74

Legend:

- PROGRAM MONITORING WELL
- NON-PROGRAM MONITORING WELL
- ABANDONED MONITORING WELL
- SEEP SAMPLE LOCATION
- DIRECT PUSH SAMPLE LOCATION
- GROUNDWATER CONTOUR LINE (FEET AMSL) (SYNOPTIC WATER LEVELS MEASURED JUNE 2015)
- 164.82' GROUNDWATER ELEVATION (FFET AMSL) (SYNOPTIC WATER LEVELS MEASURED JUNE 2015)
- GENERAL GROUNDWATER FLOW DIRECTION (APPROXIMATE)
- GROUNDWATER PLUME - SOLVENTS

Notes

1. All groundwater results are in micrograms per liter (ug/L).
2. Red results exceed cleanup criteria.

FLAGS:
J - Analyte was positively identified, but the result is estimated.

TCE Trichloroethene (5 ug/L*)
ND Not Detected [brackets indicate the MDL for 2007 and earlier, and the LOD for 2011-2016]
AMSL Above Mean Sea Level
LOD Limit of Detection
FD Field Duplicate
MDL Method Detection Limits
Q Quarter (Yearly)
NA Not Analyzed
* Analyte Cleanup Criteria

Source:
USAF, 2017c. United States Air Force, Joint Base Elmendorf-Richardson, Alaska. Environmental Restoration Program. 2016 Annual Remedial Action-Operations and Monitoring Report for Select CERCLA Sites. Draft. December.

SCALE IN FEET
0 500

UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

FIFTH FIVE-YEAR REVIEW FOR CERCLA SITES, JBER-E, ALASKA

OU5 - ST037
WESTERN PLUME SITE MAP AND HISTORICAL DATA

FIGURE
8-6
185750836.100.69030401

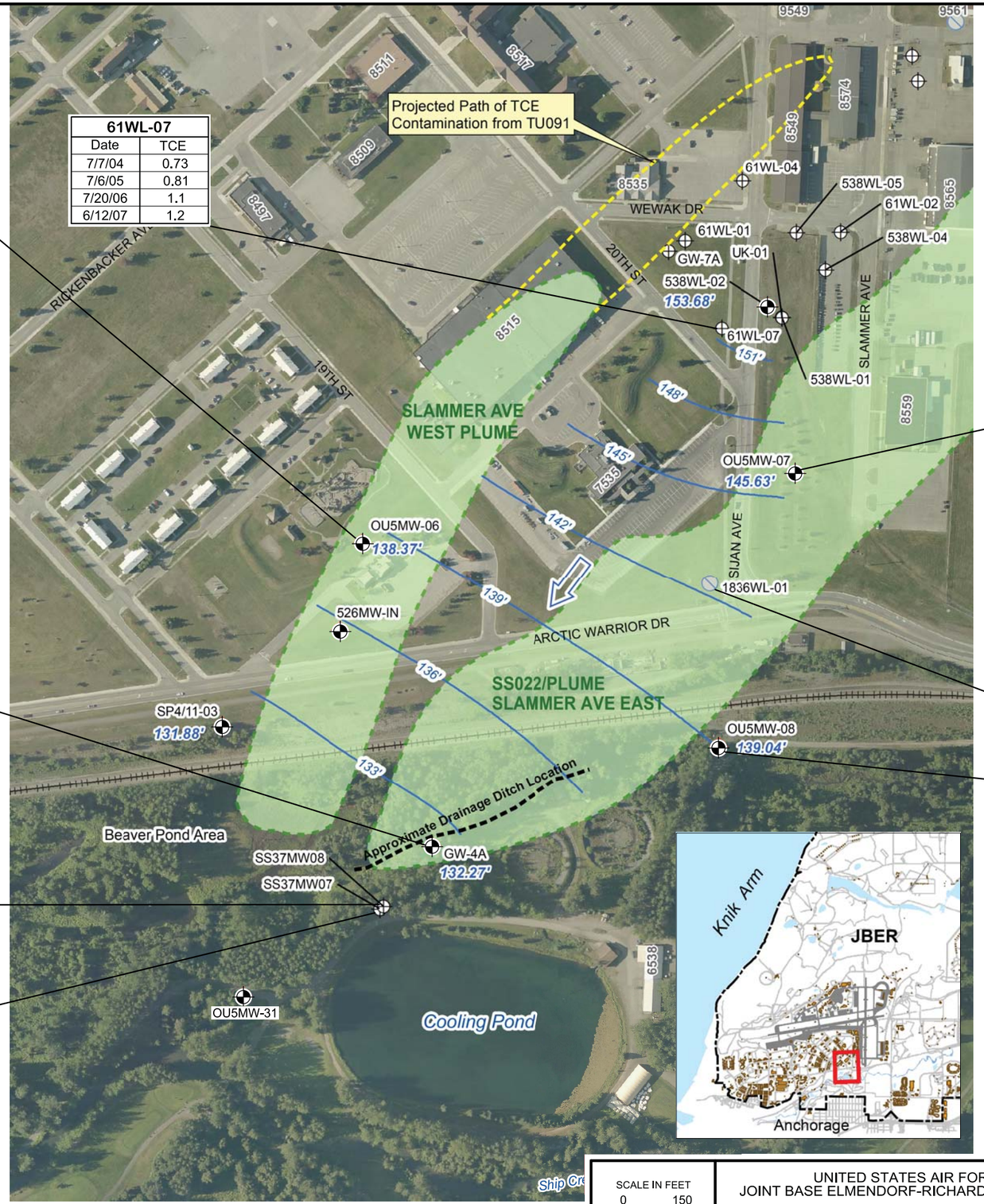
FILE: C:\D\CAD\Proj\Stantec Cardno Baker JV\2017-2019_#BER_fyr_CERCLA site_185750836\2019-2019 Fifth Five-Year Cercla Sites\5-July 2019\fig 8-6 ST037_western-data.dgn
TIME: 08-AUG-2019 13:03

OU5MW-06	
Date	TCE
6/22/95	45
9/19/95	45
6/3/96	44
9/26/96	46
5/28/97	46
9/16/97	39
5/21/98	36
8/10/98	38
8/10/98	47
5/18/99	34
7/27/99	33
5/15/00	28
7/24/00	26
5/24/01	25
8/6/01	29
6/10/02	30
8/19/02	37
6/27/03	30
7/7/04	22
7/6/05	18
6/27/06	23
6/27/06	23
6/11/07	19
6/11/07	19
6/17/08	19
6/22/09	16
6/2/10	15
6/2/10	17
8/27/11	14 J
8/21/12	15
9/8/14	8.61
9/9/15	11.5
9/8/16	11.8
9/8/16 FD	12.3

GW-4A	
Date	TCE
6/20/95	6.8
9/21/95	6.8
5/28/96	6.1
9/25/96	5.2
5/29/97	5.5
9/11/97	8
5/16/98	6.5
5/16/98	6.5
8/6/98	6.9
6/3/99	4.9
7/28/99	4.2
5/16/00	5.1
8/3/00	8.4
5/23/01	11
8/2/01	13
6/6/02	11
8/20/02	11
6/25/03	11
6/25/03	11
10/12/03	8
7/8/04	4.7
7/7/05	4.4
7/19/06	5.1
6/12/07	3.2
6/18/08	3.8
6/22/09	3.2
6/2/10	3.2
8/27/11	4.2 J
8/21/12	4.7
9/5/14	4.08
9/2/15	6.2
9/8/16	5.56

ST37MW-08	
Date	TCE
6/3/06	ND (0.27)
9/18/06	ND (0.27)

ST37MW-07	
Date	TCE
6/3/06	4.3
9/18/06	3.8



OU5MW-07	
Date	TCE
6/22/95	19
9/19/95	18
6/3/96	19
9/26/96	20
5/28/97	17
9/9/97	19
5/20/98	23
8/10/98	31
5/14/99	20
7/28/99	21
5/15/00	22
7/24/00	18
5/24/01	19
8/6/01	23
6/6/02	20
8/19/02	24
6/30/03	20
7/7/04	14
7/7/05	16
7/20/06	20
6/12/07	16
6/19/08	17
6/22/09	15
6/2/10	17
8/27/11	18 J
8/20/12	20
9/8/14	15.8
9/9/15	15.6
9/9/16	17.4

1836-WL-01	
Date	TCE
6/7/02	14
7/7/04	13
7/7/05	13
7/20/06	18
6/12/07	15

OU5MW-08	
Date	TCE
6/19/95	0.48
9/20/95	1.9
5/31/96	4.7
5/31/96	3.6
9/25/96	2.8
5/29/97	2.3
9/9/97	2.4
9/9/97	2.5
5/18/98	2.6
8/6/98	3.5
5/14/99	2.9
5/14/99	2.9
7/28/99	3.3
7/28/99	3.2
5/15/00	4
5/15/00	3.8
7/18/00	4.4
7/18/00	4.3
5/23/01	4.3
8/2/01	5.1
6/6/02	4.1
8/19/02	4.8
6/25/03	4.9
7/8/04	3.6
7/7/05	3.5
7/19/06	4.4
6/13/07	3.7
6/18/08	3.3
10/5/09	2.6
10/5/09	2.8
6/2/10	2.1
8/27/11	1.7 J
8/21/12	1.8
9/8/14	2.46 J
9/1/15	3.88
9/9/16	3.87

Legend:

- PROGRAM MONITORING WELL
- NON-PROGRAM MONITORING WELL
- ABANDONED MONITORING WELL
- GROUNDWATER PLUME - SOLVENTS (DASHED WHERE INFERRED)
- GROUNDWATER CONTOUR (FEET AMSL) (SYNOPTIC WATER LEVELS MEASURED JUNE 2015)
- GENERAL GROUNDWATER FLOW DIRECTION (APPROXIMATE)
- 164.82' GROUNDWATER ELEVATION (FFET AMSL) (SYNOPTIC WATER LEVELS MEASURED JUNE 2015)

Notes

1. All groundwater results are in micrograms per liter (ug/L).
2. Red results exceed cleanup criteria.

TCE Trichloroethene (5 ug/L*)
FD Field Duplicate
AMSL Above Mean Sea Level
ND Not Detected (LOD)
LOD Limit of Detection
* Analyte Cleanup Criteria

FLAGS:
J - Analyte was positively identified, but result is estimated.

Source:
USAF, 2017c. United States Air Force, Joint Base Elmendorf-Richardson, Alaska. Environmental Restoration Program. 2016 Annual Remedial Action-Operations and Monitoring Report for Select CERCLA Sites. Draft. December.

SCALE IN FEET
0 150

UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

FIFTH FIVE-YEAR REVIEW FOR CERCLA SITES, JBER-E, ALASKA

OU5 - ST037
SLAMMER AVENUE PLUME SITE MAP AND HISTORICAL DATA

FIGURE
8-7

185750836.100.69030401

TIME: 07-AUG-2019 15:43 FILE: C:\D\CAD\Proj\Stantec Cardno Baker JV\2017-2019 JBER_Iyr_CERCLA site_185750836\2018-2019 Fifth Five-Year Cercla Sites\5-July 2019\fig 8-7 ST037_slammer-data.dgn

LF02SP-01

Date	DRO	GRO	TAH	TAqH	BEHP	MeCl	PCA	TCE	Selenium	Thallium
2002-1	NA	NA	NA	NA	NA	NA	044 J	NA	NA	NA
2004-1	NA	NA	NA	NA	NA	NA	0.5	NA	NA	NA
2005-1	NA	NA	NA	NA	NA	NA	ND (0.37)	NA	NA	NA
2006-1	NA	NA	NA	NA	NA	NA	ND (0.15)	NA	NA	NA
2007-1	NA	NA	NA	NA	NA	NA	ND (0.15)	NA	NA	NA
2009	NA	NA	NA	NA	ND (5)	——	ND (1)	ND (1)	0.35 J	0.27 B
2010	100	ND (44)	1.0	1.7	ND (6)	——	ND (0.15)	0.16	NA	NA
2011	56	17 J	NA	NA	NA	——	NA	NA	NA	NA
9/2013	NA	NA	1.32	1.91	NA	——	ND (0.20)	0.17 J	NA	NA

53WL-05

Date	DRO	GRO	BEHP	MeCl	PCA	TCE	Selenium	Thallium
1993-1	NA	ND (0.05)	NA	ND (10)	ND (10)	ND (10)	30	NA
1994-1	NA	NA	ND (0.78)	0.53	ND (0.17)	ND (0.04)	13.1	8.9
1996-1	ND (0.0446)	ND (0.00543)	NA	NA	ND (0.227)	NA	NA	NA
1997-1	ND (0.25)	ND (0.1)	NA	NA	ND (0.34)	NA	NA	NA
1997-2	ND (0.25)	ND (0.1)	NA	NA	ND (0.34)	NA	NA	NA
1998-1	ND (0.0221)	ND (0.00427)	NA	NA	ND (0.102)	NA	NA	NA
1998-2	ND (0.0219)	ND (0.0106)	NA	NA	ND (0.120)	NA	NA	NA
1999-1	ND (0.5)	ND (0.025)	NA	NA	ND (0.17)	NA	NA	NA
1999-2	0.06	ND (0.025)	NA	NA	ND (0.17)	NA	NA	NA
2000-1	ND (0.5)	0.035	NA	NA	ND (0.14)	NA	NA	NA
2000-2	ND (0.02)	0.071	NA	NA	ND (0.138)	NA	NA	NA
2001-1	0.023	0.0389	NA	NA	ND (0.138)	NA	NA	NA
2001-2	ND (0.019)	ND (0.0206)	NA	NA	ND (0.138)	NA	NA	NA
2002-1	NA	NA	NA	NA	ND (0.138)	NA	NA	NA
2002-2	NA	NA	NA	NA	ND (0.138)	NA	NA	NA
2003-1	NA	NA	NA	NA	ND (0.13)	NA	NA	NA
2006-1	NA	NA	NA	NA	ND (0.15)	NA	NA	NA
2007-1	NA	NA	NA	NA	ND (0.15)	NA	NA	NA
2009-1	NA	NA	ND (4.9)	ND (1)	ND (1)	ND (1)	0.3 J	0.17 B
2010-1	ND (58)	ND (44)	NA	NA	NA	NA	NA	NA
2011-1	ND (71) J	ND (25)	NA	NA	NA	NA	NA	NA

53WL-02

Date	DRO	GRO	BEHP	MeCl	PCA	TCE	Selenium	Thallium
1993-1	NA	ND	NA	ND (10)	1 J	ND (10)	15	NA
1994-1	NA	NA	ND (0.8)	0.26	4.63	0.72	21.5	25
1994-2	NA	NA	ND (0.9)	2.55	4.66	0.74	1.02	55.6
2009-1	NA	NA	ND (5)	ND (1)	0.53 J	1.4	0.31 J	0.21 B
2010-1	ND (57)	ND (44)	NA	NA	NA	NA	NA	NA
2011-1	ND (71)	ND (25)	NA	NA	NA	NA	NA	NA

65WL-04R

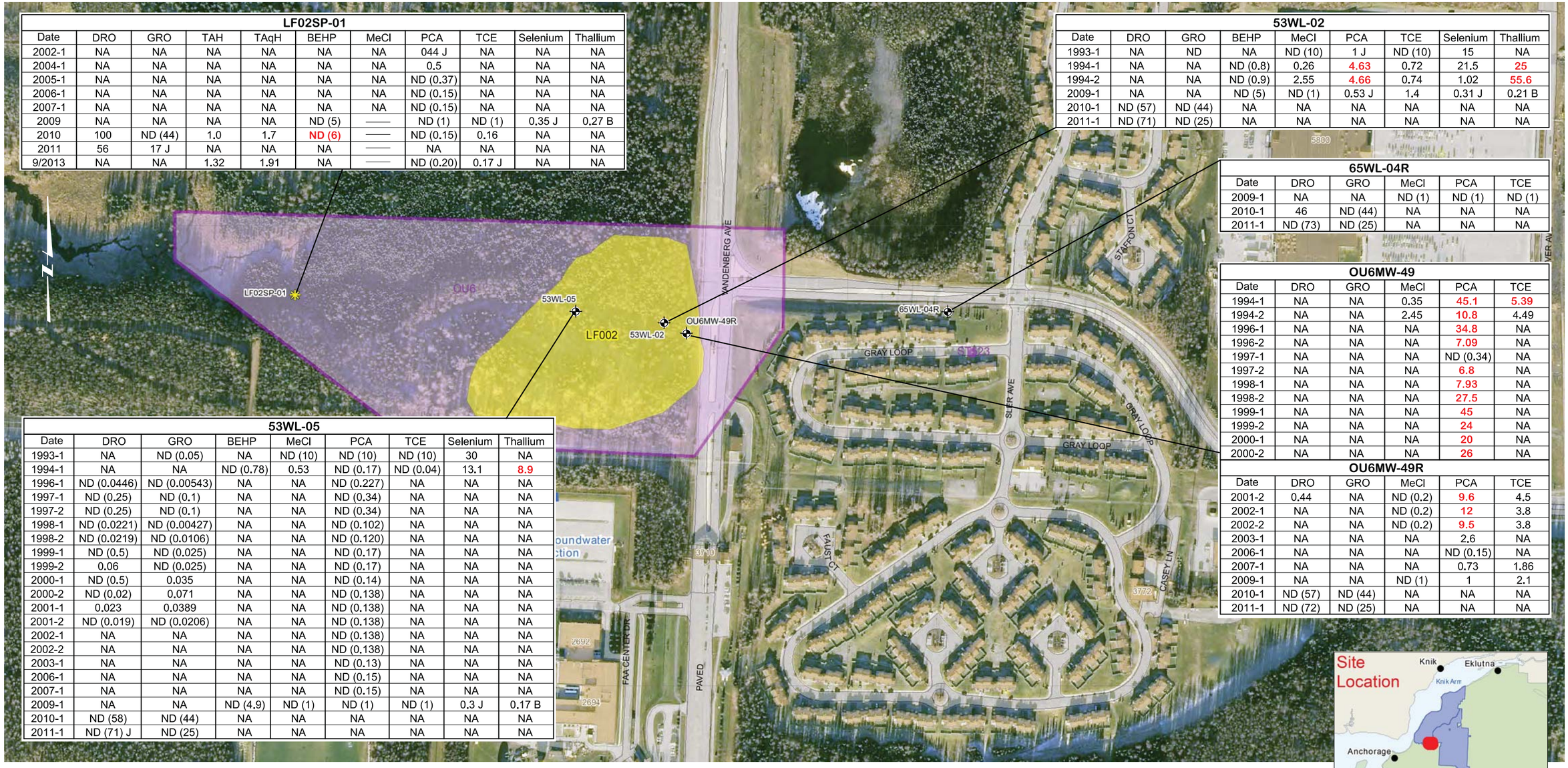
Date	DRO	GRO	MeCl	PCA	TCE
2009-1	NA	NA	ND (1)	ND (1)	ND (1)
2010-1	46	ND (44)	NA	NA	NA
2011-1	ND (73)	ND (25)	NA	NA	NA

OU6MW-49

Date	DRO	GRO	MeCl	PCA	TCE
1994-1	NA	NA	0.35	45.1	5.39
1994-2	NA	NA	2.45	10.8	4.49
1996-1	NA	NA	NA	34.8	NA
1996-2	NA	NA	NA	7.09	NA
1997-1	NA	NA	NA	ND (0.34)	NA
1997-2	NA	NA	NA	6.8	NA
1998-1	NA	NA	NA	7.93	NA
1998-2	NA	NA	NA	27.5	NA
1999-1	NA	NA	NA	45	NA
1999-2	NA	NA	NA	24	NA
2000-1	NA	NA	NA	20	NA
2000-2	NA	NA	NA	26	NA

OU6MW-49R

Date	DRO	GRO	MeCl	PCA	TCE
2001-2	0.44	NA	ND (0.2)	9.6	4.5
2002-1	NA	NA	ND (0.2)	12	3.8
2002-2	NA	NA	ND (0.2)	9.5	3.8
2003-1	NA	NA	NA	2.6	NA
2006-1	NA	NA	NA	ND (0.15)	NA
2007-1	NA	NA	NA	0.73	1.86
2009-1	NA	NA	ND (1)	1	2.1
2010-1	ND (57)	ND (44)	NA	NA	NA
2011-1	ND (72)	ND (25)	NA	NA	NA





Notes

1. All groundwater results are in micrograms per liter (ug/L).
2. Red italicized results exceed cleanup criteria.

FLAGS:
J - Analyte was positively identified, but result is estimated.
B - The analyte was detected in an associated blank sample, as well as in the sample at a concentration less than ten times the blank concentration.

ND Not Detected (brackets indicate the MDL for 2008 and earlier, the PQL for 2009, and the LOD for 2010 and 2011).
NA Not Analyzed
* Analyte Cleanup Criteria

Selenium (50 ug/L*)
Thallium (2 ug/L*)
DRO Diesel Range Organics (1,500 ug/L*)
GRO Gasoline Range Organics (2.200 ug/L*)
BEHP bis(2-ehthylexyl)pthlate (6 ug/L*)
MeCl Methylene Chloride (5 ug/L*)
PCA 1,1,2,2-tetrachloroethane (4 ug/L*)
TCE Trichloroethene (5 ug/L*)
TAH Total Aromatic Hydrocarbon (10 ug/L*)
TAqH Total Aqueous Hydrocarbon (15 ug/L*)
MDL Method Detection Limits
PQL Practical Quantification Limit
LOD Limit of Detection

Legend:

- SEEP SAMPLE LOCATION
- PROGRAM MONITORING WELL
- NON-PROGRAM MONITORING WELL
- ABANDONED MONITORING WELL
- CERCLA SITE BOUNDARY
- LAND USE CONTROL BOUNDARY

Source:
USAF, 2014. United States Air Force, Joint Base Elmendorf-Richardson, Alaska. Environmental Restoration Program. Fourth CERCLA Five-Year Review Report. JBER-Elmendorf, Alaska. Final. March.

SCALE IN FEET
0 180

UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

FIFTH FIVE-YEAR REVIEW FOR CERCLA SITES, JBER-E, ALASKA

OU6 - LF002
SITE LAYOUT AND HISTORICAL DATA

FIGURE
9-1

185750836.
100.69030401

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TIME: 07-AUG-2019 15:37

PROVIDER DR

LF003 LUC

LF003

WILKINS AVE

GLENN HWY

3752
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1900
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1902
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2735
2737
2749
2750
2739
2748
2740
197
213
180
190
230

Site Location

Knik
Eklutna
Knik Arm
Anchorage
Turnagain Arm
Hope

Note:
OU6-LF003 is located south of Provider Drive and south of Ship Creek in the southeastern corner of the JBER-E.

Source:
USAF, 2017h. United States Air Force, Joint Base Elmendorf-Richardson, Alaska. Environmental Restoration Program Atlas. Final. April.

SCALE IN FEET
0 150

UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

FIFTH FIVE-YEAR REVIEW FOR CERCLA SITES, JBER-E, ALASKA

OU6 - LF003
SITE LAYOUT AND HISTORICAL DATA

FIGURE
10-1

185750836.
100.69030401

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TIME: 04-AUG-2019 10:38

OU6MW-61					
Date	Benzene	Ethylbenzene	Toluene	Methylene Chloride	1,2-DCA
1994-1	3,140	24.8	52.4	0.5 B	32.6
1994-2	3,400	15.3	38.1	36.9 J	38.7 J
2010	1,300	63	280		ND (0.2)
2011	1,100	45	150		ND (10)
9/2015	346	37.1	36.3		ND (05)

LF04SP-02DG					
Date	Benzene	Ethylbenzene	Toluene	Methylene Chloride	1,2-DCA
2002-1	ND (0.105)	ND (0.1)	ND (0.1)	ND (0.2)	ND (0.1)
2003-1	ND (0.14	NA	NA	NA	NA
2004-1	1.3	NA	NA	NA	NA
2005-1	0.6	NA	NA	NA	NA
2006-1	ND (0.12)	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)
2007-1	ND (0.12)	ND (0.31)	ND (0.31)	NA	NA
2009-1	0.27 J	2.8	ND (1)	ND (1)	ND (1)
2010-1	0.15	1.4	012	ND (0.15)	ND (0.15)
2011-1	ND (0.2)	0.19 J	ND (0.4)	ND (0.4)	ND (0.4)
2012-1	0.15 J	0.37 J	ND (0.4)	ND (0.4)	ND (0.4)
9/2013	0.48 J	2.2	ND (0.4)		ND (0.4)
9/2014	ND (0.2)	0.510 J	ND (0.5)		ND (0.25)
9/2016	ND (0.4)	0.47 J	ND (1)		ND (0.5)

LF04SP-02							
Date	Benzene	Ethylbenzene	Toluene	Methylene Chloride	1,2-DCA	TAH	TAqH
2002-1	37	220	86	ND (1)	ND (0.46)		
2002-2	9.5	4.7	0.15 J	ND (0.2)	ND (0.1)		
2003-1	70	150	40	NA	NA		
2004-1	50	34	7.8	NA	NA		
2005-1	30	36	10	NA	NA		
2006-1	ND (0.12)	0.32 J	ND (31)	NA	NA		
2007-1	2.0	ND (31)	ND (31)	NA	NA		
2008-1	89.B	207 B	8.32	NA	NA		
2009-1	4.5	94	4.8	ND (1)	ND (1)		
2010-1	56	640	24	ND (0.15)	ND (0.2)		
2011-1	4	15	ND (0.4)	ND (0.4)	ND (0.4)		
2012-1	2	2.5	ND (0.4)	ND (0.4)	ND (0.4)		
9/2014	17.0	127	ND (0.5)		ND (0.25)	NA	NA
6/2015	5.85	192	ND (0.5)		ND (0.25)	491	502
9/2015	7.06	122	0.5 J		ND (0.25)	356	NA
12/2015	8.81	150	ND (0.5)		ND (0.25)	293	301
3/2016	28.9	166	ND (1)		ND (0.5)	474	483
6/2016	18.3	117	ND (0.5)		ND (0.25)	300	301
9/2016	15.2	90.6 J	ND (1)		ND (0.5)	214	219
12/2016	0.28 J	1.77	ND (0.5)		ND (0.25)	4.92	5.35

OU6MW-67					
Date	Benzene	Ethylbenzene	Toluene	Methylene Chloride	1,2-DCA
1994-1	9.65	9.05	11.4	2.05	ND (0.23)
1994-2	42.5	18.8	83.8	290	ND (9.89)
1996-1	7.22	4.41	6.07	11.5	ND (0.87)
1996-2	4.28	2.04	1.76	ND (3.18)	ND (2.5)
1997-1	2.1	1.9	0.64	ND (2)	ND (0.15)
1997-2	2.5	1.7	0.93	ND (2)	ND (0.15)
1998-1	3.55	1.21	0.62	0.33	ND (0.03)
1998-2	4.15	1.24	0.66	0.25	ND (0.03)
1999-1	12	2.5	0.73	ND (0.27)	ND (0.16)
1999-2	11	4.2	0.70	ND (0.27)	ND (0.16)
2000-1	ND (0.11)	8.8	0.88	ND (0.19)	ND (0.11)
2000-2	3.1	5.9	0.48	1.6	ND (0.11)
2001-1	2.8	2.9	0.61	1.3	ND (1.1)
2001-2	ND (0.53)	2.3	0.70	ND (0.97)	ND (0.58)
2002-1	1.7	1.3	NA	ND (0.2)	ND (0.11)
2002-2	1.6	1.7	NA	ND (0.2)	ND (0.11)
2007-1	ND (0.12)	ND (0.31)	ND (0.31)	NA	NA
2009-1	1.5	0.77 J	0.35 J	ND (1)	ND (1)
2011-1	2.1	1	0.43 J	ND (0.4)	ND (0.4)
8/2013	5.2	0.86 J	0.38 J		ND 0.40)
11/2014	8.22	2.48	ND (0.5)		ND (0.25)
9/2015	5.70	4.02	1.61		ND (0.5)
9/2016	5.73	2.86	0.39 J		ND (0.5)

OU6MW-63					
Date	Benzene	Ethylbenzene	Toluene	Methylene Chloride	1,2-DCA
1994-1	337	451	27	0.24	2.52
1994-2	206	344	9.87	1.08	0.63
1996-1	5.7	10.1	0.17	0.18	ND (0.12)
1996-2	5.15	34.5	ND (0.6)	ND (1.59)	ND (1.25)
1997-2	21	110	0.89	ND (2)	ND (0.15)
1998-1	13.2	31.6	ND (0.05)	0.27	ND (0.03)
1998-2	4.52	29.1	0.196	0.23	ND (0.03)
1999-1	27	10	0.48	ND (0.27)	0.58
1999-2	23 M	13	0.48	ND (0.27)	ND (0.16)
2000-1	42 M	39	1.5	ND (0.2)	ND (0.11)
2000-2	5.3	36	0.27	ND (0.2)	ND (0.11)
2001-1	24	12	0.29	0.63	ND (0.11)
2001-2	7.8	24	1.2	ND (0.2)	ND (0.11)
2002-1	6.7	7	0.35 J	ND (0.2)	ND (0.11)
2003-1	3.1	NA	NA	NA	NA
2004-1	5.6	NA	NA	NA	NA
2005-1	10	NA	NA	NA	NA
2006-1	2.27	NA	NA	NA	NA
2007-1	0.55	0.78	ND (0.31)	NA	NA
2009-1	1	3.7	0.24 J	ND (1)	ND (1)
2010-1	0.92	2.7	0.57	ND (0.15)	ND (0.2)
2011-1	0.41	0.11	ND (0.4)	ND (0.4)	ND (0.4)
2012-1	0.3 J, B	ND (0.2)	ND (0.4)	ND (0.4)	ND (0.4)
9/2016	0.15 J	ND (1)	ND (1)		ND (0.5)
9/2016 FD	0.15 J	ND (1)	ND (1)		ND (0.5)

Legend:

- Program Monitoring Well
- Non-Program Monitoring Well
- Abandoned Monitoring Well
- Seep Sample Location
- Groundwater Contour Line (feet AMSL)
- Groundwater Plume - Fuels
- CERCLA Site
- General Groundwater Flow Direction (Approximate)

Notes

1. All groundwater results are in micrograms per liter (ug/L).
2. Red results exceed cleanup criteria.
3. Monitoring Wells OU6MW-61, OU6MW-63, and OU6MW-67 are screened in Aquifer 2 (USAF, 1996)
4. Groundwater contours are based on the most recent Environmental Restoration Program Atlas (USAF, 2013a)

Benzene (5 ug/L*)
Ethylbenzene (700 ug/L*)
Toluene (1000 ug/L*)
Methylene Chloride (5 ug/L)
1,2 Dichloroethane (1,2 DCA)(5 ug/L*)
Total Aqueous Hydrocarbon (TAH) (10ug/L*)
Total Aquatic Hydrocarbon (TAqH) (15ug/L*)

ND Not Detected [LOD]
LOD Limit of Detection
FD Field Duplicate
NA Not Analyzed
* Analyte Cleanup Criteria

FLAGS:
J - Analyte was positively identified, but result is estimated.
B - The analyte was detected in the method blank. The analyte was detected in the sample at a concentration less than or equal to five times the blank concentration.

Source:
USAF, 2017c. United States Air Force, Joint Base Elmendorf-Richardson, Alaska. Environmental Restoration Program. 2016 Annual Remedial Action-Operations and Monitoring Report for Select CERCLA Sites. Draft. December.

SCALE IN FEET
0 90

UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

FIFTH FIVE-YEAR REVIEW FOR CERCLA SITES, JBER-E, ALASKA

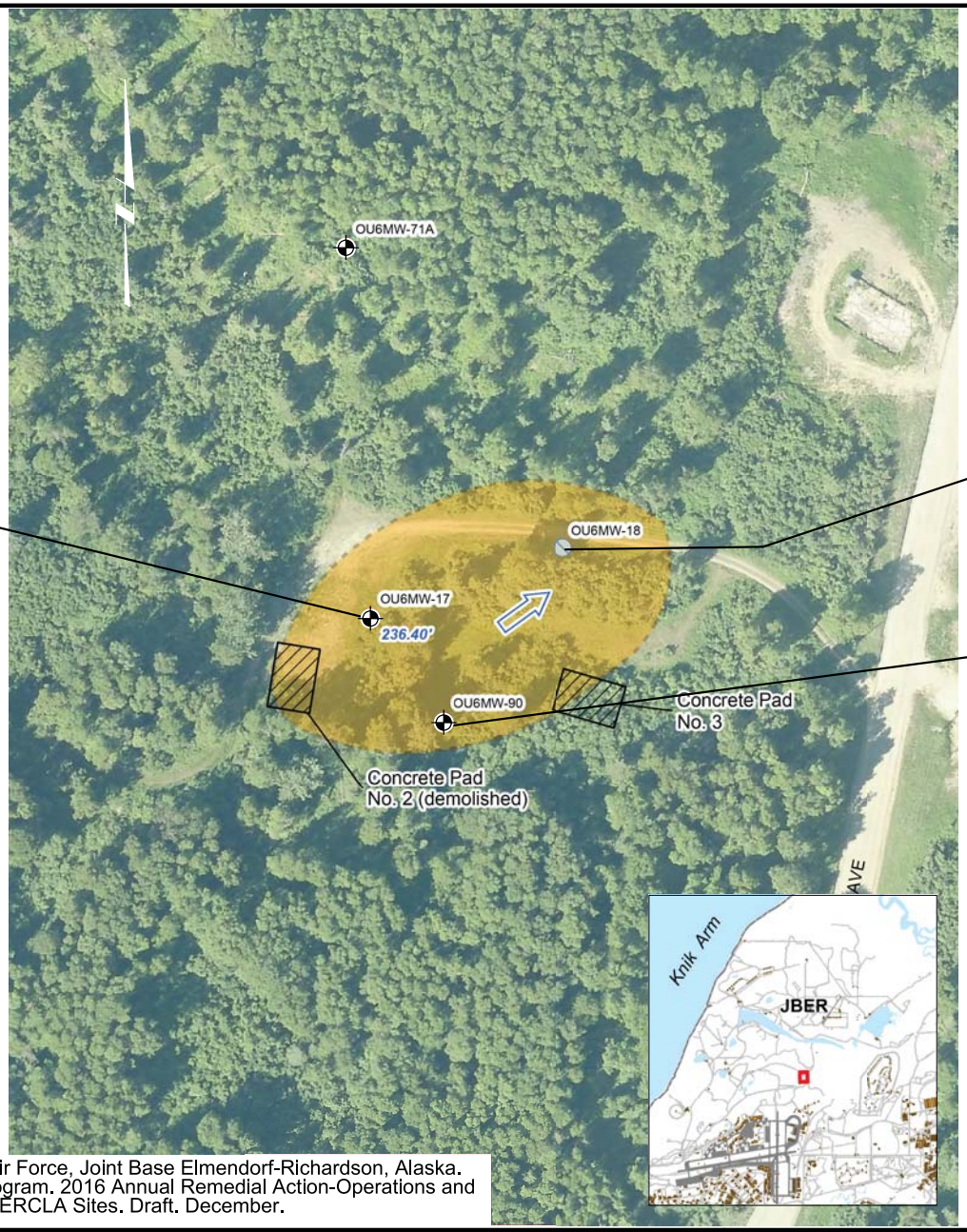
OU6 - LF004
SITE LAYOUT AND HISTORICAL DATA

FIGURE
11-1
185750836.100.69030401

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TIME: 07-AUG-2019 15:32

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OU6MW-17		
Date	Benzene	TCE
8/8/94	182	23.4
8/8/94	162	23.5
8/8/94	183	NA
8/8/94	128	NA
9/1/94	204	23.9
9/1/94	178	NA
6/10/96	174	19.5
6/10/96	171	21.1
6/10/96	172	NA
6/10/96	179	NA
5/13/98	75.9	21.3
5/13/98	84.3	NA
6/4/98	110	23.2
6/4/98	110	NA
6/3/99	9.3	4.5
8/6/99	78	14
5/22/00	160	19
8/7/00	160	18
6/5/01	64	11
6/5/01	70	11
8/16/01	39	11
6/19/02	13	10
6/19/02	13	11
8/14/02	23	9
8/14/02	22	9.7
6/24/03	100	13
7/13/05	180	12
7/13/06	86	12
10/5/06	81	7.2
6/20/07	120	NA
6/20/07	150	11
6/11/08	100	11
6/11/08	100	11
6/16/09	89	9.1
6/19/09	88	9.1
6/7/10	89	8.7
9/16/11	100	8.1
8/10/12	110	11
9/12/14	79.2	7.96
9/15/15	72	8.47
9/12/16	92.3	9.34



OU6MW-18		
Date	Benzene	TCE
8/7/94	1,380	143
8/7/94	1,430	NA
8/31/94	1,180	140
8/31/94	1,000	NA
6/11/96	521	151
6/11/96	814	NA
9/11/98	0.11	0.9
9/11/98	0.12	NA
6/3/99	43	33
8/9/99	39	38
5/22/00	110	54
8/7/00	9	6.4
6/5/01	41	27
8/15/01	41	20
6/23/03	10	20
7/14/04	0.9	6.6
7/13/05	5.9	18
7/17/06	4.2	24
6/20/07	14	NA
6/20/07	15	49
6/11/08	18	40
6/17/09	2.6	18
6/8/10	0.37 F	6

OU6MW-90		
Date	Benzene	TCE
5/13/98	4.7	5.5
5/13/98	5.37	NA
9/6/98	47.1	13.1
9/6/98	51.2	NA
6/3/99	7.9	12
8/6/99	4.3	11
5/23/00	ND (0.11)	ND (0.12)
8/7/00	11	6.9
6/6/01	1	8.3
8/15/01	ND (0.105)	10
6/19/02	1.3	6.1
8/14/02	0.37	8.5
6/23/03	0.51	7.6
7/21/04	0.81	7.1
7/13/05	10	7.4
7/13/06	0.27	7.5
7/13/06	0.25	7.1
10/11/06	ND (0.12)	2.2
6/20/07	0.76	NA
6/20/07	0.58	0.22
6/11/08	Well Dry	
6/24/09	0.99	5.7

Legend:

- PROGRAM MONITORING WELL
- ABANDONED MONITORING WELL
- GROUNDWATER PLUME - FUELS
- SOURCE AREA (APPROXIMATE)
- GENERAL GROUNDWATER FLOW DIRECTION (APPROXIMATE)
- 164.82' GROUNDWATER ELEVATION (FEET AMSL), (2016 SAMPLING EVENT)

Notes

1. All groundwater results are in micrograms per liter (ug/L).
2. Red results exceed cleanup criteria.

AMSL	Above Mean Sea Level
Benzene	Benzene (5ug/L*)
TCE	Trichloroethene (5 ug/L*)
NA	Not Analyzed
ND	Not Detected (LOD)
LOD	Limit of Detection
*	Analyte Cleanup Criteria

FLAGS:
F - Result is between the method detection limit and the reporting limit.

Source:
USAF, 2017c. United States Air Force, Joint Base Elmendorf-Richardson, Alaska. Environmental Restoration Program. 2016 Annual Remedial Action-Operations and Monitoring Report for Select CERCLA Sites. Draft. December.

SCALE IN FEET
0 70

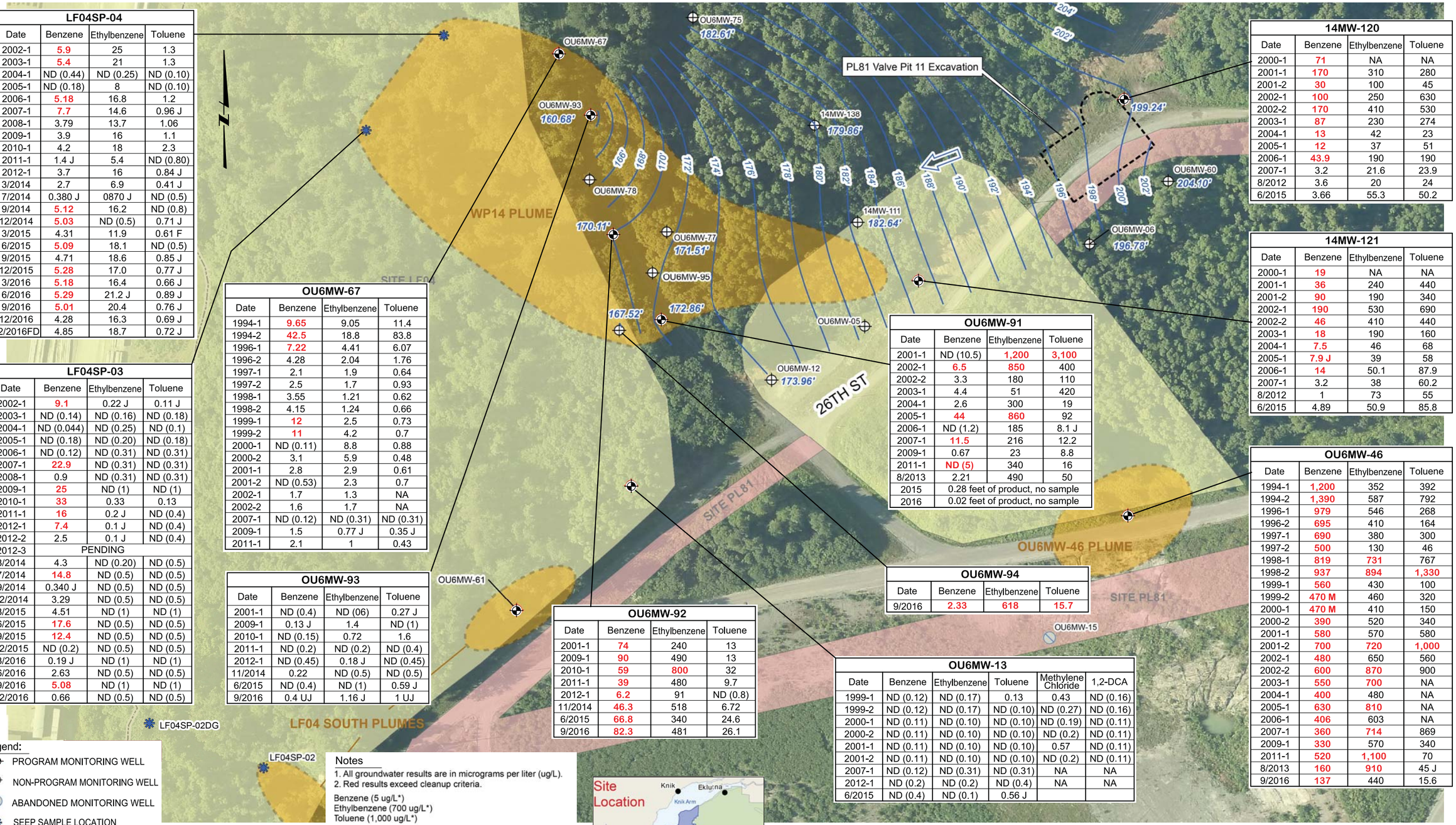
UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

FIFTH FIVE-YEAR REVIEW FOR CERCLA SITES,
JBER-E, ALASKA

OU6 - SD015
SITE LAYOUT AND HISTORICAL DATA

FIGURE
12-1

185750836.
100.69030401



LF04SP-04

Date	Benzene	Ethylbenzene	Toluene
2002-1	5.9	25	1.3
2003-1	5.4	21	1.3
2004-1	ND (0.44)	ND (0.25)	ND (0.10)
2005-1	ND (0.18)	8	ND (0.10)
2006-1	5.18	16.8	1.2
2007-1	7.7	14.6	0.96 J
2008-1	3.79	13.7	1.06
2009-1	3.9	16	1.1
2010-1	4.2	18	2.3
2011-1	1.4 J	5.4	ND (0.80)
2012-1	3.7	16	0.84 J
3/2014	2.7	6.9	0.41 J
7/2014	0.380 J	0870 J	ND (0.5)
9/2014	5.12	16.2	ND (0.8)
12/2014	5.03	ND (0.5)	0.71 J
3/2015	4.31	11.9	0.61 F
6/2015	5.09	18.1	ND (0.5)
9/2015	4.71	18.6	0.85 J
12/2015	5.28	17.0	0.77 J
3/2016	5.18	16.4	0.66 J
6/2016	5.29	21.2 J	0.89 J
9/2016	5.01	20.4	0.76 J
12/2016	4.28	16.3	0.69 J
12/2016FD	4.85	18.7	0.72 J

LF04SP-03

Date	Benzene	Ethylbenzene	Toluene
2002-1	9.1	0.22 J	0.11 J
2003-1	ND (0.14)	ND (0.16)	ND (0.18)
2004-1	ND (0.044)	ND (0.25)	ND (0.1)
2005-1	ND (0.18)	ND (0.20)	ND (0.18)
2006-1	ND (0.12)	ND (0.31)	ND (0.31)
2007-1	22.9	ND (0.31)	ND (0.31)
2008-1	0.9	ND (0.31)	ND (0.31)
2009-1	25	ND (1)	ND (1)
2010-1	33	0.33	0.13
2011-1	16	0.2 J	ND (0.4)
2012-1	7.4	0.1 J	ND (0.4)
2012-2	2.5	0.1 J	ND (0.4)
2012-3	PENDING		
3/2014	4.3	ND (0.20)	ND (0.5)
7/2014	14.8	ND (0.5)	ND (0.5)
9/2014	0.340 J	ND (0.5)	ND (0.5)
12/2014	3.29	ND (0.5)	ND (0.5)
3/2015	4.51	ND (1)	ND (1)
6/2015	17.6	ND (0.5)	ND (0.5)
9/2015	12.4	ND (0.5)	ND (0.5)
12/2015	ND (0.2)	ND (0.5)	ND (0.5)
3/2016	0.19 J	ND (1)	ND (1)
6/2016	2.63	ND (0.5)	ND (0.5)
9/2016	5.08	ND (1)	ND (1)
12/2016	0.66	ND (0.5)	ND (0.5)

OU6MW-67

Date	Benzene	Ethylbenzene	Toluene
1994-1	9.65	9.05	11.4
1994-2	42.5	18.8	83.8
1996-1	7.22	4.41	6.07
1996-2	4.28	2.04	1.76
1997-1	2.1	1.9	0.64
1997-2	2.5	1.7	0.93
1998-1	3.55	1.21	0.62
1998-2	4.15	1.24	0.66
1999-1	12	2.5	0.73
1999-2	11	4.2	0.7
2000-1	ND (0.11)	8.8	0.88
2000-2	3.1	5.9	0.48
2001-1	2.8	2.9	0.61
2001-2	ND (0.53)	2.3	0.7
2002-1	1.7	1.3	NA
2002-2	1.6	1.7	NA
2007-1	ND (0.12)	ND (0.31)	ND (0.31)
2009-1	1.5	0.77 J	0.35 J
2011-1	2.1	1	0.43

OU6MW-93

Date	Benzene	Ethylbenzene	Toluene
2001-1	ND (0.4)	ND (06)	0.27 J
2009-1	0.13 J	1.4	ND (1)
2010-1	ND (0.15)	0.72	1.6
2011-1	ND (0.2)	ND (0.2)	ND (0.4)
2012-1	ND (0.45)	0.18 J	ND (0.45)
11/2014	0.22	ND (0.5)	ND (0.5)
6/2015	ND (0.4)	ND (1)	0.59 J
9/2016	0.4 UJ	1.16 J	1 UJ

OU6MW-92

Date	Benzene	Ethylbenzene	Toluene
2001-1	74	240	13
2009-1	90	490	13
2010-1	59	800	32
2011-1	39	480	9.7
2012-1	6.2	91	ND (0.8)
11/2014	46.3	518	6.72
6/2015	66.8	340	24.6
9/2016	82.3	481	26.1

OU6MW-91

Date	Benzene	Ethylbenzene	Toluene
2001-1	ND (10.5)	1,200	3,100
2002-1	6.5	850	400
2002-2	3.3	180	110
2003-1	4.4	51	420
2004-1	2.6	300	19
2005-1	44	860	92
2006-1	ND (1.2)	185	8.1 J
2007-1	11.5	216	12.2
2009-1	0.67	23	8.8
2011-1	ND (5)	340	16
8/2013	2.21	490	50
2015	0.28 feet of product, no sample		
2016	0.02 feet of product, no sample		

OU6MW-94

Date	Benzene	Ethylbenzene	Toluene
9/2016	2.33	618	15.7

OU6MW-13

Date	Benzene	Ethylbenzene	Toluene	Methylene Chloride	1,2-DCA
1999-1	ND (0.12)	ND (0.17)	0.13	0.43	ND (0.16)
1999-2	ND (0.12)	ND (0.17)	ND (0.10)	ND (0.27)	ND (0.16)
2000-1	ND (0.11)	ND (0.10)	ND (0.10)	ND (0.19)	ND (0.11)
2000-2	ND (0.11)	ND (0.10)	ND (0.10)	ND (0.2)	ND (0.11)
2001-1	ND (0.11)	ND (0.10)	ND (0.10)	0.57	ND (0.11)
2001-2	ND (0.11)	ND (0.10)	ND (0.10)	ND (0.2)	ND (0.11)
2007-1	ND (0.12)	ND (0.31)	ND (0.31)	NA	NA
2012-1	ND (0.2)	ND (0.2)	ND (0.4)	NA	NA
6/2015	ND (0.4)	ND (0.1)	0.56 J		

14MW-120

Date	Benzene	Ethylbenzene	Toluene
2000-1	71	NA	NA
2001-1	170	310	280
2001-2	30	100	45
2002-1	100	250	630
2002-2	170	410	530
2003-1	87	230	274
2004-1	13	42	23
2005-1	12	37	51
2006-1	43.9	190	190
2007-1	3.2	21.6	23.9
8/2012	3.6	20	24
6/2015	3.66	55.3	50.2

14MW-121

Date	Benzene	Ethylbenzene	Toluene
2000-1	19	NA	NA
2001-1	36	240	440
2001-2	90	190	340
2002-1	190	530	690
2002-2	46	410	440
2003-1	18	190	160
2004-1	7.5	46	68
2005-1	7.9 J	39	58
2006-1	14	50.1	87.9
2007-1	3.2	38	60.2
8/2012	1	73	55
6/2015	4.89	50.9	85.8

OU6MW-46

Date	Benzene	Ethylbenzene	Toluene
1994-1	1,200	352	392
1994-2	1,390	587	792
1996-1	979	546	268
1996-2	695	410	164
1997-1	690	380	300
1997-2	500	130	46
1998-1	819	731	767
1998-2	937	894	1,330
1999-1	560	430	100
1999-2	470 M	460	320
2000-1	470 M	410	150
2000-2	390	520	340
2001-1	580	570	580
2001-2	700	720	1,000
2002-1	480	650	560
2002-2	600	870	900
2003-1	550	700	NA
2004-1	400	480	NA
2005-1	630	810	NA
2006-1	406	603	NA
2007-1	360	714	869
2009-1	330	570	340
2011-1	520	1,100	70
8/2013	160	910	45 J
9/2016	137	440	15.6

Legend:
- PROGRAM MONITORING WELL
- NON-PROGRAM MONITORING WELL
- ABANDONED MONITORING WELL
- SEEP SAMPLE LOCATION
- GROUNDWATER PLUME - FUELS (DASHED WHERE INFERRED)
- CERCLA SITES
- STATE SITES
- GENERAL GROUNDWATER FLOW DIRECTION (APPROXIMATE)
- 164.82' GROUNDWATER ELEVATION (FFET AMSL) (SYNOPTIC WATER LEVELS MEASURED JUNE 2015)
- GROUNDWATER CONTOUR (AMSL FEET - 5 FT. INTERVAL) (SYNOPTIC WATER LEVELS MEASURED JUNE 2015)

Notes
1. All groundwater results are in micrograms per liter (ug/L).
2. Red results exceed cleanup criteria.

Benzene (5 ug/L*)
Ethylbenzene (700 ug/L*)
Toluene (1,000 ug/L*)

AMSL Above Mean Sea Level
ND Not Detected [brackets indicate the MDL for 2008 and earlier, the PQL for 2009, and the LOD for 2010 and 2016].
MDL Method Detection Limits
LOD Limit of Detection
PQL Practical Quantification Limit
FD Field Duplicate
* Analyte Cleanup Criteria

FLAGS:
J - Analyte was positively identified, but the result is estimated.



Source:
USAF, 2017c. United States Air Force, Joint Base Elmendorf-Richardson, Alaska. Environmental Restoration Program. 2016 Annual Remedial Action-Operations and Monitoring Report for Select CERCLA Sites. Draft. December.

SCALE IN FEET
0 60

UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

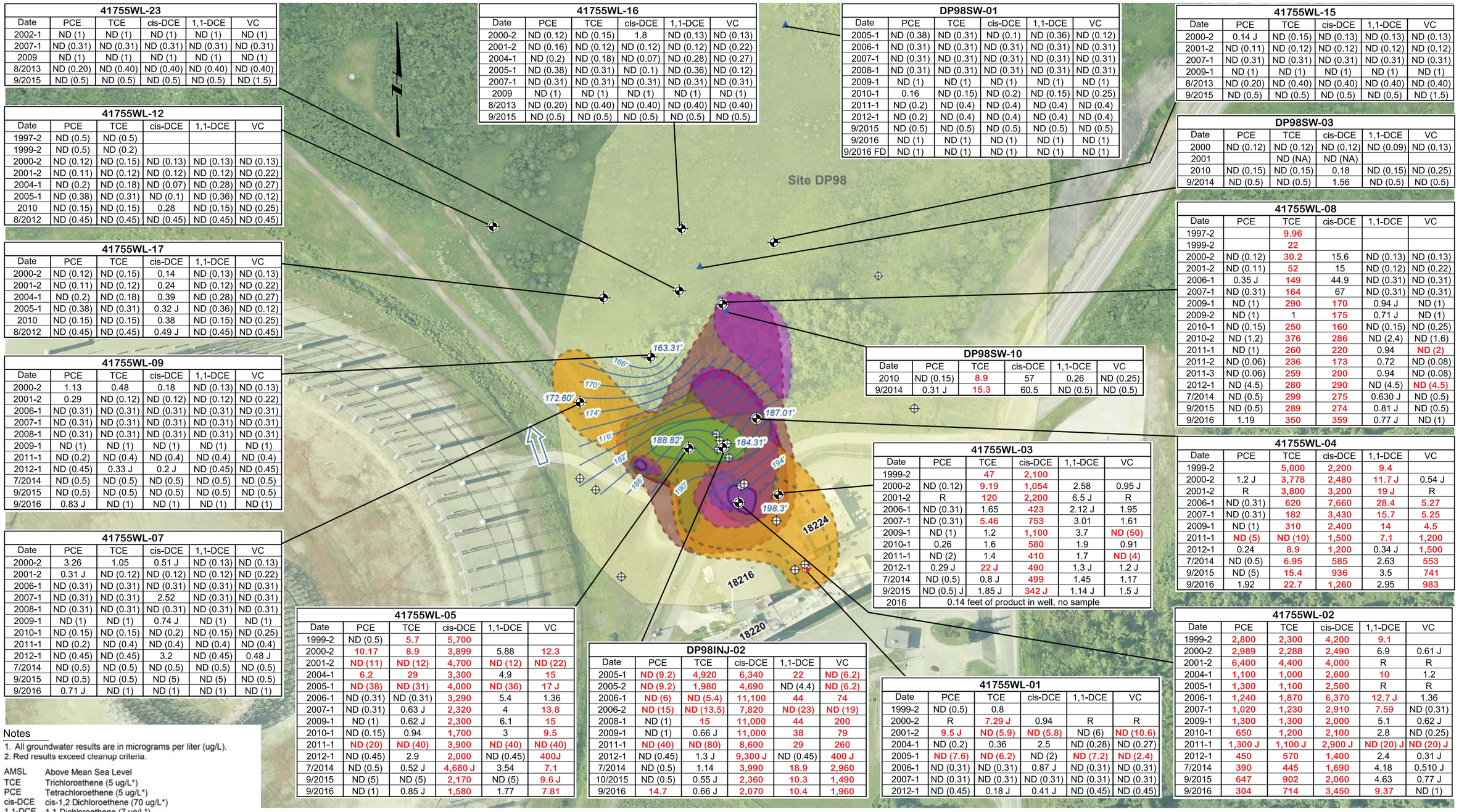
FIFTH FIVE-YEAR REVIEW FOR CERCLA SITES, JBER-E, ALASKA

OU6 - WP014
SITE LAYOUT AND HISTORICAL DATA

FIGURE
13-1

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41755WL-23

Date	PCE	TCE	cis-DCE	1,1-DCE	VC
2002-1	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
2007-1	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)
2009	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
8/2013	ND (0.20)	ND (0.40)	ND (0.40)	ND (0.40)	ND (0.40)
9/2015	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (1.5)

41755WL-12

Date	PCE	TCE	cis-DCE	1,1-DCE	VC
1997-2	ND (0.5)	ND (0.5)			
1999-2	ND (0.5)	ND (0.2)			
2000-2	ND (0.12)	ND (0.15)	ND (0.13)	ND (0.13)	ND (0.13)
2001-2	ND (0.11)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.22)
2004-1	ND (0.2)	ND (0.18)	ND (0.07)	ND (0.28)	ND (0.27)
2005-1	ND (0.38)	ND (0.31)	ND (0.1)	ND (0.36)	ND (0.12)
2010	ND (0.15)	ND (0.15)	0.28	ND (0.15)	ND (0.25)
8/2012	ND (0.45)	ND (0.45)	ND (0.45)	ND (0.45)	ND (0.45)

41755WL-17

Date	PCE	TCE	cis-DCE	1,1-DCE	VC
2000-2	ND (0.12)	ND (0.15)	0.14	ND (0.13)	ND (0.13)
2001-2	ND (0.11)	ND (0.12)	0.24	ND (0.12)	ND (0.22)
2004-1	ND (0.2)	ND (0.18)	0.39	ND (0.28)	ND (0.27)
2005-1	ND (0.38)	ND (0.31)	0.32 J	ND (0.36)	ND (0.12)
2010	ND (0.15)	ND (0.15)	0.38	ND (0.15)	ND (0.25)
8/2012	ND (0.45)	ND (0.45)	0.49 J	ND (0.45)	ND (0.45)

41755WL-09

Date	PCE	TCE	cis-DCE	1,1-DCE	VC
2000-2	1.13	0.48	0.18	ND (0.13)	ND (0.13)
2001-2	0.29	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.22)
2006-1	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)
2007-1	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)
2008-1	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)
2009-1	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
2011-1	ND (0.2)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)
2012-1	ND (0.45)	0.33 J	0.2 J	ND (0.45)	ND (0.45)
7/2014	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
9/2015	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
9/2016	0.83 J	ND (1)	ND (1)	ND (1)	ND (1)

41755WL-07

Date	PCE	TCE	cis-DCE	1,1-DCE	VC
2000-2	3.26	1.05	0.51 J	ND (0.13)	ND (0.13)
2001-2	0.31 J	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.22)
2006-1	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)
2007-1	ND (0.31)	ND (0.31)	2.52	ND (0.31)	ND (0.31)
2008-1	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)
2009-1	ND (1)	ND (1)	0.74 J	ND (1)	ND (1)
2010-1	ND (0.15)	ND (0.15)	ND (0.2)	ND (0.15)	ND (0.25)
2011-1	ND (0.2)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)
2012-1	ND (0.45)	ND (0.45)	3.2	ND (0.45)	0.48 J
7/2014	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
9/2015	ND (0.5)	ND (0.5)	ND (5)	ND (5)	ND (0.5)
9/2016	0.71 J	ND (1)	ND (1)	ND (1)	ND (1)

41755WL-16

Date	PCE	TCE	cis-DCE	1,1-DCE	VC
2000-2	ND (0.12)	ND (0.15)	1.8	ND (0.13)	ND (0.13)
2001-2	ND (0.16)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.22)
2004-1	ND (0.2)	ND (0.18)	ND (0.07)	ND (0.28)	ND (0.27)
2005-1	ND (0.38)	ND (0.31)	ND (0.1)	ND (0.36)	ND (0.12)
2007-1	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)
2009	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
8/2013	ND (0.20)	ND (0.40)	ND (0.40)	ND (0.40)	ND (0.40)
9/2015	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)

41755WL-05

Date	PCE	TCE	cis-DCE	1,1-DCE	VC
1999-2	ND (0.5)	5.7	5,700		
2000-2	10.17	8.9	3,899	5.88	12.3
2001-2	ND (11)	ND (12)	4,700	ND (12)	ND (22)
2004-1	6.2	29	3,300	4.9	15
2005-1	ND (38)	ND (31)	4,000	ND (36)	17 J
2006-1	ND (0.31)	ND (0.31)	3,290	5.4	1.36
2007-1	ND (0.31)	0.63 J	2,320	4	13.8
2009-1	ND (1)	0.62 J	2,300	6.1	15
2010-1	ND (0.15)	0.94	1,700	3	9.5
2011-1	ND (20)	ND (40)	3,900	ND (40)	ND (40)
2012-1	ND (0.45)	2.9	2,000	ND (0.45)	400J
7/2014	ND (0.5)	0.52 J	4,680 J	3.54	7.1
9/2015	ND (5)	ND (5)	2,170	ND (5)	9.6 J
9/2016	ND (1)	0.85 J	1,580	1.77	7.81

DP98SW-01

Date	PCE	TCE	cis-DCE	1,1-DCE	VC
2005-1	ND (0.38)	ND (0.31)	ND (0.1)	ND (0.36)	ND (0.12)
2006-1	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)
2007-1	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)
2008-1	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)
2009-1	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
2010-1	0.16	ND (0.15)	ND (0.2)	ND (0.15)	ND (0.25)
2011-1	ND (0.2)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)
2012-1	ND (0.2)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)
9/2015	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
9/2016	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
9/2016 FD	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)

DP98SW-10

Date	PCE	TCE	cis-DCE	1,1-DCE	VC
2010	ND (0.15)	8.9	57	0.26	ND (0.25)
9/2014	0.31 J	15.3	60.5	ND (0.5)	ND (0.5)

41755WL-03

Date	PCE	TCE	cis-DCE	1,1-DCE	VC
1999-2		47	2,100		
2000-2	ND (0.12)	9.19	1,054	2.58	0.95 J
2001-2	R	120	2,200	6.5 J	R
2006-1	ND (0.31)	1.65	423	2.12 J	1.95
2007-1	ND (0.31)	5.46	753	3.01	1.61
2009-1	ND (1)	1.2	1,100	3.7	ND (50)
2010-1	0.26	1.6	580	1.9	0.91
2011-1	ND (2)	1.4	410	1.7	ND (4)
2012-1	0.29 J	22 J	490	1.3 J	1.2 J
7/2014	ND (0.5)	0.8 J	499	1.45	1.17
9/2015	ND (0.5) J	1.85 J	342 J	1.14 J	1.5 J
2016	0.14 feet of product in well, no sample				

DP98INJ-02

Date	PCE	TCE	cis-DCE	1,1-DCE	VC
2005-1	ND (9.2)	4,920	6,340	22	ND (6.2)
2005-2	ND (9.2)	1,980	4,690	ND (4.4)	ND (6.2)
2006-1	ND (6)	ND (5.4)	11,100	44	74
2006-2	ND (15)	ND (13.5)	7,820	ND (23)	ND (19)
2008-1	ND (1)	15	11,000	44	200
2009-1	ND (1)	0.66 J	11,000	38	79
2011-1	ND (40)	ND (80)	8,600	29	260
2012-1	ND (0.45)	1.3 J	9,300 J	ND (0.45)	400 J
7/2014	ND (0.5)	1.14	3,990	18.9	2,960
10/2015	ND (0.5)	0.55 J	2,360	10.3	1,490
9/2016	14.7	0.66 J	2,070	10.4	1,960

41755WL-01

Date	PCE	TCE	cis-DCE	1,1-DCE	VC
1999-2	ND (0.5)	0.8			
2000-2	R	7.29 J	0.94	R	R
2001-2	9.5 J	ND (5.9)	ND (5.8)	ND (6)	ND (10.6)
2004-1	ND (0.2)	0.36	2.5	ND (0.28)	ND (0.27)
2005-1	ND (7.6)	ND (6.2)	ND (2)	ND (7.2)	ND (2.4)
2006-1	ND (0.31)	ND (0.31)	0.87 J	ND (0.31)	ND (0.31)
2007-1	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)
2012-1	ND (0.45)	0.18 J	0.41 J	ND (0.45)	ND (0.45)

41755WL-15

Date	PCE	TCE	cis-DCE	1,1-DCE	VC
2000-2	0.14 J	ND (0.15)	ND (0.13)	ND (0.13)	ND (0.13)
2001-2	ND (0.11)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.12)
2007-1	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)	ND (0.31)
2009-1	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
8/2013	ND (0.20)	ND (0.40)	ND (0.40)	ND (0.40)	ND (0.40)
9/2015	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (1.5)

DP98SW-03

Date	PCE	TCE	cis-DCE	1,1-DCE	VC
2000	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.09)	ND (0.13)
2001		ND (NA)	ND (NA)		
2010	ND (0.15)	ND (0.15)	0.18	ND (0.15)	ND (0.25)
9/2014	ND (0.5)	ND (0.5)	1.56	ND (0.5)	ND (0.5)

41755WL-08

Date	PCE	TCE	cis-DCE	1,1-DCE	VC
1997-2		9.96			
1999-2		22			
2000-2	ND (0.12)	30.2	15.6	ND (0.13)	ND (0.13)
2001-2	ND (0.11)	52	15	ND (0.12)	ND (0.22)
2006-1	0.35 J	149	44.9	ND (0.31)	ND (0.31)
2007-1	ND (0.31)	164	67	ND (0.31)	ND (0.31)
2009-1	ND (1)	290	170	0.94 J	ND (1)
2009-2	ND (1)	1	175	0.71 J	ND (1)
2010-1	ND (0.15)	250	160	ND (0.15)	ND (0.25)
2010-2	ND (1.2)	376	286	ND (2.4)	ND (1.6)
2011-1	ND (1)	260	220	0.94	ND (2)
2011-2	ND (0.06)	236	173	0.72	ND (0.08)
2011-3	ND (0.06)	259	200	0.94	ND (0.08)
2012-1	ND (4.5)	280	290	ND (4.5)	ND (4.5)
7/2014	ND (0.5)	299	275	0.630 J	ND (0.5)
9/2015	ND (0.5)	289	274	0.81 J	ND (0.5)
9/2016	1.19	350	359	0.77 J	ND (1)

41755WL-04

Date	PCE	TCE	cis-DCE	1,1-DCE	VC
1999-2		5,000	2,200	9.4	
2000-2	1.2 J	3,778	2,480	11.7 J	0.54 J
2001-2	R	3,800	3,200	19 J	R
2006-1	ND (0.31)	620	7,660	28.4	5.27
2007-1	ND (0.31)	182	3,430	15.7	5.25
2009-1	ND (1)	310	2,400	14	4.5
2011-1	ND (5)	ND (10)	1,500	7.1	1,200
2012-1	0.24	8.9	1,200	0.34 J	1,500
7/2014	ND (0.5)	6.95	585	2.63	553
9/2015	ND (5)	15.4	936	3.5	741
9/2016	1.92	22.7	1,260	2.95	983

41755WL-02

Date	PCE	TCE	cis-DCE	1,1-DCE	VC
1999-2	2,800	2,300	4,200	9.1	
2000-2	2,989	2,288	2,490	6.9	0.61 J
2001-2	6,400	4,400	4,000	R	R
2004-1	1,100	1,000	2,600	10	1.2
2005-1	1,300	1,100	2,500	R	R
2006-1	1,240	1,870	6,370	12.7 J	1.36
2007-1	1,020	1,230	2,910	7.59	ND (0.31)
2009-1	1,300	1,300	2,000	5.1	0.62 J
2010-1	650	1,200	2,100	2.8	ND (0.25)
2011-1	1,300 J	1,100 J	2,900 J	ND (20) J	ND (20) J
2012-1	450	570	1,400	2.4	0.31 J
7/2014	390	445	1,690	4.18	0.510 J
9/2015	647	902	2,060	4.63	0.77 J
9/2016	304	714	3,450	9.37	ND (1)

Notes

1. All groundwater results are in micrograms per liter (ug/L).
2. Red results exceed cleanup criteria.

AMSL	Above Mean Sea Level
TCE	Trichloroethene (5 ug/L*)
PCE	Tetrachloroethene (5 ug/L*)
cis-DCE	cis-1,2 Dichloroethene (70 ug/L*)
1,1-DCE	1,1-Dichloroethene (7 ug/L*)
VC	Vinyl Chloride (2 ug/L*)
ND	Not Detected [brackets indicate the PQL for 2009, and the LOD for 2010 - 2016]
LOD	Limit of Detection
PQL	Practical Quantification Limit
FD	Field Duplicate
---	Not Analyzed
*	Analyte Cleanup Criteria

FLAGS:
J - Analyte was positively identified, but result is estimated.
R - The data were rejected because certain quality control criteria were not met.

Plume Key:

- cis-DCE > 70 ug/L | > 1,000 ug/L
- DRO > 1,500 ug/L | > 10,000 ug/L
- PCE > 5 ug/L | > 1,000 ug/L
- TCE > 5 ug/L | > 1,000 ug/L
- VC > 2 ug/L | > 10 ug/L

Legend:

- PROGRAM MONITORING WELL
- NON-PROGRAM MONITORING WELL
- SURFACE WATER SAMPLE LOCATION
- 164.82' GROUNDWATER ELEVATION (FFET AMSL) (SYNOPTIC WATER LEVELS MEASURED SEPT 2014)
- GROUNDWATER CONTOU LINE (FEET AMSL) (SYNOPTIC WATER LEVELS MEASURED SEPT 2014)
- GENERAL GROUNDWATER FLOW DIRECTION (APPROXIMATE)

Source:
USAF, 2017c. United States Air Force, Joint Base Elmendorf-Richardson, Alaska. Environmental Restoration Program. 2016 Annual Remedial Action-Operations and Monitoring Report for Select CERCLA Sites. Draft. December.

SCALE IN FEET
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UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

FIFTH FIVE-YEAR REVIEW FOR CERCLA SITES, JBER-E, ALASKA

DP098
SITE LAYOUT AND HISTORICAL DATA

FIGURE
14-1

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TIME: 07-AUG-2019 15:16

APPENDIX A
Reference List

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APPENDIX A – REFERENCE LIST

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APPENDIX B
Community Notification Materials

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AFFIDAVIT OF PUBLICATION

STATE OF ALASKA

THIRD JUDICIAL DISTRICT

Joleesa Stepetin
being first duly sworn on oath deposes and says that he/she is a representative of the Alaska Dispatch News, a daily newspaper. That said newspaper has been approved by the Third Judicial Court, Anchorage, Alaska, and it now and has been published in the English language continually as a daily newspaper in Anchorage, Alaska, and it is now and during all said time was printed in an office maintained at the aforesaid place of publication of said newspaper. That the annexed is a copy of an advertisement as it was published in regular issues (and not in supplemental form) of said newspaper on

June 21, 2017, June 25, 2017

and that such newspaper was regularly distributed to its subscribers during all of said period. That the full amount of the fee charged for the foregoing publication is not in excess of the rate charged private individuals.

Signed Joleesa Stepetin

Subscribed and sworn to before me
this 26th day of June, 2017

Notary Public in and for
The State of Alaska.
Third Division
Anchorage, Alaska
MY COMMISSION EXPIRES
4/14/21

ANGELA M SIMMONS
NOTARY PUBLIC
State of Alaska
My Commission Expires Apr. 14, 2021

US Air Force Announces Start of Five-Year Review

The 673d Air Base Wing at Joint Base Elmendorf-Richardson (JBER) announces the beginning of the Five-Year Review of cleanup remedies implemented at Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) sites.

The purpose of the Five-Year Review is to evaluate whether the remedies selected to clean up contaminated sites are operating as designed and continue to remain protective of human health and the environment. The U.S. Environmental Protection Agency and Alaska Department of Environmental Conservation also are participating in this review.

Reviews are conducted at least once every five years until contaminant levels allow unlimited use of the site and unrestricted exposure to the air, soil and water. Detailed information concerning JBER cleanup efforts is available in the information repository at:

Alaska Resources Library & Information Services
University of Alaska, Anchorage Consortium Library
3211 Providence Drive
(907) 786-1871

The findings of the Five-Year Review will be placed in the information repository.

Interested persons can participate in the Five-Year Review process through September 29, 2017 by responding to a questionnaire available from:

Michael Zidek, Stantec, Inc.
725 East Fireweed Lane Suite 200
Anchorage, AK 99503
michael.zidek@stantec.com (907) 266-1126

Information on the cleanup process is distributed to interested persons through periodic JBER Environmental Restoration Program Fact Sheets. If you want to be added to the mailing list, call (907) 384-2972 or (907) 384-1824.

Published: June 21 & 25, 2017

RECEIVED
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Stantec, Anchorage

Chugiak*Eagle River STAR

11401 Old Glen Highway,
Unit 105
Eagle River, AK 99577-7499
Phone: 907-694-2727
Fax: 907-694-1545

AFFIDAVIT OF PUBLICATION

UNITED STATES OF AMERICA)
)
STATE OF ALASKA)**ss**
)
THIRD JUDICIAL DIVISION)

BEFORE ME, the undersigned, a Notary Public, this day personally appeared **Ryan Estrada** who, being first duly sworn, according to law, says that he is the **Account Executive** of the Chugiak*Eagle River STAR published at Eagle River in said Division and State of Alaska, and that the advertisement, of which the annexed is a true copy, was published in said publication on

Thursday, 6/29/17

and that the rate charged thereon is not in excess of the rate charged private individuals.

STATE OF ALASKA NOTARY PUBLIC Lora Bickford

Subscribed and sworn before me this 31st day of July, 2017.
Notary Public for State of Alaska
My Commission Expires
7/31/17

ANCHORAGE PRESS
731 I STREET SUITE 102
Anchorage, Alaska 99501



US Air Force Announces Start of Five-Year Review

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XNLV33594

I, Bridget Mackey, advertising representative for The Arctic Warrior verify that the Public Notice for Stantec appeared in the June 30,2017 Arctic Warrior issuue of the Anchorage Press Newspaper.

Bridget Mackey

Subscribed and sworn to me in the Municipality of Anchorage, in the state Alaska, on this 2nd day of august, 2017.

Notary Public Signature

5-24-21
Commission Expires

CLARE TILLEY
Notary Public
State of Alaska
My Commission Expires
May 24, 2021

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APPENDIX C
Interview Reponses

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Print Form

Interview Record

Name:	Cody Black	Date:	07/12/17
Organization:	Ahtna Environmental Inc.	Phone Number:	(907) 433-0718
Title:	Senior Program Manager	Email:	cblack@ahtna.net
Interview Type:	☒ Mail/Email	☐ Phone/In Person	

The following questions are from the U. S. Environmental Protection Agency (EPA) Comprehensive Five-Year Review Guidance. Please answer the questions when they are applicable to your experience with the cleanup activities at Joint Base Elmendorf-Richardson (JBER), Alaska. Questions can be left unanswered if they do not apply to you.

Interview Questions

1. What is your overall impression of the restoration effort at JBER, Alaska? (general sentiment)

Active pursuit of funds to perform restoration projects that meet regulatory requirements.

2. What effects do you think site operations have had on the surrounding community? Are you aware of any community concerns or complaints regarding any site or its operations? If so, please provide details.

AEI project scope did not include engagement with surrounding community.

3. Are you aware of any events, incidents, or activities at any site such as vandalism, trespassing, or emergency responses from local authorities? If so, please provide details of the events and results of the responses.

Not aware of any events.

4. Do you feel well informed about site activities and cleanup progress?

Information seems easy to obtain if interested.

5. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding a site? If so, please give purpose and results.

None.

6. Is there a continuous on-site operations and maintenance (O&M) presence at the site? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

The AEI project I participated in was a short excavation, disposal, and sampling project where up to 3 AEI personnel were present on site for approximately 2 weeks.

7. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

Not applicable to AEI Project

8. Have any problems been encountered at the site which required, or will require, changes to the cleanup activity?

None.

9. Are you aware of any changes in land use, access, or other site conditions that have occurred since the last Five-Year Review (2013) that you feel may impact the protectiveness or effectiveness of the remedy?

Not aware of any.

10. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details or reference reports.

Not applicable to AEI Project

11. Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency, or reference remedial process optimization or another report.

Not applicable to AEI Project

12. Do you have any comments, suggestions, or recommendations regarding cleanup activities at Joint Base Elmendorf-Richardson?

None.

Note: Ahtna Environmental has conducted environmental restoration activities as a contractor on JBER-E

Print Form

Interview Record

Name:	Ellen Godden	Date:	07/19/17
Organization:	AFCEC/CZOP	Phone Number:	552-7439
Title:	Project Manager/Contracting Officer Re	Email:	elizabeth.godden.1@us.af.mil
Interview Type:	☒ Mail/Email	☐ Phone/In Person	

The following questions are from the U. S. Environmental Protection Agency (EPA) Comprehensive Five-Year Review Guidance. Please answer the questions when they are applicable to your experience with the cleanup activities at Joint Base Elmendorf-Richardson (JBER), Alaska. Questions can be left unanswered if they do not apply to you.

Interview Questions

1. What is your overall impression of the restoration effort at JBER, Alaska? (general sentiment)

Outstanding

2. What effects do you think site operations have had on the surrounding community? Are you aware of any community concerns or complaints regarding any site or its operations? If so, please provide details.

Restoration efforts have benefited the surrounding community by providing employment to the Air Force civilian employees managing the program, to local contractors hired to conduct cleanup operations, and to local businesses who support both, especially those who provide supplies and equipment to contractors. Secondly, cleanup efforts have prevented escape of any contaminants from the installation boundaries.

3. Are you aware of any events, incidents, or activities at any site such as vandalism, trespassing, or emergency responses from local authorities? If so, please provide details of the events and results of the responses.

No

4. Do you feel well informed about site activities and cleanup progress?

Yes

5. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding a site? If so, please give purpose and results.

Yes. Our office provides technical surveillance for any work on sites conducted through AFCEC contracts or task orders. Results, such as number of visits and inspections, observations and reports vary. Currently, over 100 JBER sites are under AFCEC task orders or contracts.

6. Is there a continuous on-site operations and maintenance (O&M) presence at the site? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

Technical surveillance requires site visits or surveillance when the customer (the base remedial project manager) reports a problem with contractor performance as it relates to Statement of Work. These reports are infrequent and typically easily remedied through an email requesting the contractor correct the issue.

7. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

There have been no changes of which I am aware that would effect protectiveness or effectiveness of a remedy.

8. Have any problems been encountered at the site which required, or will require, changes to the cleanup activity?

Not to my knowledge.

9. Are you aware of any changes in land use, access, or other site conditions that have occurred since the last Five-Year Review (2013) that you feel may impact the protectiveness or effectiveness of the remedy?

No

10. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details or reference reports.

There have been none to my knowledge.

11. Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency, or reference remedial process optimization or another report.

Over 100 JBER sites are includes in the Alaska Group PBR. All sites that have not reached SC have required optimization efforts as a part of the minimum performance objectives.

12. Do you have any comments, suggestions, or recommendations regarding cleanup activities at Joint Base Elmendorf-Richardson?

I think JBER has a strong restoration program. My opinion is not un-biased. I have worked in or in support of the program since 2001.

Print Form

Interview Record

Name:	Sandra Halstead	Date:	02/09/18
Organization:	EPA Region 10	Phone Number:	(907) 271-1218
Title:	CERCLA Remedial Project Manager	Email:	halstead.sandra@epa.gov
Interview Type:	☒ Mail/Email	☐ Phone/In Person	

The following questions are from the U. S. Environmental Protection Agency (EPA) Comprehensive Five-Year Review Guidance. Please answer the questions when they are applicable to your experience with the cleanup activities at Joint Base Elmendorf-Richardson (JBER), Alaska. Questions can be left unanswered if they do not apply to you.

Interview Questions

1. What is your overall impression of the restoration effort at JBER, Alaska? (general sentiment)

The Installation Restoration Program at Joint Base Elmendorf Richardson is an organized and pro-active effort to identify historically contaminated sites, assess risk to humans (workers, residents) and wildlife, and determine effective methods to reduce any risks from chemical exposures. The program is mature and has experienced staff and contractors to assist in assessing and achieving site cleanups. This Five Year Review (2018) will assess if the remedies in place at Elmendorf AFB are effective. It does not consider a number of newly identified contaminated sites that are still under investigation.

2. What effects do you think site operations have had on the surrounding community? Are you aware of any community concerns or complaints regarding any site or its operations? If so, please provide details.

JBER conducts community advisory board meetings two times per year, which provides an open forum for dialogue and discussion on environmental concerns with JBER command and the environmental restoration staff. Additionally, JBER accepts written and verbal comments prior to finalizing any formal cleanup decisions. Overall I am not aware of any substantial community concerns.

3. Are you aware of any events, incidents, or activities at any site such as vandalism, trespassing, or emergency responses from local authorities? If so, please provide details of the events and results of the responses.

No, I am not aware of any vandalism, trespassing, or emergency response at JBER involving historically contaminated sites.

4. Do you feel well informed about site activities and cleanup progress?

Yes, JBER staff and contractors conduct scoping sessions prior to initializing projects to obtain EPA and ADEC feedback. Workplans and reports on site activities are provided for review and comment. JBER and the regulatory agencies meet twice a year to discuss progress and overall restoration projects in addition to the individual site meetings.

5. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding a site? If so, please give purpose and results.

EPA Region 10 has an office in Anchorage and the EPA RPM assigned to JBER has the opportunity for informal site visits on the installation. EPA conducted split sampling with the Air Force in the summer of 2016 during investigation of the Poly and Perfluorinated Compounds (PFAS) at the installation. Additionally in the summer of 2017, EPA and the Air Force conducted a tour of JBER sites for EPA visiting directors and staff from the Federal Facilities Restoration and Reuse Office (FFRRO - EPA HQ) and Region 10 Office of Environmental Cleanup.

6. Is there a continuous on-site operations and maintenance (O&M) presence at the site? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

Operation and Maintenance of the existing remedies consists primarily of groundwater monitoring via annual sampling. Contractors perform these activities. Reporting of results is often quite delayed one or two years following a sampling event, which could result in missed opportunities to react or change procedures in subsequent monitoring events.
At JBER-E, a passive wetland remediation system operates as a component of the OU5 remedy to attenuate VOCs prior to discharge to Ship Creek. OU6 LF004 Landfill debris removal has been reduced from annual to every 3 years due to stabilization of the eroding bluff.

7. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

Not directly. There are individual source areas on Elmendorf that have achieved interim remedial action completion, which will eliminate the requirement for groundwater sampling under CERCLA. In some cases, this may also lead to decommissioning of monitoring wells if groundwater has also attained cleanup for state listed contaminants (primarily fuels).

8. Have any problems been encountered at the site which required, or will require, changes to the cleanup activity?

There are some groundwater plumes on Elmendorf where contaminant concentrations are not decreasing at a rate to meet timelines established in the ROD(s). Some plumes, for example DP98, have increasing concentrations at the downgradient edge, suggesting the plume is not stable and may be migrating. Treatability studies may be useful to test new remedial technologies at these long-term groundwater plumes.

9. Are you aware of any changes in land use, access, or other site conditions that have occurred since the last Five-Year Review (2013) that you feel may impact the protectiveness or effectiveness of the remedy?

The Air Force conducted preliminary sampling for the Poly and Perfluorinated Compounds in 2016 and the detection of these chemicals in soils and groundwater above current human health advisory levels will lead to additional investigation and possible actions. Many of the sites are on Elmendorf and a few overlap with areas with existing RODs.

10. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details or reference reports.

Federal budget cuts in the Installation Restoration Program may limit the ability of the Air Force to complete O&M or test innovative technologies.

11. Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency, or reference remedial process optimization or another report.

For sites that have attained Remedial Action Objectives (cleanup levels established in the RODs), CERCLA O&M can be discontinued. Interim Remedial Action Completion Reports have been documented for sites: OU1 LF059 (groundwater plume transferred to upgradient source associated with new site CG704), OU4 SD024 and OU4 SD028. Additionally, an Explanation of Significant Difference was completed for OU4 SD025 to transfer this site with non-CERLCA contaminants to the State of Alaska for cleanup oversight.

12. Do you have any comments, suggestions, or recommendations regarding cleanup activities at Joint Base Elmendorf-Richardson?

The Installation Restoration Program team at JBER is professional and dedicated to ensuring historical contamination at the installation is addressed to protect human health and the environment.

Print Form

Interview Record

Name:	Louis Howard	Date:	07/06/17
Organization:	ADEC	Phone Number:	(907) 269-7552
Title:	Environmental Program Specialits	Email:	louis.howard@alaska.gov
Interview Type:	☒ Mail/Email	☐ Phone/In Person	

The following questions are from the U. S. Environmental Protection Agency (EPA) Comprehensive Five-Year Review Guidance. Please answer the questions when they are applicable to your experience with the cleanup activities at Joint Base Elmendorf-Richardson (JBER), Alaska. Questions can be left unanswered if they do not apply to you.

Interview Questions

1. What is your overall impression of the restoration effort at JBER, Alaska? (general sentiment)

Overall, the environmental work by JBER is commendable. The cleanup effort has been very effective for historical spills and releases to the environment.

2. What effects do you think site operations have had on the surrounding community? Are you aware of any community concerns or complaints regarding any site or its operations? If so, please provide details.

Positive effects. The cleanup efforts have eliminated or substantially reduced the original sources of contamination. Not aware of any community concerns or complaints regarding any site or its operations.

3. Are you aware of any events, incidents, or activities at any site such as vandalism, trespassing, or emergency responses from local authorities? If so, please provide details of the events and results of the responses.

No.

4. Do you feel well informed about site activities and cleanup progress?

Yes.

5. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding a site? If so, please give purpose and results.

Yes. These included inspections of investigations and cleanups during the field seasons, Base tours for the JBER Community Environmental Board, CERCLA Remedial Project Manager meetings on site activities, review, comment and comment resolution meetings on technical documents.

6. Is there a continuous on-site operations and maintenance (O&M) presence at the site? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

The semi-annual reports and groundwater annual reports for CERCLA, Petroleum sites provide detailed information on this question. O&M changes have been required for change in frequency of monitoring and various treatability studies for enhancing remedies.

7. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

   See above.

8. Have any problems been encountered at the site which required, or will require, changes to the cleanup activity?

   PFOS/PFOA contamination recently detected in soil and groundwater above ADEC cleanup levels and groundwater contamination above EPA Health Advisory levels will require either reopening closed sites under Records of Decisions (ROD amendments) or require AFEC to conduct a new remedial investigation/feasibility study as new source areas under CERCLA and the respective Federal Facility Agreements.

9. Are you aware of any changes in land use, access, or other site conditions that have occurred since the last Five-Year Review (2013) that you feel may impact the protectiveness or effectiveness of the remedy?

   Recent investigation has shown that source areas ST037 and LF004 have PFOS/PFOA contamination in groundwater at the southern and southwestern Base boundaries which may be migrating off base in groundwater and surface water. SS022 has a 1.6 mile plume of trichloroethylene and other solvents originating from Anomaly 10, which has the potential to impact Ship Creek (located 220 feet away from the downgradient edge) as it migrates off site. The last sampling event showed TCE in a drainage ditch at the downgradient edge of the plume (2013 RI/FS SS022).

10. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details or reference reports.

    No.

11. Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency, or reference remedial process optimization or another report.

See semi-annual reports and various reports by the performance based contractors for JBER-Elmendorf and JBER-Richardson.

12. Do you have any comments, suggestions, or recommendations regarding cleanup activities at Joint Base Elmendorf-Richardson?

No.

Print Form

Interview Record

Name:	Arthur D. Isham	Date:	06/30/17
Organization:	Aerospace Logistics Services	Phone Number:	(907) 227-2307
Title:	Owner	Email:	isham@gci.net
Interview Type:	☒ Mail/Email	☐ Phone/In Person	

The following questions are from the U. S. Environmental Protection Agency (EPA) Comprehensive Five-Year Review Guidance. Please answer the questions when they are applicable to your experience with the cleanup activities at Joint Base Elmendorf-Richardson (JBER), Alaska. Questions can be left unanswered if they do not apply to you.

Interview Questions

1. What is your overall impression of the restoration effort at JBER, Alaska? (general sentiment)

Progress is being made as best as possible within budget restrictions.

2. What effects do you think site operations have had on the surrounding community? Are you aware of any community concerns or complaints regarding any site or its operations? If so, please provide details.

Minimal impact. No complaints that I am aware of.

3. Are you aware of any events, incidents, or activities at any site such as vandalism, trespassing, or emergency responses from local authorities? If so, please provide details of the events and results of the responses.

No

4. Do you feel well informed about site activities and cleanup progress?

Yes, because I am a member of the Community Environmental Board

5. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding a site? If so, please give purpose and results.

No

6. Is there a continuous on-site operations and maintenance (O&M) presence at the site? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

No

7. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

N/A

8. Have any problems been encountered at the site which required, or will require, changes to the cleanup activity?

N/A

9. Are you aware of any changes in land use, access, or other site conditions that have occurred since the last Five-Year Review (2013) that you feel may impact the protectiveness or effectiveness of the remedy?

N/A

10. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details or reference reports.

N/A

11. Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency, or reference remedial process optimization or another report.

N/A

12. Do you have any comments, suggestions, or recommendations regarding cleanup activities at Joint Base Elmendorf-Richardson?

More publicity to let the public know that you are cleaning up the environmental problems inherited from a previous generation, and the safeguards that are in place to ensure that it does not happen again.

Print Form

Interview Record

Name:	Jody Kuhns	Date:	07/12/17
Organization:	Community Envr. Board	Phone Number:	(907) 297-9881
Title:	Safety and QA Manager	Email:	'jkuhns@jlproperties.com'
Interview Type:	☐ Mail/Email	☒ Phone/In Person	

The following questions are from the U. S. Environmental Protection Agency (EPA) Comprehensive Five-Year Review Guidance. Please answer the questions when they are applicable to your experience with the cleanup activities at Joint Base Elmendorf-Richardson (JBER), Alaska. Questions can be left unanswered if they do not apply to you.

Interview Questions

1. What is your overall impression of the restoration effort at JBER, Alaska? (general sentiment)

My general impression is excellent, they are going by all the DEC, EPA regulations that have been laid out. Any of the meetings I go to have covered all of the bases and have experts there, the team goes above and beyond to make sure there are relevant experts at the meetings.

2. What effects do you think site operations have had on the surrounding community? Are you aware of any community concerns or complaints regarding any site or its operations? If so, please provide details.

I'm not aware of any community concerns at this time.

3. Are you aware of any events, incidents, or activities at any site such as vandalism, trespassing, or emergency responses from local authorities? If so, please provide details of the events and results of the responses.

No

4. Do you feel well informed about site activities and cleanup progress?

Yes

5. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding a site? If so, please give purpose and results.

No, our office does not get involved with that.

6. Is there a continuous on-site operations and maintenance (O&M) presence at the site? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

I know there is continued on site activity because test wells are examined on a scheduled basis. My organization is not notified of the tests but I hear about it through the community environmental board meetings.

7. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

Not that I am aware of.

8. Have any problems been encountered at the site which required, or will require, changes to the cleanup activity?

Not that I am aware of.

9. Are you aware of any changes in land use, access, or other site conditions that have occurred since the last Five-Year Review (2013) that you feel may impact the protectiveness or effectiveness of the remedy?

Not since 2013.

10. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details or reference reports.

Not that I am aware of.

11. Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency, or reference remedial process optimization or another report.

Not that I am aware of.

12. Do you have any comments, suggestions, or recommendations regarding cleanup activities at Joint Base Elmendorf-Richardson?

No

Print Form

Interview Record

Name:	Marc Lamoreaux	Date:	07/12/17
Organization:	NV Eklutna	Phone Number:	(907) 242-6967
Title:	Land and Environment Director	Email:	nve.ledirector@eklutna-nsn.go
Interview Type:	☐ Mail/Email	☒ Phone/In Person	

The following questions are from the U. S. Environmental Protection Agency (EPA) Comprehensive Five-Year Review Guidance. Please answer the questions when they are applicable to your experience with the cleanup activities at Joint Base Elmendorf-Richardson (JBER), Alaska. Questions can be left unanswered if they do not apply to you.

Interview Questions

1. What is your overall impression of the restoration effort at JBER, Alaska? (general sentiment)

Not very happy because of the way the Eagle river flats were drained to address white phosphorous contaminations. They were contaminated because of the live fire exercises and now they drained the water out which is not good for the environment and the dust will blow away.

2. What effects do you think site operations have had on the surrounding community? Are you aware of any community concerns or complaints regarding any site or its operations? If so, please provide details.

Overall JBER has been a good neighbor. They have people help out with our events and they do a lot of good consultation with the tribes. NALAMP is a cleanup effort at eklutna sites and it is very good for us.

3. Are you aware of any events, incidents, or activities at any site such as vandalism, trespassing, or emergency responses from local authorities? If so, please provide details of the events and results of the responses.

No

4. Do you feel well informed about site activities and cleanup progress?

Info is always available to us.

5. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding a site? If so, please give purpose and results.

Yes about the eklutna river flats, not other sites

6. Is there a continuous on-site operations and maintenance (O&M) presence at the site? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

NA

7. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

NA

8. Have any problems been encountered at the site which required, or will require, changes to the cleanup activity?

Just Eklutna River Flats re: draining the wetlands

9. Are you aware of any changes in land use, access, or other site conditions that have occurred since the last Five-Year Review (2013) that you feel may impact the protectiveness or effectiveness of the remedy?

No

10. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details or reference reports.

NA

11. Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency, or reference remedial process optimization or another report.

NA

12. Do you have any comments, suggestions, or recommendations regarding cleanup activities at Joint Base Elmendorf-Richardson?

Keep it up!

Print Form

Interview Record

Name:	Leah A. Waller	Date:	07/18/17
Organization:	CH2M HILL	Phone Number:	
Title:	Project Manager	Email:	leah.waller@ch2m.com
Interview Type:	☒ Mail/Email	☐ Phone/In Person	

The following questions are from the U. S. Environmental Protection Agency (EPA) Comprehensive Five-Year Review Guidance. Please answer the questions when they are applicable to your experience with the cleanup activities at Joint Base Elmendorf-Richardson (JBER), Alaska. Questions can be left unanswered if they do not apply to you.

Interview Questions

1. What is your overall impression of the restoration effort at JBER, Alaska? (general sentiment)

2. What effects do you think site operations have had on the surrounding community? Are you aware of any community concerns or complaints regarding any site or its operations? If so, please provide details.

I am not aware of any community concerns or complaints regarding any site or its operations at JBER.

3. Are you aware of any events, incidents, or activities at any site such as vandalism, trespassing, or emergency responses from local authorities? If so, please provide details of the events and results of the responses.

I am not aware of any events, incidents, or activities.

4. Do you feel well informed about site activities and cleanup progress?

5. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding a site? If so, please give purpose and results.

Site inspections and groundwater sampling and associated reporting are completed for contracted sites under CH2M's PBR contract with Weston (for the USAF) for the following CERCLA sites:
Annual Site Inspections: CG039, DA089, SS044, XU022/XE023
Annual groundwater sampling: CG039, DA089
Five-year Review groundwater sampling: SS044

Treatability studies are being conducted for CG039, DA089. Sampling results are reported with the annual groundwater sampling results.

6. Is there a continuous on-site operations and maintenance (O&M) presence at the site? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

There are no continuous on-site O&M activities at the sites noted above.

7. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

8. Have any problems been encountered at the site which required, or will require, changes to the cleanup activity?

No

9. Are you aware of any changes in land use, access, or other site conditions that have occurred since the last Five-Year Review (2013) that you feel may impact the protectiveness or effectiveness of the remedy?

No

10. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details or reference reports.

11. Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency, or reference remedial process optimization or another report.

Revisions to annual groundwater sampling efforts are noted in the annual reports and the Remedial Action - Operations and Monitoring Letter Work Plan and Basewide UFP-QAPP Addendum.

12. Do you have any comments, suggestions, or recommendations regarding cleanup activities at Joint Base Elmendorf-Richardson?

Note: CH2M Hill has conducted environmental restoration activities as a contractor on JBER-E

APPENDIX D
JBER-E Land Use Controls Management Plan, January 2003

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UNITED STATES AIR FORCE

ELMENDORF AIR FORCE BASE, ALASKA

ENVIRONMENTAL RESTORATION PROGRAM

LAND USE CONTROLS MANAGEMENT PLAN FINAL

JANUARY 2003

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A Site Inspection LUC Checklist, Five-Year Review LUC Checklist, and Interview Form

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Acronyms

3 CES	3rd Wing Civil Engineer Squadron
ADEC	Alaska Department of Environmental Conservation
AFI	Air Force Instruction
CECD	Base Development Section
CEV	Environmental Flight
CEVP	Environmental Planning Section
CEVR	Environmental Restoration Section
EAFB	Elmendorf Air Force Base
EPA	U.S. Environmental Protection Agency
FFA	Federal Facilities Agreement
GP	General Plan
LUC	land use control
LUCMP	Land Use Controls Management Plan
NPL	National Priorities List
OU	operable unit
RAB	Restoration Advisory Board
ROD	record of decision
SERA	State-Elmendorf Restoration Agreement
USAF	U.S. Air Force

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Executive Summary

The intent of this Land Use Controls Management Plan is to provide base personnel and other entities involved in real estate management or project implementation with information on Elmendorf Air Force Base's (EAFB) land use control (LUC) requirements and guidance for ensuring continued LUC compliance.

The term "institutional controls" is used in EAFB records of decision (RODs), however the Air Force prefers the use of the term "land use controls." For the purposes of this report, the terms "institutional controls" and "land use controls" are used synonymously.

EAFB has implemented LUCs at several operable units (OUs) as part of its environmental restoration program. LUCs were established for OUs 1, 2, 4, 5, and 6 in their respective OU ROD as a component of their selected remedies. These LUCs were established at EAFB to prevent exposure to contaminated media, and they include restrictions on the use of the shallow aquifer south of the Elmendorf Moraine, limitations on the types of buildings at certain areas (primarily occupancy limitations), and designations of certain areas for recreational use only. As selected remedies for contaminated sites being addressed under the Environmental Quality program are negotiated, it is anticipated that the established LUCs will be expanded to support the remedies, or new LUCs will be established as required.

LUC management and compliance requirements reside within the following 3rd Wing Civil Engineer Squadron processes and subprocesses:

- Real estate management
- Facility siting
- Construction processes
  - Initial planning and facility siting
  - Preparation of construction contract documents
  - Project design review
  - Project implementation

Tracking and awareness methods for LUCs include use of an LUC certification database to issue and track annual LUC compliance certifications to government and private tenant organizations, active educational programs, discussions at briefings and meetings, site visits, and 5-year reviews as required by the U.S. Environmental Protection Agency.

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SECTION 1

Introduction

Elmendorf Air Force Base (EAFB) has implemented land use controls (LUCs) at several operable units (OUs) as part of its environmental restoration program. The term "institutional controls" is used in individual OUs record of decision (ROD), however the Air Force prefers the use of the term "land use controls." For the purposes of this report, the terms institutional controls and LUCs are used synonymously. LUCs were established for OUs 1, 2, 4, 5, and 6 in their respective RODs as a component of their selected remedies. These LUCs were established at EAFB to prevent exposure to contaminated media, and they include restrictions on the use of the shallow aquifer south of the Elmendorf Moraine, limitations on the types of buildings at certain areas (primarily occupancy limitations), and designations of certain areas for recreational use only. LUCs also apply to current and future permitted solid waste landfills at EAFB.

In addition, future LUCs may be required under the Environmental Quality Program sites through the State-Elmendorf Restoration Agreement (SERA). As future LUCs are developed, they will be added to this plan during future updates.

1.1 Purpose

Information appearing in text boxes indicates key information related to LUC management.

The purpose of this Land Use Controls Management Plan (LUCMP) is to document the processes used to manage, track, and enforce LUCs at EAFB. This LUCMP also provides a framework to ensure consistent and effective LUC management for 3rd Wing Civil Engineer Squadron (3 CES) staff (Engineering, Environmental, Planning, Real Estate, Operations, and Contracts), and Headquarters Pacific Air Forces. This plan is also intended to be used as a reference source for base contractors, Restoration Advisory Board (RAB) members, and regulatory agencies.

1.2 Background

1.2.1 U.S. Air Force LUC Policy

The intent of U.S. Air Force (USAF) regarding LUCs is to ensure that land-use activities remain compatible with land-use restrictions imposed on real estate as a result of the environmental restoration process. The policy on land use controls associated with environmental restoration activities was issued in a memorandum dated 17 January 2001 from the Office of the Deputy Under Secretary of Defense (Environmental Security) and includes guidance for both active installations and installations scheduled to be closed. Since EAFB is currently active and there are no plans to close the installation, this LUCMP focuses on the policy guidance related to active installations.

1.2.2 Environmental Restoration Program

The U.S. Environmental Protection Agency (EPA) placed EAFB on the National Priorities List (NPL) in August 1990, and EAFB signed a Federal Facilities Agreement (FFA) with the EPA and the Alaska Department of Environmental Conservation (ADEC) in November 1991. Pursuant to the FFA, EAFB implemented the Department of Defense's Environmental Restoration Program, formerly called the Installation Restoration Program, to identify, characterize, and remediate environmental contamination resulting from past operations. EAFB personnel, EPA, and ADEC comprise EAFB's restoration team.

The restoration team conducted record searches and intense investigations to identify potentially contaminated sources. This research identified 84 contaminated sites on EAFB, where contamination resulted from past landfill use, fuel spills, and underground storage tanks. The contaminated sites were divided into six operable units (OUs) based on either geographic proximity or those sites having similar contaminants. RODs were signed to outline cleanup actions to be taken at each of the six OUs. In addition to the clean up actions, LUCs, consisting of land-use and groundwater-use restrictions, were established to ensure both the short- and long-term protection of human health and the environment.

In October 1992, EAFB and ADEC signed the State-Elmendorf Restoration Agreement, under which 39 source areas were designated as state program sites. Remedial activities for these sites are currently being performed. LUCs associated with SERA sites will be addressed by site-specific decision documents and included in future updates of this LUCMP.

1.2.3 Groundwater Monitoring Program

Two aquifers exist south of the Elmendorf Moraine, beneath EAFB, separated by an impermeable layer of silt and clay. The lower aquifer is not contaminated and provides water to the power plant, fish hatchery, and EAFB water supply wells. The upper, or shallow aquifer is located 10 to 50 feet below ground surface and contains zones of contamination. Several of the RODs require groundwater monitoring in the upper aquifer as part of the selected remedies.

Natural attenuation was selected as a cleanup remedy for groundwater in the shallow aquifer and involves passive cleanup through natural biological, chemical, and physical processes. EAFB monitors this groundwater to ensure protection of human health and the environment. The monitoring program involves the sampling of approximately 100 groundwater monitoring wells one or two times per year. Additional wells may be added to or removed from the program as necessary based on the results of the monitoring efforts.

Overall, groundwater natural attenuation has been working successfully and groundwater contamination appears to be diminishing. Contaminated groundwater is estimated to be restored within the next 25 years, however, LUCs will be in place and enforceable until groundwater cleanup levels have been achieved.

1.3 Definition, Source, and Timing of LUCs

LUCs are legal or administrative tools or actions taken to reduce the potential for exposure to hazardous substances or to enhance the protectiveness of a remedy. LUCs are imposed to ensure the continued effectiveness of land-use restrictions. LUCs may include, but are not limited to, easements, covenants, well drilling prohibitions, zoning restrictions, or special permit requirements. LUCs are distinguished from physical mechanisms, also referred to as engineering controls, which prevent or minimize exposure to hazardous substances through physical means. These physical mechanisms may include, but are not limited to, signage, fencing, capping, and other types of physical barriers.

LUCs must be in place as long as a property is not available for unrestricted use or unlimited exposure and may include temporary or permanent restrictions or requirements. When all cleanup goals have been achieved for a given site, temporary controls, such as groundwater use restrictions, may be removed.

Table 1-1 provides significant dates regarding LUC implementation at EAFB.

TABLE 1-1
Significant LUC Implementation Dates

Operable Unit	Record of Decision Signature Date	LUC Implementation Date
1	28 September 1994	May 1995
2	19 May 1995	March 1995
3	Not applicable -- no LUCs are in effect at OU3	
4	10 October 1995	April 1998
5	1 February 1995	July 1996
6	27 January 1997	September 1997

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SECTION 2

Existing LUCs at EAFB

LUCs in effect at the EAFB include site-specific LUCs and restrictions on groundwater use. These LUCs are discussed in the following paragraphs.

LUCs will be terminated as specified in their individual RODs. As future LUCs are established, they will be incorporated into future revisions of this LUCMP.

2.1 Site-Specific LUCs

EAFB has implemented several types of LUCs to prevent exposure to contaminated media and to enhance the protective remedies of the RODs in the form of site-specific LUCs. These LUCs are described in Table 2-1 and in Figure 2-1.

2.2 Groundwater LUCs

EAFB has implemented a restriction on the use of groundwater from the shallow aquifer. This groundwater LUC applies to any contaminated site, whether CERCLA or SERA, within the Outwash Plain (south of Elmendorf Moraine). Use of EAFB's shallow aquifer in the Outwash Plain for any purpose including, but not limited to, drinking, irrigation, fire control, dust control, or any other activity south of the Elmendorf Moraine is strictly prohibited. It is understood that portions of the shallow aquifer are contaminated and may pose a health risk.

To help avoid contact with groundwater from the shallow aquifer, historically high groundwater elevations were reviewed and mapped in the area south of the Elmendorf Moraine. These groundwater elevations, relative to mean sea level, are shown in Figure 2-2.

TABLE 2-1
EAFB Site-Specific LUC Descriptions

Site-Specific by Operable Unit	LUC Description	Anticipated 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.	Indefinite

TABLE 2-1
EAFB Site-Specific LUC Descriptions

Site-Specific by Operable Unit	LUC Description	Anticipated Year of LUC Expiration
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 (East/West)	"Airfield Use Area" designated for aircraft operations and maintenance 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. As a former landfill, this designation will remain indefinitely.	Indefinite
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)	The use of contaminated groundwater throughout SD15 for any purpose including, but not limited to, drinking, irrigation, fire control, dust control or any other activity is prohibited.	2002
6 (WP14)	"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 WP14 for any purpose including, but not limited to, drinking, irrigation, fire control, dust control or any other activity is prohibited.	2011



LEGEND

SITE SPECIFIC LUCs:

Operable Unit 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.
Operable Unit 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 any sort 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.
Operable Unit 4 (East/West)	"Airfield Use Area" designated for aircraft operations and maintenance which include active and inactive runways, taxiways, and parking aprons for aircraft. The establishment of residential development of the areas is strictly prohibited.
Operable Unit 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. As a former landfill, this designation will remain indefinitely.
Operable Unit 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.
Operable Unit 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.
Operable Unit 6 (SD15)	The use of contaminated groundwater throughout SD15 for any purpose including, but not limited to, drinking, irrigation, fire control, dust control or any other activity is prohibited.
Operable Unit 6 (WP14)	"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 WP14 for any purpose including, but not limited to, drinking, irrigation, fire control, dust control or any other activity is prohibited.

Note:
LUC – Land Use Control

Figure 2-1
Site-Specific LUCs, Elmendorf AFB, Alaska



LEGEND

- Elmendorf Moraine Boundary
- Area of Consistent Shallow Groundwater Elevation
- 170 ft (52.3 m) — Historically High Groundwater Elevation in feet (meters)

BASEWIDE LUC:

Shallow Aquifer – Use of EAFB's shallow aquifer in the Outwash Plain for any purpose including, but not limited to, drinking, irrigation, fire control, dust control, or any other activity south of the Elmendorf Moraine is strictly prohibited. It is understood that portions of the shallow aquifer are contaminated and may pose a health threat.

Notes:

- Elevations of groundwater are provided relative to mean sea level in feet (meters)
- EAFB – Elmendorf Air Force Base
- LUC – Land Use Control

Figure 2-2
Basewide LUC, Elmendorf AFB, Alaska

SECTION 3

Implementation, Management, and Awareness

An effective LUC program requires an implementation strategy, consistent management, and awareness to ensure that LUC integrity is maintained. These requirements are described in the following paragraphs.

3.1 Implementation Strategy

LUCs are incorporated into existing land-use planning and management systems on base through the use of GeoBase, the Base Comprehensive Plan, and various approval processes.

The GeoBase System is a geographical information system (GIS) that will show EAFB LUCs and other environmental constraints. Though not currently implemented, this system will be available on the EAFB local area network, allowing all base organizations access to LUC data on their desk top computers.

3.2 LUC Management Processes

LUC management processes reside within the following EAFB functions:

- Real estate management
- Facility siting, construction, or modification

Base organizations shall refer to the following guidelines to ensure compliance with LUCs.

The following paragraphs describe the LUC processes and the EAFB organization responsible for managing the process.

3.2.1 Real Estate Management

3 CES/Real Estate Section will ensure that LUCs are incorporated into all real estate instruments such as property leases, property transfers, tenant support agreements, easements, and right-of-ways.

Land-use and groundwater-use restrictions are identified in the Environmental Baseline Survey, which shall be incorporated into the real estate instrument in its entirety.

To ensure that the appropriate LUCs are included in real estate instruments, compliance with Air Force Instruction (AFI) 32-7066 is mandatory. AFI 32-7066 requires either that an Environmental Baseline Survey be conducted for real estate transactions and renewals of existing real estate instruments or that a waiver from that requirement be obtained. A waiver must be in writing and document why the transaction qualifies for a waiver. The resultant Environmental Baseline Survey or written waiver is included in the real estate transaction administrative record.

Compliance with LUCs is therefore incumbent on any party entering into a real estate lease agreement with EAFB.

3.2.2 Facility Siting, Construction, and Modification

LUCs essentially dictate the type of facility that can be constructed at a given location. Facilities may include buildings, structures, utilities, pavement, and ranges. Four facilities processes are relevant to the implementation of LUCs. These processes include the following:

- Initial planning and facility siting
- Preparation of construction contract documents
- Project design review
- Project execution

All construction or operations and maintenance projects conducted on EAFB, regardless of size, will pass through one or more of these processes, ensuring continued compliance with LUCs. These processes, as they relate to LUC management, are described in the following paragraphs.

3.2.2.1 Initial Planning and Facility Siting

The General Plan shall be consulted prior to facility siting or proposing changes in land use.

3 CES/Base Development Section (CECD) has incorporated LUCs into the base's General Plan (GP), which is available to all base organizations, consultants and site activation task forces to aid in the facility planning process.

A Constraints and Opportunities Map, "Tab D-6, Sheets 1 through 8," is a subset of the EAFB Record Drawing Set that is frequently used by 3 CES/CECD for the initial siting of new facilities. Tab D-6, used in conjunction with the GP, identifies areas restricted for construction. These areas include but are not limited to, explosive clear zones, lateral clear zones, electromagnetic burst zones, easements, right-of-ways, flood zones, and safety clear areas. Environmental constraints, which include LUCs, have also been added to Tab D-6. When a project is planned for implementation at EAFB, the project must be approved by the EAFB Base Development office (3 CES/CECD).

3 CES/CECD reviews Tab D-6 during the initial planning or facility siting process to ensure that a project is not constructed in an area inconsistent with the type of facility planned. If the project is in an environmentally-restricted area, coordinate with the Environmental flight for resolution.

By adding LUCs to the GP and Tab D-6, compliance with LUCs is checked early in the planning process.

AF Form 332 is required for all projects, regardless of size or organization (including tenant organizations) that will be conducting the work

Following the initial planning or siting process, a Work Order Request (Air Force Form 332) will be completed and submitted to 3 CES/CECD. AF Form 813, which is required as part of the AF Form 332 coordination process, is used to request an Environmental Impact Analysis (EIA). CEVP will prepare AF Form 813 on all projects to determine the level of environmental

documentation required, whether it is categorically excluded or requires an EIA.

Attachments to AF Form 332 shall describe the project in detail, including type of work to be performed, location of work, whether digging or trenching will be conducted, and which base organization is responsible for work.

If work is to be performed in an area with LUCs or a contaminated area, the form will include information about LUCs specific to the project location.

3.2.2.2 Preparation of Construction Contract Documents

Construction contract documents provide specification sections for technical provisions (Section 01010) and environmental constraints/protection measures (Section 01120) required by the contract. 3 CES/Environmental Restoration Section (CEVR) has included general LUC language into these documents.

3.2.2.3 Project Design Review

Following preparation of construction contract documents, a project design review will be conducted. This review will include 3 CES/CEVR and a variety of other EAFB organizations. From an environmental planning perspective, this review represents an intermediate check to ensure that all environmental factors have been considered in the project design, including LUCs.

3.2.2.4 Project Implementation

All projects at EAFB resulting in ground disturbance of greater than four inches below ground surface require a Work Clearance Request (3 WG Form 3). See Wing Instruction 32-1007.

Wing Instruction 32-1007, Work Clearance Request, represents one of the final checks in the LUC management process by requiring 3 CES/CEVR signature on all digging permits. All projects executed at EAFB that require ground disturbance of more than four inches below ground surface are subjected to the Work Clearance Request process.

3 CES/CEVR will provide basewide groundwater and site-specific LUC requirements and identify any known soil contaminated sites and monitoring wells for the area of the proposed project. This process alerts 3 CES/CEVR to conduct site visits to ensure compliance with LUCs during project implementation (see Section 3.3).

3.3 Tracking and Awareness Procedures

EAFB LUCs are tracked and enforced by 3 CES/CEVR. The following LUC tracking and awareness methods will be implemented by an individual of 3 CES/CEVR assigned to specifically monitor the LUC program. The following procedures will be monitored by this individual:

- Issuance of biennial LUC compliance certifications to government and private tenant organizations. An LUC certification database will be used to identify overdue LUC compliance certifications. Overdue reports result in a reminder notice sent to the responsible organization.
- Site-specific construction inspections will be performed and site inspection checklists completed to verify compliance with LUCs on a weekly basis with priority given to

3 CES/CEVR will ensure that all base, government, and private tenant organizations are informed of applicable LUCs, and that site-specific inspections are completed as necessary.

projects conducted in areas that have LUCs. A blank site inspection checklist is provided in Appendix A.

- After completion of a project that involves excavation in areas that have site-specific LUCs in effect, the base organization or contractor will sign a statement of LUC compliance and return the statement to 3 CES/CEVR.
- Active educational programs will include the following:
  - Disseminating updated fact sheets and LUC information
  - Providing notices through the EAFB intranet and the Sourdough Sentinel
  - LUC briefings at project kick-off meetings, annual Environmental Protection Committee meetings, and RAB meetings

After projects are completed, the EAFB organization or contractor shall sign a certification of LUC compliance statement and return the compliance statement to 3 CES/CEVR.

- Five-year reviews will be conducted by 3 CES/CEVR at 5-year intervals beginning 5 August 1998. The following information is provided in Appendix A to help guide 5-year reviews as they relate to LUCs:
  - Five-Year Review Checklist
  - LUC Interview Form

3 CES/CEVR will disseminate LUC information to personnel involved in LUC management. Annual LUC compliance reports will also be issued, acknowledged, and tracked by 3 CES/CEVR.

Projects that require excavation in areas where site-specific LUCs are in effect are required to comply with all LUCs and Wing and Air Force instructions. In addition, base contractors and tenant organizations have LUC compliance requirements incorporated into their contracts. If they do not comply with LUCs, they will be penalized in accordance with the provisions specified in their contract documents.

Refer to Appendix A for LUC management process evaluation checklists.

SECTION 4

References

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U.S. Air Force. *Tab D-6, Constraints and Opportunities Map.* Dec 2001.

U.S. Air Force. *EAFB Groundwater Monitoring Program Fact Sheet.* April 2002.

U.S. Army. *Land Use Control Implementation Plan, Anniston Army Depot, AL, Chemical Waste Burial Pit (SWMU-7).* May 2002.

U.S. Department of Defense. *Policy on Land Use Controls Associated with Environmental Restoration Activities.* Memorandum. January 2001.

U.S. Environmental Protection Agency. *Comprehensive Five-Year Review Guidance.* OSWER No. 9355.7-03B-P. June 2001.

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Appendix A
Site Inspection LUC Checklist, Five-Year Review LUC Checklist, and Interview Form

Land Use Controls
Site Inspection Checklist

Project Name: _____

Project Number: _____

Location: _____

Basewide Groundwater Land Use Controls

_____ Has soil been excavated on this project?

_____ If yes, has a dig permit been processed for this excavation?

_____ Has groundwater been exposed during this excavation?

_____ If yes, has work been stopped?

_____ Is the groundwater being used for any purpose, but not limited to, drinking, irrigation, fire control, dust control, or any other activity?

_____ Has a well been installed during this project?

_____ Has drilling occurred that goes through the shallow groundwater aquifer into the confined groundwater aquifer without 3 CES/CEVR review of engineering controls and methods to prevent cross-contamination between the two aquifers?

_____ Has there been damage or interference, in any way, with access to and operation of groundwater monitoring wells, remedial treatment systems or sampling efforts?

Site-Specific Land Use Controls

_____ Do site-specific land use controls apply at this site?

_____ Has a manned facility been constructed at this site? (OUs 1, 2, and 6 - LF02, LF03, LF04, and WP14)

_____ Has excavation occurred that affects the integrity and function of the landfill caps, or impacts the shallow groundwater table? (OU1)

_____ Has a residential development been established at this site? (OU4)

_____ Has any wells been installed into the shallow groundwater for any use including residential, industrial, and agricultural at this site? (OU6 - SD15)

_____ Has any wells been installed in the contaminated plume for residential, industrial, and agricultural use at this site? (OU6 - WP14)

Additional comments:

Inspected by: _____

Five-Year LUC Review Checklist

I. SITE INFORMATION	
Site name: Elmendorf AFB	**Date of inspection:**
Location and Region: **Anchorage, Alaska, Region X**	**EPA ID:**
Agency, office, or company leading the five-year review:	**Weather/temperature: N/A**

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☐ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other -- This review was conducted specifically for institutional controls
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS

Personnel Interviewed (organizations recommended to be interviewed include 3 CES/CEVR, CEVP, CECD, and 11 AF/JA)

Remarks:

Name	Organization	Name	Organization

1. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

2. **Other interviews** (optional) ☐Reports attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

☐ O&M manual	☐ Readily available	☐ Up to date	☐ N/A
☐ As-built drawings	☐ Readily available	☐ Up to date	☐ N/A
☐ Maintenance logs	☐ Readily available	☐ Up to date	☐ N/A

Remarks _____

_____

2. **Site-Specific Health and Safety Plan** ☐ Readily available ☐ Up to date ☐ N/A
Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☐ N/A

Remarks _____

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date ☐ N/A
Remarks _____

_____

4. **Permits and Service Agreements**

Air discharge permit	☐ Readily available	☐ Up to date	☐ N/A
Effluent discharge	☐ Readily available	☐ Up to date	☐ N/A
Waste disposal, POTW	☐ Readily available	☐ Up to date	☐ N/A
Other permits	☐ Readily available	☐ Up to date	☐ N/A

Remarks _____

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☐ N/A
Remarks_____

_____

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☐ N/A
Remarks_____

_____

7. **Groundwater Monitoring Records** ☐ Readily available ☐ Up to date ☐ N/A
Remarks_____

_____

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☐ N/A
Remarks_____

_____

9. **Discharge Compliance Records**

☐ Air	☐ Readily available	☐ Up to date	☐ N/A
☐ Water (effluent)	☐ Readily available	☐ Up to date	☐ N/A

Remarks_____

_____

10. **Daily Access/Security Logs** ☐ Readily available ☐ Up to date ☐ N/A
Remarks_____

_____

IV. ACCESS AND LAND USE CONTROLS ☐ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☐ N/A

   Remarks _____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

   Remarks_____

C. Land Use Controls (LUCs)

1. **Implementation and enforcement**

   Site conditions imply LUCs not properly implemented ☐ Yes ☐ No ☐ N/A
   Site conditions imply LUCs not being fully enforced ☐ Yes ☐ No ☐ N/A

   Type of monitoring (*e.g.*, self-reporting, drive by)
   Frequency
   Responsible party/agency
   Contact Name Title Date Phone no.

   Reporting is up-to-date ☐ Yes ☐ No ☐ N/A
   Reports are verified by the lead agency ☐ Yes ☐ No ☐ N/A
   Requirements in deed or decision documents have been met ☐ Yes ☐ No ☐ N/A
   Violations have been reported ☐ Yes ☐ No ☐ N/A
   Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☐ LUCs are adequate ☐ LUCs are inadequate ☐ N/A

   Remarks:

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☐No vandalism evident
   Remarks_____
   _____

2. **Land use changes on site** ☐ N/A
   Remarks –

3. **Land use changes off site** ☐ N/A
   Remarks_____
   _____

LUC Interview Form

Elmendorf AFB, Alaska

Person Interviewed: **Date:**

Title/Office Symbol: **Location:**

Type/Location of Interview: ☐ Office ☐ Phone ☐ Site Visit (indicate which site visited)
Role in Land Use Controls:
If you would, could you summarize the land use controls process currently in place?
In your opinion, is this land use control process working?

Are there any opportunities for improvement?
Have there been instances where land use controls have been violated?
Are there any issues associated with controlling land use on base (i.e., tenants, right of ways, etc.)?
If you could change one thing about the land use controls process, what would it be?

APPENDIX E
Site Inspection Checklists and Photos

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Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: LF059	**Date of inspection:** August 2, 2017
Location and Region: JBER-E, AK Region 10	**EPA ID:** AK8570028649
Agency, office, or company leading the five-year review: Stantec	**Weather/temperature:** Warm and mostly sunny, 65°F

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☐ Access controls
- **X** Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other: _____
- **X** Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** __N/A_____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____
   _____

2. **O&M staff** _____N/A_____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____
   _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____ **ADEC** _____
Contact Louis Howard Environmental Program Specialist III 7/26/2017 (907)269-7552
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None_____
_____

Agency _____ **EPA** _____
Contact Sandra Halstead Remedial Project Manager 7/26/2017 (907)271-1218
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None_____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual ☐ Readily available ☐ Up to date **x** N/A
   - ☐ As-built drawings ☐ Readily available ☐ Up to date ☐ N/A
   - ☐ Maintenance logs ☐ Readily available ☐ Up to date ☐ N/A

   Remarks_____

2. **Site-Specific Health and Safety Plan** ☐ Readily available ☐ Up to date **x** N/A
   - ☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☐ N/A

   Remarks_____

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

4. **Permits and Service Agreements**
   - ☐ Air discharge permit ☐ Readily available ☐ Up to date **x** N/A
   - ☐ Effluent discharge ☐ Readily available ☐ Up to date **x** N/A
   - ☐ Waste disposal, POTW ☐ Readily available ☐ Up to date **x** N/A
   - ☐ Other permits_____ ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

5. **Gas Generation Records** ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

7. **Groundwater Monitoring Records** **x** Readily available **x** Up to date ☐ N/A

   Remarks: Annual Field Activities Reporting_____

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

9. **Discharge Compliance Records**
   - ☐ Air ☐ Readily available ☐ Up to date **x** N/A
   - ☐ Water (effluent) ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

10. **Daily Access/Security Logs** ☐ Readily available ☐ Up to date **x** N/A

    Remarks_____

IV. O&M COSTS

1. **O&M Organization** **N/A**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other_____
_____

2. **O&M Cost Records** **N/A**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: N/A_____
_____
_____
_____
_____
_____

V. ACCESS AND INSTITUTIONAL CONTROLS x Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured x N/A

Remarks: No fencing used to restrict access.
_____
_____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks: ICs on land use and water use are in place and enforced by the Base Planning and Environmental Management Offices as documented in the Base General Plan.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes **X** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **x** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) **Annual LUC inspection**._____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No **x** N/A
Reports are verified by the lead agency ☐ Yes ☐ No **x** N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No **x** N/A
Violations have been reported ☐ Yes ☐ No **x** N/A
Other problems or suggestions: ☐ Report attached
_____
_____
_____
_____

2. **Adequacy** **x** ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks_____
_____
_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map **x** No vandalism evident
Remarks_____
_____

2. **Land use changes on site** ☐ N/A
Remarks: No observable changes in land use.
_____
_____

3. **Land use changes off site** ☐ N/A
Remarks: No observable changes in land use
_____
_____

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable **X** N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A
Remarks_____
_____

B. Other Site Conditions

Remarks: _____

_____

_____

_____

_____

_____

VII. LANDFILL COVERS ☐ Applicable **x** N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks:
   _____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks_____
   _____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent_____ Height_____
   Remarks_____
   _____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent_____
☐ Ponding ☐ Location shown on site map Areal extent_____
☐ Seeps ☐ Location shown on site map Areal extent_____
☐ Soft subgrade ☐ Location shown on site map Areal extent_____
Remarks_____
_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent_____
Remarks_____
_____

B. Benches ☐ Applicable ☐ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

C. Letdown Channels ☐ Applicable ☐ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____
_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____
_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks: _____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____
_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____
_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____
_____

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ Active☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____
_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____
_____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____
   _____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____
   _____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____
   _____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____
   _____

H. Retaining Walls ☐ Applicable ☐ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____
   _____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____
   _____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____
   _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable **x** N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____
   _____

IX. GROUNDWATER/SURFACE WATER REMEDIES **x** Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable **x** N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
☐ Good condition☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
Remarks_____
_____
_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
Remarks_____
_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable **x** N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
Remarks_____
_____

C. Treatment System ☐ Applicable **x** N/A

1. **Treatment Train** (Check components that apply)
   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   ☐ Air stripping ☐ Carbon adsorbers
   ☐ Filters_____
   ☐ Additive (*e.g.*, chelation agent, flocculent)_____
   ☐ Others_____
   ☐ Good condition ☐ Needs Maintenance
   ☐ Sampling ports properly marked and functional
   ☐ Sampling/maintenance log displayed and up to date
   ☐ Equipment properly identified
   ☐ Quantity of groundwater treated annually_____
   ☐ Quantity of surface water treated annually_____
   Remarks_____
   _____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ☐ N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

3. **Tanks, Vaults, Storage Vessels**
   ☐ N/A ☐ Good condition☐ Proper secondary containment ☐ Needs Maintenance
   Remarks_____
   _____

4. **Discharge Structure and Appurtenances**
   ☐ N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

5. **Treatment Building(s)**
   ☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   ☐ Chemicals and equipment properly stored
   Remarks_____
   _____

6. **Monitoring Wells** (pump and treatment remedy)
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

D. Monitoring Data

1. Monitoring Data
   x Is routinely submitted on time **x** Is of acceptable quality

2. Monitoring data suggests:
   ☐ Groundwater plume is effectively contained **x** Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
x Properly secured/locked x Functioning x Routinely sampled x Good condition
x All required wells located ☐ Needs Maintenance ☐ N/A
Remarks: Program wells LF59MW-02 & LF59MW-03 were observed in the field.

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

There are ICs on land and water use to prevent assess to contaminated media. There is no evidence that the ICs are not functioning as intended.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

N/A

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

_None

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

_ADEC has recommended the installation of a downgradient monitoring well to further delineate the groundwater TCE plume.



General view of LF059 looking southwest across Arctic Warrior Dr.



Monitoring Well LF59MW-03.



Monitoring Well LF59MW-02.

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: ST041	**Date of inspection:** August 1, 2017
Location and Region: JBER-E, AK Region 10	**EPA ID:** AK8570028649
Agency, office, or company leading the five-year review: Stantec	**Weather/temperature:** **M**ostly cloudy, 56°F

Remedy Includes: (Check all that apply)

☐ Landfill cover/containment
X Monitored natural attenuation
☐ Access controls
☐ Groundwater containment
X Institutional controls
☐ Vertical barrier walls
☐ Groundwater pump and treatment
☐ Surface water collection and treatment
☐ Other: _____

_____

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** __N/A_____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____
   _____

2. **O&M staff** _____N/A_____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____
   _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____ **ADEC** _____
Contact Louis Howard Environmental Program Specialist III 7/26/2017 (907)269-7552
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None_____
_____

Agency _____ **EPA** _____
Contact Sandra Halstead Remedial Project Manager 7/26/2017 (907)271-1218
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None_____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual ☐ Readily available ☐ Up to date **x** N/A
   - ☐ As-built drawings ☐ Readily available ☐ Up to date ☐ N/A
   - ☐ Maintenance logs ☐ Readily available ☐ Up to date ☐ N/A

   Remarks_____

2. **Site-Specific Health and Safety Plan** ☐ Readily available ☐ Up to date **x** N/A
   - ☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☐ N/A

   Remarks_____

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

4. **Permits and Service Agreements**
   - ☐ Air discharge permit ☐ Readily available ☐ Up to date **x** N/A
   - ☐ Effluent discharge ☐ Readily available ☐ Up to date **x** N/A
   - ☐ Waste disposal, POTW ☐ Readily available ☐ Up to date **x** N/A
   - ☐ Other permits_____ ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

5. **Gas Generation Records** ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

7. **Groundwater Monitoring Records** **x** Readily available **x** Up to date ☐ N/A

   Remarks: Annual Field Activities Reporting_____

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

9. **Discharge Compliance Records**
   - ☐ Air ☐ Readily available ☐ Up to date **x** N/A
   - ☐ Water (effluent) ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

10. **Daily Access/Security Logs** ☐ Readily available ☐ Up to date **x** N/A

    Remarks_____

IV. O&M COSTS

1. **O&M Organization** **N/A**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other_____
_____

2. **O&M Cost Records** **N/A**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: N/A_____
_____
_____
_____
_____
_____

V. ACCESS AND INSTITUTIONAL CONTROLS x Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured x N/A

Remarks: No fencing used to restrict access.
_____
_____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks: ICs on land use and water use are in place and enforced by the Base Planning and Environmental Management Offices as documented in the Base General Plan.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes **X** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **x** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) **Annual LUC inspection**._____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No **x** N/A
Reports are verified by the lead agency ☐ Yes ☐ No **x** N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No **x** N/A
Violations have been reported ☐ Yes ☐ No **x** N/A
Other problems or suggestions: ☐ Report attached
_____
_____
_____
_____

2. **Adequacy** **x** ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks_____
_____
_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map **x** No vandalism evident
Remarks_____
_____

2. **Land use changes on site** ☐ N/A
Remarks: No observable changes in land use.
_____
_____

3. **Land use changes off site** ☐ N/A
Remarks: No observable changes in land use
_____
_____

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable **X** N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A
Remarks_____
_____

B. Other Site Conditions

Remarks: _____

_____

_____

_____

_____

_____

VII. LANDFILL COVERS ☐ Applicable **x** N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks:
   _____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks_____
   _____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent_____ Height_____
   Remarks_____
   _____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent_____
☐ Ponding ☐ Location shown on site map Areal extent_____
☐ Seeps ☐ Location shown on site map Areal extent_____
☐ Soft subgrade ☐ Location shown on site map Areal extent_____
Remarks_____
_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent_____
Remarks_____
_____

B. Benches ☐ Applicable ☐ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

C. Letdown Channels ☐ Applicable ☐ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____
_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____
_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks: _____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____
_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____
_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____
_____

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ Active☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____
_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____
_____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____
   _____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____
   _____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____
   _____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____
   _____

H. Retaining Walls ☐ Applicable ☐ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____
   _____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____
   _____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____
   _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable **x** N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____
   _____

IX. GROUNDWATER/SURFACE WATER REMEDIES **x** Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable **x** N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
☐ Good condition☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
Remarks_____
_____
_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
Remarks_____
_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable **x** N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
Remarks_____
_____

C. Treatment System ☐ Applicable **x** N/A

1. **Treatment Train** (Check components that apply)
   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   ☐ Air stripping ☐ Carbon adsorbers
   ☐ Filters_____
   ☐ Additive (*e.g.*, chelation agent, flocculent)_____
   ☐ Others_____
   ☐ Good condition ☐ Needs Maintenance
   ☐ Sampling ports properly marked and functional
   ☐ Sampling/maintenance log displayed and up to date
   ☐ Equipment properly identified
   ☐ Quantity of groundwater treated annually_____
   ☐ Quantity of surface water treated annually_____
   Remarks_____
   _____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ☐ N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

3. **Tanks, Vaults, Storage Vessels**
   ☐ N/A ☐ Good condition☐ Proper secondary containment ☐ Needs Maintenance
   Remarks_____
   _____

4. **Discharge Structure and Appurtenances**
   ☐ N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

5. **Treatment Building(s)**
   ☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   ☐ Chemicals and equipment properly stored
   Remarks_____
   _____

6. **Monitoring Wells** (pump and treatment remedy)
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

D. Monitoring Data

1. Monitoring Data
   x Is routinely submitted on time **x** Is of acceptable quality

2. Monitoring data suggests:
   x Groundwater plume is effectively contained **x** Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

x Properly secured/locked x Functioning x Routinely sampled x Good condition
x All required wells located ☐ Needs Maintenance ☐ N/A

Remarks: All Program wells were observed in the field.

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

Information kiosk remains damaged. There are ICs on land and water use to prevent access to contaminated media. There is no evidence that the ICs are not functioning as intended.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

__N/A

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

_None

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

_ADEC has recommended the sampling for PAHs in addition to BTEX in groundwater since the RI/FS showed exceedances, and for TAqH in surface water to ensure remedy protectiveness.

Implement the Treatability Study using direct-push technology to inject ISCO/ORC near Monitoring Well ST41-16 and evaluate its effectiveness.



Monitoring Well ST41-28 is secured and appears to be in good working condition.



Monitoring Well ST41-10R is secured and appears to be in good working condition.



Monitoring Well ST41-20 is secured and appears to be in good working condition.



Surface water sampling location ST41SW-13 is marked only by a small traffic cone and is difficult to locate. The well does not appear to be compromised and to be in good working condition. Additional

marking (e.g. bollard) could make finding this well easier, particularly when there is snow on the ground, and add security.



Monitoring Well ST41-30 is secured and appears to be in good working condition.



Monitoring Well ST41-16 is secured and appears to be in good working condition.



Monitoring Well ST41-25 is secured and appears to be in good working condition.



Damaged information kiosk.

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: FT023	**Date of inspection:** August 3, 2017
Location and Region: JBER-E, AK Region 10	**EPA ID:** AK8570028649
Agency, office, or company leading the five-year review: Stantec	**Weather/temperature:** Warm with light rain, 57°F

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☐ Access controls
- **X** Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other: _____

- **X** Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** __N/A_____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** _____N/A_____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____ **ADEC** _____
Contact Louis Howard Environmental Program Specialist III 7/26/2017 (907)269-7552
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None_____
_____

Agency _____ **EPA** _____
Contact Sandra Halstead Remedial Project Manager 11/3/2017 (907)271-1218
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None_____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ As-built drawings — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Maintenance logs — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

2. **Site-Specific Health and Safety Plan** — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Contingency plan/emergency response plan — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

3. **O&M and OSHA Training Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Effluent discharge — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Other permits_____ — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

7. **Groundwater Monitoring Records** — **x** Readily available — **x** Up to date — ☐ N/A

   Remarks: Annual Field Activities Reporting_____

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

9. **Discharge Compliance Records**
   - ☐ Air — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Water (effluent) — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

10. **Daily Access/Security Logs** — ☐ Readily available — ☐ Up to date — **x** N/A

    Remarks_____

IV. O&M COSTS

1. **O&M Organization** **N/A**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other_____
_____

2. **O&M Cost Records** **N/A**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: N/A_____
_____
_____
_____
_____
_____

V. ACCESS AND INSTITUTIONAL CONTROLS x Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map x Gates secured ☐ N/A

Remarks: Although not explicitly part of the remedy, airfield security fencing does restrict access to Program Wells and most of the OU4 West LUC area.
_____
_____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks: ICs on land use and water use are in place and enforced by the Base Planning and Environmental Management Offices as documented in the Base General Plan.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes **x** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **x** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) **Annual LUC inspection**._____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes X No ☐ N/A
Reports are verified by the lead agency ☐ Yes ☐ No **x** N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No **x** N/A
Violations have been reported ☐ Yes ☐ No **x** N/A
Other problems or suggestions: ☐ Report attached
Although annual LUC inspections occur, reports typically lag completion for 1-2 years_____
_____
_____
_____

2. **Adequacy** **x** ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks_____
_____
_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map **x** No vandalism evident
Remarks_____
_____

2. **Land use changes on site** ☐ N/A
Remarks: No observable changes in land use.
_____
_____

3. **Land use changes off site** ☐ N/A
Remarks: No observable changes in land use
_____
_____

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable **X** N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A
Remarks_____
_____

B. Other Site Conditions

Remarks: _____

_____

_____

_____

_____

_____

VII. LANDFILL COVERS ☐ Applicable **x** N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks:
   _____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks_____
   _____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent_____ Height_____
   Remarks_____
   _____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
   ☐ Wet areas ☐ Location shown on site map Areal extent_____
   ☐ Ponding ☐ Location shown on site map Areal extent_____
   ☐ Seeps ☐ Location shown on site map Areal extent_____
   ☐ Soft subgrade ☐ Location shown on site map Areal extent_____
   Remarks_____
   _____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
   Areal extent_____
   Remarks_____
   _____

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
   Remarks_____
   _____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
   Remarks_____
   _____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
   Remarks_____
   _____

C. Letdown Channels ☐ Applicable ☐ N/A

(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
   Material type_____ Areal extent_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
   Areal extent_____ Depth_____
   Remarks: _____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____
_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____
_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____
_____

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ Active☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____
_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____
_____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____
   _____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____
   _____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____
   _____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____
   _____

H. Retaining Walls ☐ Applicable ☐ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____
   _____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____
   _____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____
   _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable **x** N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____
   _____

IX. GROUNDWATER/SURFACE WATER REMEDIES **x** Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable **x** N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☐ Good condition☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____
   _____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
   Remarks_____
   _____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable **x** N/A

1. **Collection Structures, Pumps, and Electrical**
   ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
   Remarks_____
   _____

C. Treatment System ☐ Applicable **x** N/A

1. **Treatment Train** (Check components that apply)
   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   ☐ Air stripping ☐ Carbon adsorbers
   ☐ Filters_____
   ☐ Additive (*e.g.*, chelation agent, flocculent)_____
   ☐ Others_____
   ☐ Good condition ☐ Needs Maintenance
   ☐ Sampling ports properly marked and functional
   ☐ Sampling/maintenance log displayed and up to date
   ☐ Equipment properly identified
   ☐ Quantity of groundwater treated annually_____
   ☐ Quantity of surface water treated annually_____
   Remarks_____
   _____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ☐ N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

3. **Tanks, Vaults, Storage Vessels**
   ☐ N/A ☐ Good condition☐ Proper secondary containment ☐ Needs Maintenance
   Remarks_____
   _____

4. **Discharge Structure and Appurtenances**
   ☐ N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

5. **Treatment Building(s)**
   ☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   ☐ Chemicals and equipment properly stored
   Remarks_____
   _____

6. **Monitoring Wells** (pump and treatment remedy)
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

D. Monitoring Data

1. Monitoring Data
   x Is routinely submitted on time **x** Is of acceptable quality

2. Monitoring data suggests:
   ☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining
   Contaminant concentrations remain above cleanup levels.

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

x Properly secured/locked x Functioning x Routinely sampled x Good condition
x All required wells located ☐ Needs Maintenance ☐ N/A

Remarks: Program wells OU4W-11 & 407MW-01 were observed in the field.

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

There are ICs on land and water use to prevent access to contaminated media. There is no evidence the ICs are not functioning as intended. Natural attenuation of chlorinated solvents occurs slowly and concentrations remain above cleanup goals.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

__N/A

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

_None

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

ADEC has recommended the installation of a downgradient monitoring well and additional soil sampling to further delineate the chlorinated solvent plume and to assess the potential presence of fuel contaminants.



General view of FT023 looking from within the site southeast across the airfield security fence towards Building 17534.



Monitoring Well OU4W-11 is secured and appears to be in good working condition.



Monitoring Well 407MW-01 in the foreground with Building 17508 in the background. Monitoring Well 407MW-01 is secured and appears to be in good working condition.

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: SD029	**Date of inspection:** August 16, 2017
Location and Region: JBER-E, AK Region 10	**EPA ID:** AK8570028649
Agency, office, or company leading the five-year review: Stantec	**Weather/temperature:** Overcast, light rain, 57°F

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☐ Access controls
- **X** Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other: _____

- **X** Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** __N/A_____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** _____N/A_____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____ **ADEC** _____
Contact Louis Howard Environmental Program Specialist III 7/6/2017 (907)269-7552
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None_____
_____

Agency _____ **EPA** _____
Contact Sandra Halstead Remedial Project Manager 11/3/2017 (907)271-1218
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None_____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ As-built drawings — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Maintenance logs — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

2. **Site-Specific Health and Safety Plan** — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Contingency plan/emergency response plan — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

3. **O&M and OSHA Training Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Effluent discharge — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Other permits_____ — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

7. **Groundwater Monitoring Records** — **x** Readily available — **x** Up to date — ☐ N/A

   Remarks: Annual Field Activities Reporting_____

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

9. **Discharge Compliance Records**
   - ☐ Air — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Water (effluent) — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

10. **Daily Access/Security Logs** — ☐ Readily available — ☐ Up to date — **x** N/A

    Remarks_____

IV. O&M COSTS

1. **O&M Organization** **N/A**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other_____
_____

2. **O&M Cost Records** **N/A**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: N/A_____
_____
_____
_____
_____
_____

V. ACCESS AND INSTITUTIONAL CONTROLS x Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map x Gates secured ☐ N/A

Remarks: Although not explicitly part of the remedy, airfield security fencing does restrict access to the site. _____
_____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks: ICs on land use and water use are in place and enforced by the Base Planning and Environmental Management Offices as documented in the Base General Plan.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes **x** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **x** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Annual LUC inspection._____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No **x** N/A
Reports are verified by the lead agency ☐ Yes ☐ No **x** N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No **x** N/A
Violations have been reported ☐ Yes ☐ No **x** N/A
Other problems or suggestions: ☐ Report attached

_____
_____
_____
_____

2. **Adequacy** **x** ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks_____
_____
_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map **x** No vandalism evident
Remarks_____
_____

2. **Land use changes on site** ☐ N/A
Remarks: No observable changes in land use.
_____
_____

3. **Land use changes off site** ☐ N/A
Remarks: No observable changes in land use
_____
_____

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable **X** N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A
Remarks_____
_____

B. Other Site Conditions

Remarks: _____

_____

_____

_____

_____

_____

VII. LANDFILL COVERS ☐ Applicable **x** N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks:

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks_____
   _____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent_____ Height_____
   Remarks_____
   _____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent_____
☐ Ponding ☐ Location shown on site map Areal extent_____
☐ Seeps ☐ Location shown on site map Areal extent_____
☐ Soft subgrade ☐ Location shown on site map Areal extent_____
Remarks_____
_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent_____
Remarks_____
_____

B. Benches ☐ Applicable ☐ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

C. Letdown Channels ☐ Applicable ☐ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____
_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____
_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks: _____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____
_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____
_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____
_____

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ Active☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____
_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____
_____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____
   _____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____
   _____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____
   _____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____
   _____

H. Retaining Walls ☐ Applicable ☐ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____
   _____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____
   _____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____
   _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable **x** N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____
   _____

IX. GROUNDWATER/SURFACE WATER REMEDIES **x** Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable **x** N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☐ Good condition☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____
   _____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
   Remarks_____
   _____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable **x** N/A

1. **Collection Structures, Pumps, and Electrical**
   ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
   Remarks_____
   _____

C. Treatment System ☐ Applicable **x** N/A

1. **Treatment Train** (Check components that apply)
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (*e.g.*, chelation agent, flocculent)_____
☐ Others_____
☐ Good condition ☐ Needs Maintenance
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☐ Quantity of groundwater treated annually_____
☐ Quantity of surface water treated annually_____
Remarks_____
_____

2. **Electrical Enclosures and Panels** (properly rated and functional)
☐ N/A ☐ Good condition☐ Needs Maintenance
Remarks_____
_____

3. **Tanks, Vaults, Storage Vessels**
☐ N/A ☐ Good condition☐ Proper secondary containment ☐ Needs Maintenance
Remarks_____
_____

4. **Discharge Structure and Appurtenances**
☐ N/A ☐ Good condition☐ Needs Maintenance
Remarks_____
_____

5. **Treatment Building(s)**
☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks_____
_____

6. **Monitoring Wells** (pump and treatment remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

D. Monitoring Data

1. Monitoring Data
x Is routinely submitted on time **x** Is of acceptable quality

2. Monitoring data suggests:
x Groundwater plume is effectively contained **x** Contaminant concentrations are declining
Concentrations of COCs (PCE and TCE) are declining and likely to reach OU4 ROD cleanup goals.

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

x Properly secured/locked x Functioning x Routinely sampled x Good condition
x All required wells located x Needs Maintenance ☐ N/A

Remarks: Program wells IS6-01 & 421MW-01 were observed in the field. Well IS6-01 is secured but protective casing is missing a bolt and is below grade. Storm water runoff inundation was observed over the well protective casing. Replacement of the protective casing and bringing the asphalt apron to grade is warranted for the long-term functionality and integrity of the well.

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

There are ICs on land and water use to prevent access to contaminated media. There is no evidence the ICs are not functioning as intended. Natural attenuation appears to be effective.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

N/A

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. _None
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.



General view of SD029 looking from the east side of Building 16716 to the northwest.



Monitoring Well IS6-01 is secured but protective casing is missing a bolt and is below grade. Storm water runoff inundation was observed over the well protective casing. Replacement of the protective casing and bringing the asphalt apron to grade is warranted for the long-term functionality and integrity of the well.

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Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: ST037	**Date of inspection:** August 15, 2017
Location and Region: JBER-E, AK Region 10	**EPA ID:** AK8570028649
Agency, office, or company leading the five-year review: Stantec	**Weather/temperature:** Mostly cloudy, 62°F

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☐ Access controls
- **X** Institutional controls
- ☐ Groundwater pump and treatment
- **X** Surface water collection and treatment
- ☐ Other: _____
- **X** Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** __N/A_____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____
   _____

2. **O&M staff** _____N/A_____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____
   _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____ **ADEC** _____
Contact Louis Howard Environmental Program Specialist III 7/6/2017 (907)269-7552
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None_____
_____

Agency _____ **EPA** _____
Contact Sandra Halstead Remedial Project Manager 11/3/2017 (907)271-1218
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None_____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual ☐ Readily available ☐ Up to date **x** N/A
   - ☐ As-built drawings ☐ Readily available ☐ Up to date **x** N/A
   - ☐ Maintenance logs ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

2. **Site-Specific Health and Safety Plan** ☐ Readily available ☐ Up to date **x** N/A
   - ☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

4. **Permits and Service Agreements**
   - ☐ Air discharge permit ☐ Readily available ☐ Up to date **x** N/A
   - ☐ Effluent discharge ☐ Readily available ☐ Up to date **x** N/A
   - ☐ Waste disposal, POTW ☐ Readily available ☐ Up to date **x** N/A
   - ☐ Other permits_____ ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

5. **Gas Generation Records** ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

7. **Groundwater Monitoring Records** **x** Readily available **x** Up to date ☐ N/A

   Remarks: Annual Field Activities Reporting_____

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

9. **Discharge Compliance Records**
   - ☐ Air ☐ Readily available ☐ Up to date **x** N/A
   - ☐ Water (effluent) ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

10. **Daily Access/Security Logs** ☐ Readily available ☐ Up to date **x** N/A

    Remarks_____

IV. O&M COSTS

1. **O&M Organization** **N/A**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other_____
_____

2. **O&M Cost Records** **N/A**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: N/A_____
_____
_____
_____
_____
_____

V. ACCESS AND INSTITUTIONAL CONTROLS x Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map x Gates secured ☐ N/A

Remarks: The site is contained within the secured boundary of the installation and Alaska Railroad property. _____
_____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks: There is a Caution sign warning of surface water contamination associated with the wetland treatment system along the adjacent pedestrian walk way. ICs on land use and water use are in place and enforced by the Base Planning and Environmental Management Offices as documented in the Base General Plan.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes **x** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **x** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Annual LUC inspection._____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No **x** N/A
Reports are verified by the lead agency ☐ Yes ☐ No **x** N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No **x** N/A
Violations have been reported ☐ Yes ☐ No **x** N/A
Other problems or suggestions: ☐ Report attached

_____
_____
_____
_____

2. **Adequacy** **x** ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks_____
_____
_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map **x** No vandalism evident
Remarks_____
_____

2. **Land use changes on site** ☐ N/A
Remarks: No observable changes in land use.
_____
_____

3. **Land use changes off site** ☐ N/A
Remarks: No observable changes in land use
_____
_____

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable **X** N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A
Remarks_____
_____

B. Other Site Conditions

Remarks: _____

_____

_____

_____

_____

_____

VII. LANDFILL COVERS ☐ Applicable **x** N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks:
   _____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks_____
   _____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent_____ Height_____
   Remarks_____
   _____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent_____
☐ Ponding ☐ Location shown on site map Areal extent_____
☐ Seeps ☐ Location shown on site map Areal extent_____
☐ Soft subgrade ☐ Location shown on site map Areal extent_____
Remarks_____
_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent_____
Remarks_____
_____

B. Benches ☐ Applicable ☐ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

C. Letdown Channels ☐ Applicable ☐ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____
_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____
_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks: _____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____
_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____
_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____
_____

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ Active☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____
_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____
_____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____
   _____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____
   _____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____
   _____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____
   _____

H. Retaining Walls ☐ Applicable ☐ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____
   _____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____
   _____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____
   _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable **x** N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____
   _____

IX. GROUNDWATER/SURFACE WATER REMEDIES **x** Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable **x** N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
☐ Good condition☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
Remarks_____
_____
_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
Remarks_____
_____

B. Surface Water Collection Structures, Pumps, and Pipelines **x** Applicable ☐ N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
Remarks_____
_____

C. Treatment System x Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   ☐ Air stripping ☐ Carbon adsorbers
   ☐ Filters_____
   ☐ Additive (*e.g.*, chelation agent, flocculent)_____
   ☐ Others_____
   ☐ Good condition ☐ Needs Maintenance
   ☐ Sampling ports properly marked and functional
   ☐ Sampling/maintenance log displayed and up to date
   ☐ Equipment properly identified
   ☐ Quantity of groundwater treated annually_____
   ☐ Quantity of surface water treated annually_____
   Remarks_____
   _____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   x N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

3. **Tanks, Vaults, Storage Vessels**
   x N/A ☐ Good condition☐ Proper secondary containment ☐ Needs Maintenance
   Remarks_____
   _____

4. **Discharge Structure and Appurtenances**
   x N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

5. **Treatment Building(s)**
   x N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   ☐ Chemicals and equipment properly stored
   Remarks_____
   _____

6. **Monitoring Wells** (pump and treatment remedy)
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance x N/A
   Remarks_____
   _____

D. Monitoring Data

1. Monitoring Data
   x Is routinely submitted on time x Is of acceptable quality

2. Monitoring data suggests:
   ☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

x Properly secured/locked x Functioning x Routinely sampled x Good condition
x All required wells located ☐ Needs Maintenance ☐ N/A

Remarks: All Program wells were observed in the field, including the general location of seep water collection and surface water collection.

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

There are ICs on land and water use to prevent access to contaminated media. There is no evidence that the ICs are not functioning as intended. There were no changes observed in land use impacting monitoring wells, seep water collection sites, surface water collection sites, or to the point of compliance, Ship Creek.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

N/A

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. None
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.



Monitoring Well OU5MW-34. This monitoring well is secure and in good working condition.



Monitoring Well OU5MW-38. This monitoring well is secure and in good working condition. The concrete apron is cracked and in need of repair.



Monitoring Well OU5MW-43. This monitoring well is secure and in good working condition.



Monitoring Well OU5MW-46. This monitoring well is secure and in good working condition.



Monitoring Well SP1-02. This monitoring well is secure and in good working condition.



Monitoring Well OU5MW-45. This monitoring well is secure and in good working condition.



Monitoring Well OU5MW-44. This monitoring well is missing bolts on the protective casing and is in need of repair/replacement of the protective casing. The inner PVC casing is in good condition for sampling.



Monitoring Well 403WL-01. This monitoring well is secure and in good working condition.



Monitoring Well NS3-02. This monitoring well is secure and in good working condition.



Monitoring Well OU5MW-09. This monitoring well is secure and in good working condition.



Monitoring Well OU5MW-15 in background, railcar in foreground. This monitoring well is secure and in good working condition.



Monitoring Well SP4/11-03. This monitoring well is secure and in good working condition.



Monitoring Well OU5MW-07. This monitoring well is secure and in good working condition. The cap on the protective casing is slightly elevated suggesting the possibility of frost heaving.



Monitoring Well OU5MW-06. This monitoring well is secure and in good working condition. The cap on the protective casing is missing a bolt and is slightly elevated suggesting the possibility of frost heaving.



Monitoring Well OU5MW-08. This monitoring well is secure and in good working condition.



Monitoring Well GW-4A. This monitoring well is secure and in good working condition.



Monitoring Well OU3MW-02. This monitoring well is missing bolts on the protective casing, otherwise it appears to be in good working condition.



Monitoring Well OU3MW-11. This monitoring well is secure and in good working condition. The protective casing is missing one bolt with the cap slightly elevated, which might indicate frost heaving.



Looking north across near the approximate location for the collection of surface water. There was no observed changes in land use in the area or any impacts to the area affecting the remedy.



Warning sign near the approximate location for the collection of surface water. The sign warns the surface water may be contaminated. The sign is easily visible from nearby recreation trail.

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: LF002	**Date of inspection:** August 2, 2017
Location and Region: JBER-E, AK Region 10	**EPA ID:** AK8570028649
Agency, office, or company leading the five-year review: Stantec	**Weather/temperature:** Warm and mostly sunny, 65°F

Remedy Includes: (Check all that apply)

- **X** Landfill cover/containment
- ☐ Access controls
- **X** Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other: _____
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** __N/A_____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** _____N/A_____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____ **ADEC** _____
Contact Louis Howard Environmental Program Specialist III 7/2/2017 (907)269-7552
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None_____
_____

Agency _____ **EPA** _____
Contact Sandra Halstead Remedial Project Manager 11/3/2017 (907)271-1218
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None_____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ As-built drawings — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Maintenance logs — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

2. **Site-Specific Health and Safety Plan** — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Contingency plan/emergency response plan — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

3. **O&M and OSHA Training Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Effluent discharge — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Other permits_____ — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

7. **Groundwater Monitoring Records** — **x** Readily available — **x** Up to date — ☐ N/A

   Remarks: _____

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

9. **Discharge Compliance Records**
   - ☐ Air — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Water (effluent) — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

10. **Daily Access/Security Logs** — ☐ Readily available — ☐ Up to date — **x** N/A

    Remarks_____

IV. O&M COSTS

1. **O&M Organization** **N/A**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other_____
_____

2. **O&M Cost Records** **N/A**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: N/A_____
_____
_____
_____
_____
_____

V. ACCESS AND INSTITUTIONAL CONTROLS x Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured **x** N/A

Remarks: _____
_____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map **x** N/A

Remarks:

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes **x** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **x** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by): **Annual LUC inspection**._____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes **x** No ☐ N/A
Reports are verified by the lead agency ☐ Yes ☐ No **x** N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No **x** N/A
Violations have been reported ☐ Yes ☐ No **x** N/A
Other problems or suggestions: ☐ Report attached

_____
_____
_____
_____

2. **Adequacy** **x** ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks_____
_____
_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map **x** No vandalism evident
Remarks_____
_____

2. **Land use changes on site** ☐ N/A
Remarks: No observable changes in land use.
_____
_____

3. **Land use changes off site** ☐ N/A
Remarks: No observable changes in land use
_____
_____

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable **X** N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A
Remarks_____
_____

B. Other Site Conditions

Remarks: ___In general the site is well maintained and is largely indistinguishable from the surrounding landscape._____

_____

_____

_____

_____

_____

VII. LANDFILL COVERS **x** Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map **x** Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Cracks** ☐ Location shown on site map **x** Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map **x** Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Holes** ☐ Location shown on site map **x** Holes not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

5. **Vegetative Cover** ☐ Grass **x** Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks: Much of the site is indistinguishable from the surrounding forested landscape.

6. **Alternative Cover (armored rock, concrete, etc.)** **x** N/A
   Remarks_____
   _____

7. **Bulges** ☐ Location shown on site map **x** Bulges not evident
   Areal extent_____ Height_____
   Remarks_____
   _____

8. **Wet Areas/Water Damage** x Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent_____
☐ Ponding ☐ Location shown on site map Areal extent_____
☐ Seeps ☐ Location shown on site map Areal extent_____
☐ Soft subgrade ☐ Location shown on site map Areal extent_____
Remarks_____
_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map x No evidence of slope instability
Areal extent_____
Remarks_____
_____

B. Benches ☐ Applicable x N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

C. Letdown Channels ☐ Applicable x N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____
_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____
_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks: There is erosion along the steep western boundary._____
_____

4. **Undercutting** ☐ Location shown on site map **x** No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____
_____

5. **Obstructions** Type_____ **x** No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____
_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____
_____

D. Cover Penetrations ☐ Applicable **x** N/A

1. **Gas Vents** ☐ Active☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____
_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____
_____

E. Gas Collection and Treatment ☐ Applicable **x** N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

F. Cover Drainage Layer ☐ Applicable **x** N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

G. Detention/Sedimentation Ponds ☐ Applicable **x** N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____
   _____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____
   _____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____
   _____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____
   _____

H. Retaining Walls ☐ Applicable **x** N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____
   _____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____
   _____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable **x** N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____
   _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable **x** N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____
   _____

IX. GROUNDWATER/SURFACE WATER REMEDIES **x** Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable **x** N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☐ Good condition☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____
   _____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
   Remarks_____
   _____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable **x** N/A

1. **Collection Structures, Pumps, and Electrical**
   ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
   Remarks_____
   _____

C. Treatment System ☐ Applicable **x** N/A

1. **Treatment Train** (Check components that apply)
   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   ☐ Air stripping ☐ Carbon adsorbers
   ☐ Filters_____
   ☐ Additive (*e.g.*, chelation agent, flocculent)_____
   ☐ Others_____
   ☐ Good condition ☐ Needs Maintenance
   ☐ Sampling ports properly marked and functional
   ☐ Sampling/maintenance log displayed and up to date
   ☐ Equipment properly identified
   ☐ Quantity of groundwater treated annually_____
   ☐ Quantity of surface water treated annually_____
   Remarks_____
   _____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ☐ N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

3. **Tanks, Vaults, Storage Vessels**
   ☐ N/A ☐ Good condition☐ Proper secondary containment ☐ Needs Maintenance
   Remarks_____
   _____

4. **Discharge Structure and Appurtenances**
   ☐ N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

5. **Treatment Building(s)**
   ☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   ☐ Chemicals and equipment properly stored
   Remarks_____
   _____

6. **Monitoring Wells** (pump and treatment remedy)
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

D. Monitoring Data

1. Monitoring Data
   ☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring data suggests:
   ☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

x Properly secured/locked x Functioning ☐ Routinely sampled x Good condition
x All required wells located ☐ Needs Maintenance ☐ N/A

Remarks: Program wells OU6MW-49R, 53WL-05, & 52WL-02 were all located in the field. Closure sampling completed in 2011.

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

LF002 is a former WWII era landfill with metals in the soil and chlorinated ethane (PCA) in the groundwater. The remedy included a cap to prevent exposure to metals, groundwater monitoring, and Institutional Controls (ICs). There is no evidence that the soil cap is ineffective nor that of the ICs. Site closure groundwater sampling results indicate there are no COCs above cleanup levels.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

N/A

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. None
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Monitoring well decommissioning has not been completed at the time of this inspection, but are assumed to be completed in the near future.



General view of LF002 looking south along Vandenberg Ave. In the distance, along the tree line, is monitoring well OU6MW-49R.



Monitoring well OU6MW-49R



Monitoring Well 53WL-02.



Monitoring Well 53WL-05.

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: LF003	**Date of inspection:** August 2, 2017
Location and Region: JBER-E, AK Region 10	**EPA ID:** AK8570028649
Agency, office, or company leading the five-year review: Stantec	**Weather/temperature:** Warm and mostly sunny, 65°F

Remedy Includes: (Check all that apply)

- **X** Landfill cover/containment
- ☐ Access controls
- **X** Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other: _____
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** __N/A_____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** _____N/A_____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____ **ADEC** _____
Contact Louis Howard Environmental Program Specialist III 7/6/2017 (907)269-7552
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None_____
_____

Agency _____ **EPA** _____
Contact Sandra Halstead Remedial Project Manager 11/3/2017 (907)271-1218
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None_____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ As-built drawings — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Maintenance logs — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

2. **Site-Specific Health and Safety Plan** — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Contingency plan/emergency response plan — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

3. **O&M and OSHA Training Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Effluent discharge — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Other permits_____ — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

7. **Groundwater Monitoring Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks: _____

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

9. **Discharge Compliance Records**
   - ☐ Air — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Water (effluent) — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

10. **Daily Access/Security Logs** — ☐ Readily available — ☐ Up to date — **x** N/A

    Remarks_____

IV. O&M COSTS

1. **O&M Organization** **N/A**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other_____
_____

2. **O&M Cost Records** **N/A**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: N/A_____
_____
_____
_____
_____
_____

V. ACCESS AND INSTITUTIONAL CONTROLS x Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☐ N/A

Remarks: Unsecured Trex fence preventing direct access from adjacent street.
_____
_____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks: There are Off Limits warning signs posted along regular intervals on Trex fence.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes **x** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **x** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) **Annual LUC inspection**._____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No **x** N/A
Reports are verified by the lead agency ☐ Yes ☐ No **x** N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No **x** N/A
Violations have been reported ☐ Yes ☐ No **x** N/A
Other problems or suggestions: ☐ Report attached
_____
_____
_____
_____

2. **Adequacy** **x** ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks_____
_____
_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map **x** No vandalism evident
Remarks_____
_____

2. **Land use changes on site** ☐ N/A
Remarks: No observable changes in land use.
_____
_____

3. **Land use changes off site** ☐ N/A
Remarks: No observable changes in land use
_____
_____

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable **X** N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A
Remarks_____
_____

B. Other Site Conditions

Remarks: _____

_____

_____

_____

_____

_____

VII. LANDFILL COVERS **x** Applicable ☐ N/A

Although the selected remedy does include a landfill cover, this site is a former landfill and thus some relevant portions of section VII are filled out to provide more information about the current condition of the site.

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map **x** Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Cracks** ☐ Location shown on site map **x** Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map **x** Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Holes** ☐ Location shown on site map **x** Holes not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

5. **Vegetative Cover** ☐ Grass **x** Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks: Much of the site is indistinguishable from the surrounding forested landscape. However, there is erosion and bank exposure along the steep western boundary of the site adjacent to the Port of Anchorage.
   _____

6. **Alternative Cover (armored rock, concrete, etc.)** **x** N/A
   Remarks_____
   _____

7. **Bulges** ☐ Location shown on site map **x** Bulges not evident
   Areal extent_____ Height_____
   Remarks_____
   _____

8. **Wet Areas/Water Damage** x Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent_____
☐ Ponding ☐ Location shown on site map Areal extent_____
☐ Seeps ☐ Location shown on site map Areal extent_____
☐ Soft subgrade ☐ Location shown on site map Areal extent_____
Remarks_____
_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map x No evidence of slope instability
Areal extent_____
Remarks_____
_____

B. Benches ☐ Applicable x N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

C. Letdown Channels ☐ Applicable x N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____
_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____
_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks: There is erosion along the steep western boundary._____
_____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____
_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____
_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____
_____

D. Cover Penetrations ☐ Applicable **x** N/A

1. **Gas Vents** ☐ Active☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____
_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____
_____

E. Gas Collection and Treatment ☐ Applicable **x** N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

F. Cover Drainage Layer ☐ Applicable **x** N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

G. Detention/Sedimentation Ponds ☐ Applicable **x** N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____
   _____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____
   _____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____
   _____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____
   _____

H. Retaining Walls ☐ Applicable **x** N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable **x** N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable **x** N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable **x** N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
☐ Good condition☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
Remarks_____
_____
_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
Remarks_____
_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
Remarks_____
_____

C. Treatment System ☐ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   ☐ Air stripping ☐ Carbon adsorbers
   ☐ Filters_____
   ☐ Additive (*e.g.*, chelation agent, flocculent)_____
   ☐ Others_____
   ☐ Good condition ☐ Needs Maintenance
   ☐ Sampling ports properly marked and functional
   ☐ Sampling/maintenance log displayed and up to date
   ☐ Equipment properly identified
   ☐ Quantity of groundwater treated annually_____
   ☐ Quantity of surface water treated annually_____
   Remarks_____
   _____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ☐ N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

3. **Tanks, Vaults, Storage Vessels**
   ☐ N/A ☐ Good condition☐ Proper secondary containment ☐ Needs Maintenance
   Remarks_____
   _____

4. **Discharge Structure and Appurtenances**
   ☐ N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

5. **Treatment Building(s)**
   ☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   ☐ Chemicals and equipment properly stored
   Remarks_____
   _____

6. **Monitoring Wells** (pump and treatment remedy)
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

D. Monitoring Data N/A

1. Monitoring Data
   ☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring data suggests:
   ☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks_____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

LF003 is a Restricted Use Area to prevent exposure to this old landfill site. There is a well maintained fence that limits access. There is no evidence of improper use of the area, thus the remedy is functioning and effective.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

__N/A_____

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

None

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

None



Fence erected to restrict direct access to LF003 with access warning signs.



Example of an access warning sign posted on the access control fence.

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Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: LF004	**Date of inspection:** August 1, 2017
Location and Region: JBER-E, AK Region 10	**EPA ID:** AK8570028649
Agency, office, or company leading the five-year review: Stantec	**Weather/temperature:** Warm and mostly sunny, 61°F

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- **X** Access controls
- **X** Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- **X** Other: Debris removal_____

- **X** Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** __N/A_____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____
   _____

2. **O&M staff** _____N/A_____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____
   _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____ **ADEC** _____
Contact Louis Howard Environmental Program Specialist III 7/6/2017 (907)269-7552
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None_____
_____

Agency _____ **EPA** _____
Contact Sandra Halstead Remedial Project Manager 11/3/2017 (907)271-1218
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None_____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ As-built drawings — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Maintenance logs — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

2. **Site-Specific Health and Safety Plan** — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Contingency plan/emergency response plan — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

3. **O&M and OSHA Training Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Effluent discharge — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Other permits_____ — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

7. **Groundwater Monitoring Records** — **x** Readily available — **x** Up to date — ☐ N/A

   Remarks: Annual Field Activities Reporting_____

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

9. **Discharge Compliance Records**
   - ☐ Air — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Water (effluent) — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

10. **Daily Access/Security Logs** — ☐ Readily available — ☐ Up to date — **x** N/A

    Remarks_____

IV. O&M COSTS

1. **O&M Organization** **N/A**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other_____
_____

2. **O&M Cost Records** **N/A**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: N/A_____
_____
_____
_____
_____
_____

V. ACCESS AND INSTITUTIONAL CONTROLS x Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map x Gates secured ☐ N/A

Remarks_____
_____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks: There are warning signs posted on the security gate and near beach / Port of Anchorage access.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes **x** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **x** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) **Annual LUC inspection**._____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No **x** N/A
Reports are verified by the lead agency ☐ Yes ☐ No **x** N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No **x** N/A
Violations have been reported ☐ Yes ☐ No **x** N/A
Other problems or suggestions: ☐ Report attached

_____
_____
_____
_____

2. **Adequacy** **x** ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks_____
_____
_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map **x** No vandalism evident
Remarks_____
_____

2. **Land use changes on site** ☐ N/A
Remarks: No observable changes in land use.
_____
_____

3. **Land use changes off site** ☐ N/A
Remarks: No observable changes in land use
_____
_____

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable **X** N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A
Remarks_____
_____

B. Other Site Conditions

Remarks: Site is well maintained with adequate access to monitoring wells for groundwater sampling.

VII. LANDFILL COVERS **x** Applicable ☐ N/A

Although the selected remedy does include a landfill cover, this site is a former landfill and thus some relevant portions of section VII are filled out to provide more information about the current condition of the site.

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map **x** Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Cracks** ☐ Location shown on site map **x** Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____

3. **Erosion** ☐ Location shown on site map **x** Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Holes** ☐ Location shown on site map **x** Holes not evident
   Areal extent_____ Depth_____
   Remarks_____

5. **Vegetative Cover** ☐ Grass **x** Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks: Much of the site is indistinguishable from the surrounding forested landscape. However, there is erosion and bank exposure along the steep western boundary of the site adjacent to the Port of Anchorage.

6. **Alternative Cover (armored rock, concrete, etc.)** **x** N/A
   Remarks_____

7. **Bulges** ☐ Location shown on site map **x** Bulges not evident
Areal extent_____ Height_____
Remarks_____
_____

8. **Wet Areas/Water Damage** **X** Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent_____
☐ Ponding ☐ Location shown on site map Areal extent_____
☐ Seeps ☐ Location shown on site map Areal extent_____
☐ Soft subgrade ☐ Location shown on site map Areal extent_____
Remarks_____
_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map **x** No evidence of slope instability
Areal extent_____
Remarks_____
_____

B. Benches ☐ Applicable **x** N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

C. Letdown Channels ☐ Applicable **x** N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____
_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____
_____

3.	**Erosion**	☐ Location shown on site map ☐ No evidence of erosion
	Areal extent_____	Depth_____
	Remarks: There is erosion along the steep western boundary._____	
	_____	

4. **Undercutting** ☐ Location shown on site map **x** No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____
_____

5. **Obstructions** Type_____ **x** No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____
_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____
_____

D. Cover Penetrations ☐ Applicable **x** N/A

1. **Gas Vents** ☐ Active☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____
_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____
_____

E. Gas Collection and Treatment ☐ Applicable **x** N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

F. Cover Drainage Layer ☐ Applicable **X** N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

G. Detention/Sedimentation Ponds ☐ Applicable **x** N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____
   _____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____
   _____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____
   _____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____
   _____

H. Retaining Walls ☐ Applicable **x** N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____
   _____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____
   _____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable **x** N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____
   _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable **x** N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____
   _____

IX. GROUNDWATER/SURFACE WATER REMEDIES **x** Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable **x** N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
☐ Good condition☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
Remarks_____
_____
_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
Remarks_____
_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable **x** N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
Remarks_____
_____

C. Treatment System ☐ Applicable **x** N/A

1. **Treatment Train** (Check components that apply)
   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   ☐ Air stripping ☐ Carbon adsorbers
   ☐ Filters_____
   ☐ Additive (*e.g.*, chelation agent, flocculent)_____
   ☐ Others_____
   ☐ Good condition ☐ Needs Maintenance
   ☐ Sampling ports properly marked and functional
   ☐ Sampling/maintenance log displayed and up to date
   ☐ Equipment properly identified
   ☐ Quantity of groundwater treated annually_____
   ☐ Quantity of surface water treated annually_____
   Remarks_____
   _____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ☐ N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

3. **Tanks, Vaults, Storage Vessels**
   ☐ N/A ☐ Good condition☐ Proper secondary containment ☐ Needs Maintenance
   Remarks_____
   _____

4. **Discharge Structure and Appurtenances**
   ☐ N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

5. **Treatment Building(s)**
   ☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   ☐ Chemicals and equipment properly stored
   Remarks_____
   _____

6. **Monitoring Wells** (pump and treatment remedy)
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

D. Monitoring Data

1. Monitoring Data
   x Is routinely submitted on time **x** Is of acceptable quality

2. Monitoring data suggests:
   x Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
   x Properly secured/locked **x** Functioning **x** Routinely sampled **x** Good condition
   x All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks_____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The implementation of Institutional Controls and Monitoring of Natural Attenuation, coupled with Access Controls, is functioning to protect COC exposure. Natural Attenuation in the groundwater is occurring slower than expected. Although landfill debris removal has significantly decreased since 08/09 construction activities at the Port of Anchorage, further erosion of the western boundary is likely and will continue to expose landfill debris.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. None
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. None



Warning sign posted on the sliding chain link fence that restricts access to LF004 from within JBER-E.



Monitoring Well OU6MW-67 from LF004 is in good condition and properly secured. All other Program Wells are in similar condition.



Monitoring Well OU6MW-67 from LF004 is in good condition and properly secured. All other Program Wells are in similar condition.

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Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: SD015	**Date of inspection:** July 28, 2017
Location and Region: JBER, AK Region 10	**EPA ID:** AK8570028649
Agency, office, or company leading the five-year review: Stantec	**Weather/temperature:** Warm and mostly sunny, 58°F

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☐ Access controls
- **X** Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other_____
- **X** Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** __N/A_____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____
   _____

2. **O&M staff** _____N/A_____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____
   _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____ **ADEC** _____
Contact Louis Howard Environmental Program Specialist III 7/6/2017 (907)269-7552
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None_____
_____

Agency _____ **EPA** _____
Contact Sandra Halstead Remedial Project Manager 11/3/2017 (907)271-1218
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None_____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ As-built drawings — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Maintenance logs — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

2. **Site-Specific Health and Safety Plan** — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Contingency plan/emergency response plan — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

3. **O&M and OSHA Training Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Effluent discharge — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Other permits_____ — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

7. **Groundwater Monitoring Records** — **x** Readily available — **x** Up to date — ☐ N/A

   Remarks: Annual Field Activities Reporting_____

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

9. **Discharge Compliance Records**
   - ☐ Air — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Water (effluent) — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

10. **Daily Access/Security Logs** — ☐ Readily available — ☐ Up to date — **x** N/A

    Remarks_____

IV. O&M COSTS

1. **O&M Organization** **N/A**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other_____
_____

2. **O&M Cost Records** **N/A**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: N/A_____
_____
_____
_____
_____
_____

V. ACCESS AND INSTITUTIONAL CONTROLS x Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map x Gates secured ☐ N/A

Remarks. Locked two-panel chain link gate restricting vehicle access._____
_____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks: There is signage on the chain link gate.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes **x** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **x** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by)L: **Annual LUC Inspections**_____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No **x** N/A
Reports are verified by the lead agency ☐ Yes ☐ No **x** N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No **x** N/A
Violations have been reported ☐ Yes ☐ No **x** N/A
Other problems or suggestions: ☐ Report attached

_____
_____
_____
_____

2. **Adequacy** **x** ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks_____
_____
_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map **x** No vandalism evident
Remarks_____
_____

2. **Land use changes on site** ☐ N/A
Remarks: No observable changes in land use.
_____
_____

3. **Land use changes off site**☐ N/A
Remarks: No observable changes in land use
_____
_____

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable **X** N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate☐ N/A
Remarks_____
_____

B. Other Site Conditions

Remarks: The site is well maintained, including the only Monitoring Well OU6MW-17

_____

_____

_____

_____

_____

_____

VII. LANDFILL COVERS ☐ Applicable **x** N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks_____
   _____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks_____
   _____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent_____ Height_____
   Remarks_____
   _____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent_____
☐ Ponding ☐ Location shown on site map Areal extent_____
☐ Seeps ☐ Location shown on site map Areal extent_____
☐ Soft subgrade ☐ Location shown on site map Areal extent_____
Remarks_____
_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent_____
Remarks_____
_____

B. Benches ☐ Applicable ☐ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

C. Letdown Channels ☐ Applicable ☐ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____
_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____
_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks_____
_____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____
_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____
_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____
_____

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ Active☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____
_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____
_____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____
   _____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____
   _____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____
   _____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____
   _____

H. Retaining Walls ☐ Applicable ☐ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____
   _____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____
   _____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____
   _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable **x** N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____
   _____

IX. GROUNDWATER/SURFACE WATER REMEDIES **x** Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable **x** N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
☐ Good condition☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
Remarks_____
_____
_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
Remarks_____
_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable **x** N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
Remarks_____
_____

C. Treatment System ☐ Applicable **x** N/A

1. **Treatment Train** (Check components that apply)
   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   ☐ Air stripping ☐ Carbon adsorbers
   ☐ Filters_____
   ☐ Additive (*e.g.*, chelation agent, flocculent)_____
   ☐ Others_____
   ☐ Good condition ☐ Needs Maintenance
   ☐ Sampling ports properly marked and functional
   ☐ Sampling/maintenance log displayed and up to date
   ☐ Equipment properly identified
   ☐ Quantity of groundwater treated annually_____
   ☐ Quantity of surface water treated annually_____
   Remarks_____
   _____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ☐ N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

3. **Tanks, Vaults, Storage Vessels**
   ☐ N/A ☐ Good condition☐ Proper secondary containment ☐ Needs Maintenance
   Remarks_____
   _____

4. **Discharge Structure and Appurtenances**
   ☐ N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

5. **Treatment Building(s)**
   ☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   ☐ Chemicals and equipment properly stored
   Remarks_____
   _____

6. **Monitoring Wells** (pump and treatment remedy)
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

D. Monitoring Data

1. Monitoring Data
   x Is routinely submitted on time **x** Is of acceptable quality

2. Monitoring data suggests:
   x Groundwater plume is effectively contained **x** Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
x Properly secured/locked **x** Functioning **x** Routinely sampled **x** Good condition
x All required wells located ☐ Needs Maintenance ☐ N/A
Remarks: Monitoring Well OU6MW-17 was found to be secure and in good working condition.___

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

__Monitored Natural Attenuation indicates COCs are stable.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

__O & M costs were not provided for this review.

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.



Two panel chain link gate with signage restricting access to SD015.



Monitoring Well OU6MW-17 secured and in good condition.

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Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: WP014	**Date of inspection:** August 1, 2017
Location and Region: JBER-E, AK Region 10	**EPA ID:** AK8570028649
Agency, office, or company leading the five-year review: Stantec	**Weather/temperature:** Warm and mostly sunny, 63°F

Remedy Includes: (Check all that apply)

☐ Landfill cover/containment
☐ Access controls
X Institutional controls
☐ Groundwater pump and treatment
☐ Surface water collection and treatment
☐ Other: _____

X Monitored natural attenuation
☐ Groundwater containment
☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** __N/A_____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** _____N/A_____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____ **ADEC** _____
Contact Louis Howard Environmental Program Specialist III 7/6/2017 (907)269-7552
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None_____
_____

Agency _____ **EPA** _____
Contact Sandra Halstead Remedial Project Manager 11/3/2017 (907)271-1218
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None_____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual ☐ Readily available ☐ Up to date **x** N/A
   - ☐ As-built drawings ☐ Readily available ☐ Up to date **x** N/A
   - ☐ Maintenance logs ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

2. **Site-Specific Health and Safety Plan** ☐ Readily available ☐ Up to date **x** N/A
   - ☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

4. **Permits and Service Agreements**
   - ☐ Air discharge permit ☐ Readily available ☐ Up to date **x** N/A
   - ☐ Effluent discharge ☐ Readily available ☐ Up to date **x** N/A
   - ☐ Waste disposal, POTW ☐ Readily available ☐ Up to date **x** N/A
   - ☐ Other permits_____ ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

5. **Gas Generation Records** ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

7. **Groundwater Monitoring Records** **x** Readily available **x** Up to date ☐ N/A

   Remarks: Annual Field Activities Reporting_____

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

9. **Discharge Compliance Records**
   - ☐ Air ☐ Readily available ☐ Up to date **x** N/A
   - ☐ Water (effluent) ☐ Readily available ☐ Up to date **x** N/A

   Remarks_____

10. **Daily Access/Security Logs** ☐ Readily available ☐ Up to date **x** N/A

    Remarks_____

IV. O&M COSTS

1. **O&M Organization** **N/A**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other_____
_____

2. **O&M Cost Records** **N/A**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: N/A_____
_____
_____
_____
_____
_____

V. ACCESS AND INSTITUTIONAL CONTROLS x Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured x N/A

Remarks: No fencing used to restrict access.
_____
_____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks: ICs on land use and water use are in place and enforced by the Base Planning and Environmental Management Offices as documented in the Base General Plan.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes **x** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **x** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) **Annual LUC inspection**._____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No **x** N/A
Reports are verified by the lead agency ☐ Yes ☐ No **x** N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No **x** N/A
Violations have been reported ☐ Yes ☐ No **x** N/A
Other problems or suggestions: ☐ Report attached

_____
_____
_____
_____

2. **Adequacy** **x** ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks_____
_____
_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map **x** No vandalism evident
Remarks_____
_____

2. **Land use changes on site** ☐ N/A
Remarks: No observable changes in land use.
_____
_____

3. **Land use changes off site** ☐ N/A
Remarks: No observable changes in land use
_____
_____

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable **X** N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A
Remarks_____
_____

B. Other Site Conditions

Remarks: _____

_____

_____

_____

_____

_____

VII. LANDFILL COVERS ☐ Applicable **x** N/A

Although the selected remedy does include a landfill cover, this site is a former landfill and thus some relevant portions of section VII are filled out to provide more information about the current condition of the site.

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks:
   _____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks_____
   _____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent_____ Height_____
   Remarks_____
   _____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent_____
☐ Ponding ☐ Location shown on site map Areal extent_____
☐ Seeps ☐ Location shown on site map Areal extent_____
☐ Soft subgrade ☐ Location shown on site map Areal extent_____
Remarks_____
_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent_____
Remarks_____
_____

B. Benches ☐ Applicable ☐ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

C. Letdown Channels ☐ Applicable ☐ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____
_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____
_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:
_____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____
_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____
_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____
_____

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ Active☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____
_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____
_____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____
   _____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____
   _____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____
   _____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____
   _____

H. Retaining Walls ☐ Applicable ☐ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____
   _____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____
   _____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____
   _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable **x** N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____
   _____

IX. GROUNDWATER/SURFACE WATER REMEDIES **x** Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable **x** N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
☐ Good condition☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
Remarks_____
_____
_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
Remarks_____
_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable **x** N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
Remarks_____
_____

C. Treatment System ☐ Applicable **x** N/A

1. **Treatment Train** (Check components that apply)
   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   ☐ Air stripping ☐ Carbon adsorbers
   ☐ Filters_____
   ☐ Additive (*e.g.*, chelation agent, flocculent)_____
   ☐ Others_____
   ☐ Good condition ☐ Needs Maintenance
   ☐ Sampling ports properly marked and functional
   ☐ Sampling/maintenance log displayed and up to date
   ☐ Equipment properly identified
   ☐ Quantity of groundwater treated annually_____
   ☐ Quantity of surface water treated annually_____
   Remarks_____
   _____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ☐ N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

3. **Tanks, Vaults, Storage Vessels**
   ☐ N/A ☐ Good condition☐ Proper secondary containment ☐ Needs Maintenance
   Remarks_____
   _____

4. **Discharge Structure and Appurtenances**
   ☐ N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

5. **Treatment Building(s)**
   ☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   ☐ Chemicals and equipment properly stored
   Remarks_____
   _____

6. **Monitoring Wells** (pump and treatment remedy)
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

D. Monitoring Data

1. Monitoring Data
   x Is routinely submitted on time **x** Is of acceptable quality

2. Monitoring data suggests:
   x Groundwater plume is effectively contained **x** Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

x Properly secured/locked x Functioning x Routinely sampled x Good condition

☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks: Only Program Well OU6MW-13 was not observed in the field. No land use changes were observed on any part of the site.

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

There are ICs on land and water use to prevent assess to contaminated media. There is no evidence that the ICs are not functioning as intended.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

__N/A

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

_None

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

_None



Monitoring Well OU6MW-46



Monitoring Well 14MW-120



Monitoring Well 14MW-121



Monitoring Well OU6MW-67



Monitoring Well OU6MW-93



Monitoring Well OU6MW-92



Monitoring Well OU6MW-91



Monitoring Well OU6MW-63

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: DP098	**Date of inspection:** August 16, 2017
Location and Region: JBER-E, AK Region 10	**EPA ID:** AK8570028649
Agency, office, or company leading the five-year review: Stantec	**Weather/temperature:** Overcast and light rain, 56°F

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☐ Access controls
- **X** Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other: _____

- **X** Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** __N/A_____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____
   _____

2. **O&M staff** _____N/A_____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____
   _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____ **ADEC** _____
Contact Louis Howard Environmental Program Specialist III 7/6/2017 (907)269-7552
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None_____
_____

Agency _____ **EPA** _____
Contact Sandra Halstead Remedial Project Manager 11/3/2017 (907)271-1218
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None_____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ As-built drawings — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Maintenance logs — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

2. **Site-Specific Health and Safety Plan** — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Contingency plan/emergency response plan — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

3. **O&M and OSHA Training Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Effluent discharge — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Other permits_____ — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

7. **Groundwater Monitoring Records** — **x** Readily available — **x** Up to date — ☐ N/A

   Remarks: Annual Field Activities Reporting_____

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

9. **Discharge Compliance Records**
   - ☐ Air — ☐ Readily available — ☐ Up to date — **x** N/A
   - ☐ Water (effluent) — ☐ Readily available — ☐ Up to date — **x** N/A

   Remarks_____

10. **Daily Access/Security Logs** — ☐ Readily available — ☐ Up to date — **x** N/A

    Remarks_____

IV. O&M COSTS

1. **O&M Organization** **N/A**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other_____
_____

2. **O&M Cost Records** **N/A**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: N/A_____
_____
_____
_____
_____
_____

V. ACCESS AND INSTITUTIONAL CONTROLS x Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map x Gates secured ☐ N/A

Remarks: Although not explicitly part of the remedy, the site is within and adjacent to a highly secure facility surrounded by a well maintained security fence.
_____
_____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks: See part A above. ICs on land use and water use are in place and enforced by the Base Planning and Environmental Management Offices as documented in the Base General Plan.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes **x** No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes **x** No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Annual LUC inspection._____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No **x** N/A
Reports are verified by the lead agency ☐ Yes ☐ No **x** N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No **x** N/A
Violations have been reported ☐ Yes ☐ No **x** N/A
Other problems or suggestions: ☐ Report attached

_____
_____
_____
_____

2. **Adequacy** **x** ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks_____
_____
_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map **x** No vandalism evident
Remarks_____
_____

2. **Land use changes on site** ☐ N/A
Remarks: No observable changes in land use.
_____
_____

3. **Land use changes off site** ☐ N/A
Remarks: No observable changes in land use
_____
_____

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable **X** N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A
Remarks_____
_____

B. Other Site Conditions

Remarks: _____

_____

_____

_____

_____

_____

VII. LANDFILL COVERS ☐ Applicable **x** N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks:
   _____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks_____
   _____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent_____ Height_____
   Remarks_____
   _____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent_____
☐ Ponding ☐ Location shown on site map Areal extent_____
☐ Seeps ☐ Location shown on site map Areal extent_____
☐ Soft subgrade ☐ Location shown on site map Areal extent_____
Remarks_____
_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent_____
Remarks_____
_____

B. Benches ☐ Applicable ☐ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

C. Letdown Channels ☐ Applicable ☐ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____
_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____
_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks: _____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____
_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____
_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____
_____

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ Active☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____
_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____
_____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____
   _____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____
   _____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____
   _____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____
   _____

H. Retaining Walls ☐ Applicable ☐ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____
   _____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____
   _____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____
   _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable **x** N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____
   _____

IX. GROUNDWATER/SURFACE WATER REMEDIES **x** Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable **x** N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
☐ Good condition☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
Remarks_____
_____
_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
Remarks_____
_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable **x** N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
Remarks_____
_____

C. Treatment System ☐ Applicable **x** N/A

1. **Treatment Train** (Check components that apply)
   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   ☐ Air stripping ☐ Carbon adsorbers
   ☐ Filters_____
   ☐ Additive (*e.g.*, chelation agent, flocculent)_____
   ☐ Others_____
   ☐ Good condition ☐ Needs Maintenance
   ☐ Sampling ports properly marked and functional
   ☐ Sampling/maintenance log displayed and up to date
   ☐ Equipment properly identified
   ☐ Quantity of groundwater treated annually_____
   ☐ Quantity of surface water treated annually_____
   Remarks_____
   _____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ☐ N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

3. **Tanks, Vaults, Storage Vessels**
   ☐ N/A ☐ Good condition☐ Proper secondary containment ☐ Needs Maintenance
   Remarks_____
   _____

4. **Discharge Structure and Appurtenances**
   ☐ N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

5. **Treatment Building(s)**
   ☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   ☐ Chemicals and equipment properly stored
   Remarks_____
   _____

6. **Monitoring Wells** (pump and treatment remedy)
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

D. Monitoring Data

1. Monitoring Data
   x Is routinely submitted on time **x** Is of acceptable quality

2. Monitoring data suggests:
   x Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

x Properly secured/locked x Functioning x Routinely sampled x Good condition
x All required wells located ☐ Needs Maintenance ☐ N/A

Remarks: All Program wells were observed in the field. Photographs could not be taken because of security restrictions.

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

There are ICs on land and water use to prevent access to contaminated media. There is no evidence the ICs are not functioning as intended. Natural attenuation under the revised and more conservative cleanup levels (18 AAC 75 Table C) will extend the timeline for meeting concentration goals in the ROD.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

N/A

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. _None

D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. _ADEC has recommended review of any newly promulgated standards, including revised chemical-specific requirements (such as MCLs, ambient water quality criteria), revised action and location-specific requirements, and State standards if they were considered ARARs in the ROD.

APPENDIX F
Cleanup Levels, Toxicity, and Risk Evaluation

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APPENDIX F: CLEANUP LEVELS, TOXICITY, AND RISK EVALUATION

The effects of changes in standards used at the time of remedy selection that may impact the future protectiveness of the remedy were evaluated as part of the technical assessment of the Five-Year Review (FYR) for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites at the former Elmendorf Air Force Base (JBER-E). This was done according to USEPA (2001) Guidance. Results of the evaluation are discussed in the Technical Assessment of this FYR report. The evaluation is completed in a step-wise process documented in Tables F-1 through F-3.

Table F-1 lists the COPCs (as identified in the ROD, with the exception of OU6, for which the Remedial Investigation/ Feasibility Study COPC list was used because COPCs were not listed in the ROD for OU6), the ROD cleanup level or applicable standard from the previous review period, and the current ADEC standard. For soils, the lower of the 18 Alaska Administrative Code (AAC) 75.341 Table B1 Method Two Human Health for the Under 40-inch Zone or Migration to Groundwater cleanup level (as amended through November 7, 2017) was used. For surface water and groundwater, the more conservative, or lower, of the values in 18 AAC 70 / Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances (as amended through December 12, 2008) and 18 AAC 75 Table C (as amended through November 7, 2017) was used.

Table F-2, where a new or more stringent standard was identified, the COPC was then evaluated by comparing the current cleanup level with the maximum detected concentration for each OU. Data used in this comparison was pulled from the available ERPIMs dataset; for COPCs where no recent ERPIMS data was available, the maximum detected concentration at the time of the ROD was used.

Table F-3, where an OU-specific contaminant concentration sample taken in the last 5 years exceeded a more stringent cleanup level, a risk evaluation was conducted for that contaminant. In order to develop a more detailed evaluation for OUs with multiple source areas (i.e., OU-4 and OU-6), site-specific COPC concentrations were used in Table F-3; in some cases, a COPC that was selected based on the OU-wide evaluation in Table F-2 was not evaluated in Table F-3 because it was not detected or was detected at a concentration less than the applicable screening level. Chemicals where no sample had been taken in the last 5 years but a previous sample exceeded the 2017 ADEC cleanup level, these chemicals were indicated that a new sample should be collected.

Cancer risk and non-cancer hazard estimates were calculated using methods presented in Procedures for Calculating Cleanup Levels (ADEC, 2016). Soil COPCs were evaluated based on the more protective of the direct contact (the Under 40-inch Zone) or migration to groundwater pathways. Risk and hazard estimates presented in Tables F-3 were compared to the U.S. Environmental Protection Agency (EPA) management decision risk range of 1×10^{-6} to 1×10^{-4} for carcinogens, and hazard quotient criterion of 1 for noncarcinogens.

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Table F-1
Evaluation of Changes in Chemical-Specific Standards

Operable Unit (matrix and units)	COPCs (Final ROD COCs in bold)	ROD-Established RAO for COCs or Former Standard from previous review period	Current Federal MCL	Current Alaska Cleanup Level[5]	Is There A Newly Promulgated Cleanup Level Since Previous Review?	Is the New Level More Stringent than the Previous Standard?
Operable Unit 1						
OU1 (Groundwater, µg/L)	1,1,2,2-Tetrachloroethane	4.3	--	0.76 (A)	Yes	Yes
	1,2-Dibromoethane	0.05	0.05	0.05 (B)	No	N/A
	Arsenic	10	10	0.52 (A)	Yes	No
	Barium	2,000	2,000	2,000 (B)	No	N/A
	Benzene	5	5	4.6 (A)	Yes	Yes
	Beryllium	4	4	4 (B)	No	N/A
	Bis(2-	6	6	6 (B)	No	N/A
	cis-1,2-Dichloroethylene	70	70	36 (A)	Yes	Yes
	FLUORIDE	4,000	--	4,000 (B)	No	N/A
	Lead	15	15	15 (A)	No	N/A
	Manganese	9,100	--	50[b] (B)	Yes	No
	Methyl Ethyl Ketone (2-	22,000	--	5,600 (A)	Yes	Yes
	Nickel	100	9	390 (A)	Yes	No
	PCB, Total	0.5	0.5	0.44 (A)	Yes	Yes
	Tetrachloroethylene	5	5	5 (B)	No	N/A
	Toluene	1,000	1,000	1,000 (B)	No	N/A
	Trichloroethylene	5	5	2.8 (A)	Yes	Yes
	Vinyl Chloride	2	2	0.19 (A)	Yes	Yes
OU1 (Soil, mg/kg)	2-Methylnaphthalene	6.1	--	1.3	Yes	Yes
	Antimony	3.6	--	4.6	Yes	No
	Aroclor 1260	1	--	1	No	N/A
	Arsenic	3.9	--	0.2	Yes	No
	Barium	1,100	--	2100	Yes	No
	Benzo(a)anthracene	3.6	--	0.7	Yes	Yes
	Benzo(b)fluoranthene	4.9	--	15	Yes	No
	Benzo(k)fluoranthene	49	--	150	Yes	No
	Beryllium	42	--	200	Yes	No
	Bis(2-	13	--	88	Yes	No
	Cadmium	5.0	--	9.1	Yes	No
	Chrysene	360	--	600	Yes	No
	Copper	460	--	370	Yes	Yes
	Lead	400	--	400	No	N/A
	Mercury	1.4	--	0.36	Yes	Yes
	Sodium	--	--	--	No	N/A
	TPH	--	--	--	No	N/A
	Zinc	4,100	--	4,900	Yes	No
OU1 (Surface Water,	TPH (TAH)	10[a]	--	10[a] (B)	No	N/A

Table F-1
Evaluation of Changes in Chemical-Specific Standards

Operable Unit (matrix and units)	COPCs (Final ROD COCs in bold)	ROD-Established RAO for COCs or Former Standard from previous review period	Current Federal MCL	Current Alaska Cleanup Level[5]	Is There A Newly Promulgated Cleanup Level Since Previous Review?	Is the New Level More Stringent than the Previous Standard?
Operable Unit 2						
OU2 (Groundwater, µg/L)	1,1,2,2-Tetrachloroethane	4.3	--	0.76 (A)	Yes	Yes
	1,2-Dibromoethane	0.05	0.05	0.05 (B)	No	N/A
	2-Methylnaphthalene	150	--	36 (A)	Yes	Yes
	Antimony	6	6	6 (B)	No	N/A
	Arsenic	10[b]	10	0.52 (A)	Yes	Yes
	Barium	2,000	2,000	2,000 (B)	No	N/A
	Benzene	5	5	4.6 (A)	Yes	Yes
	Beryllium	4[b]	4	4 (B)	No	N/A
	Bis(2-	6	6	6 (B)	No	N/A
	Cadmium	5	5	5 (B)	No	N/A
	Chloroform	140	80	2.2 (A)	Yes	Yes
	Chromium, Total	100	100	100 (B)	No	N/A
	Ethylbenzene	700	700	15 (A)	Yes	Yes
	Lead	15	15	15 (A)	No	N/A
	Manganese	50[c]	--	50[b] (B)	No	N/A
	Methylene Chloride	5	5	5 (B)	No	N/A
	Naphthalene	730	--	1.7 (A)	Yes	Yes
	Nickel	100	9	390 (A)	Yes	No
	Nitrate (as N)	10,000	10,000	--	No	N/A
	p-Cresol	180	--	1,900 (A)	Yes	No
	Thallium	2[b]	2	0.2 (A)	Yes	Yes
	Toluene	1,000	1,000	1,000 (B)	No	N/A
	TPH	--	--	--	No	N/A
	Trichlorofluoromethane	11,000	--	5,200 (A)	Yes	Yes
	Vanadium	260	--	86 (A)	Yes	Yes
	Xylenes, total	10,000	10,000	190 (A)	Yes	Yes
OU2 (Surface Water, µg/L)	1,2-Dichloroethane	5 (A)	5	1.7 (A)	Yes	Yes
	Arsenic	50[b]	10	0.52 (A)	Yes	Yes
	Benzene[2]	10	5	4.6 (A)	Yes	Yes
	Diesel (TAqH)	15[a]	--	15[a] (B)	No	N/A
	Ethylbenzene	10	700	15 (A)	Yes	No
	Gasoline (TAqH)	15[a]	--	15[a] (B)	No	N/A
	Lead	15 (B)	15	15 (A)	No	N/A
	Manganese	50[b,c]	--	50 (B)	No	N/A
	Thallium	2[b]	2	0.2 (A)	Yes	Yes
	Toluene	10	1,000	1,000 (B)	Yes	No
	Xylenes, total	10	10,000	190 (A)	Yes	No

Table F-1
Evaluation of Changes in Chemical-Specific Standards

Operable Unit (matrix and units)	COPCs (Final ROD COCs in bold)	ROD-Established RAO for COCs or Former Standard from previous review period	Current Federal MCL	Current Alaska Cleanup Level[5]	Is There A Newly Promulgated Cleanup Level Since Previous Review?	Is the New Level More Stringent than the Previous Standard?
OU2 (Soil, mg/kg)	Arsenic	--	--	0.2	Yes	Yes
	DRO	--	--	1,000[e]	Yes	Yes
	GRO	--	--	500[e]	Yes	Yes
	Mercury	--	--	0.36	Yes	Yes
	Lead	--	--	400	Yes	Yes
	Pentachlorophenol	--	--	0.0043	Yes	Yes
	2-Methylnaphthalene	--	--	1.3	Yes	Yes
	Benzo(a)anthracene	--	--	0.28	Yes	Yes
	Chrysene	--	--	82	Yes	Yes
	Benzo(b)fluoranthene	--	--	2	Yes	Yes
	Benzo(k)fluoranthene	--	--	20	Yes	Yes
	Benzo(a)anthracene	--	--	0.28	Yes	Yes
Operable Unit 4						
OU4 (Groundwater, µg/L)	**1,1,1-Trichloroethane**	200	200	200 (B)	No	N/A
	1,1,2-Trichloroethane	5	5	0.41 (A)	Yes	Yes
	1,1-Dichloroethane	7,300	--	28 (A)	Yes	Yes
	1,1-Dichloroethene	7	7	7 (B)	No	N/A
	1,2-Dichlorobenzene	600	600	300 (A)	Yes	Yes
	1,2-Dichloroethane	5	5	1.7 (A)	Yes	Yes
	1,3-Dichlorobenzene	3,300	--	300 (A)	Yes	Yes
	1,4-Dichlorobenzene	75	75	4.8 (A)	Yes	Yes
	2-Methylnaphthalene	150	--	36 (A)	Yes	Yes
	Acenaphthene	2,200	--	530 (A)	Yes	Yes
	Acetone	3,300	--	14,000 (A)	Yes	No
	Aluminum	--		--	No	N/A
	Benzene	5	5	4.6 (A)	Yes	Yes
	Benzoic Acid	150,000	--	75,000 (A)	Yes	Yes
	chloroethane	290	--	21,000 (A)	Yes	No
	Chloroform (TTHM)	140	80[d]	2.2 (A)	Yes	Yes
	Chloromethane[1]	66	--	190 (A)	Yes	No
	cis-1,2-Dichloroethylene	70	70	36 (A)	Yes	Yes
	cis-1,3-Dichloropropene	8.5	--	4.7 (A)	Yes	Yes
	Delta-BHC	--	--	--	No	N/A
	Diesel (DRO)	1,500	--	1,500 (A)	No	N/A
	Ethylbenzene	700	700	15 (A)	Yes	Yes
	Fluorene	1,500	--	290 (A)	Yes	Yes
	Methyl Ethyl Ketone (2-	22,000	--	5,600 (A)	Yes	Yes
	Naphthalene	730	--	1.7 (A)	Yes	Yes
	Nitrate-Nitrite as N	10,000	10000	--	No	N/A
	o-Cresol	1,800	--	930 (A)	Yes	Yes
	p-Cresol	180	--	1,900 (A)	Yes	No
	Phenol	11,000	--	5,800 (A)	Yes	Yes
	Tetrachloroethylene	5	5	5 (B)	No	N/A

Table F-1
Evaluation of Changes in Chemical-Specific Standards

Operable Unit (matrix and units)	COPCs (Final ROD COCs in bold)	ROD-Established RAO for COCs or Former Standard from previous review period	Current Federal MCL	Current Alaska Cleanup Level[5]	Is There A Newly Promulgated Cleanup Level Since Previous Review?	Is the New Level More Stringent than the Previous Standard?
OU4 (Groundwater, µg/L) (Cont.)	**Toluene**	1,000	1,000	1,000 (B)	No	N/A
	trans-1,2-	100	100	100 (B)	No	N/A
	Trichloroethylene	5	5	2.8 (A)	Yes	Yes
	Trichlorofluoromethane	11,000	--	5,200 (A)	Yes	Yes
	Vinyl Chloride	2	2	0.19 (A)	Yes	Yes
	Xylenes, total	10,000	10,000	190 (A)	Yes	Yes
OU4 (Soil, mg/kg)	1,1,1-Trichloroethane	0.82	--	32	Yes	No
	2-Methylnaphthalene	6.1	--	1.3	Yes	Yes
	4,4-DDD	7.2	--	0.098	Yes	Yes
	4,4-DDE	5.1	--	0.72	Yes	Yes
	4,4-DDT	7.3	--	5.1	Yes	Yes
	Acenaphthene	180	--	37	Yes	Yes
	Acenaphthylene	1,000	--	18	Yes	Yes
	Acetone	88	--	38	Yes	Yes
	Aldrin	0.070	--	0.0099	Yes	Yes
	alpha-BHC	0.0064	--	0.0029	Yes	Yes
	Aluminum	--		--	No	N/A
	Anthracene	3,000	--	390	Yes	Yes
	Aroclor 1260	1d	--	1	No	N/A
	Benzene	0.025	--	0.022	Yes	Yes
	Benzo(a)anthracene[1]	6[d]	--	0.7	Yes	Yes
	Benzo(a)pyrene[1]	1[b]	--	1.5	Yes	No
	Benzo(b)fluoranthene[1]	11[b]	--	15	Yes	No
	Benzo(g,h,i)perylene	1,400	--	2,300	Yes	No
	Benzo(k)fluoranthene[1]	110[b]	--	150	Yes	No
	beta-BHC	0.022	--	0.01	Yes	Yes
	Bis(2-	13	--	88	Yes	No
	BTEX	100	--	--[f]	--[f]	--[f]
	Butyl Benzyl Phthalate	920	--	16	Yes	Yes
	Calcium	--	--	--	No	N/A
	Chromium, Total	25	--	--	No	N/A
	Chrysene	360	--	600	Yes	No
	cis-1,2-Dichloroethylene	0.24	--	0.12	Yes	Yes
	Cobalt	19.52 [g]	--	--	No	N/A
	Copper	460	--	370	Yes	Yes
	Cyanide	27	--	0.2	Yes	Yes
	Dibenzo(a,h)anthracene	1[b]	--	1.5	Yes	No
	Dibenzofuran	11	--	0.97	Yes	Yes
	Dibutyl Phthalate	80	--	16	Yes	Yes
	Endosulfan sulfate	64	--	9.3	Yes	Yes
	Endrin	0.29	--	0.61	Yes	No
	Ethylbenzene	6.9	--	0.13	Yes	Yes
	Fluoranthene	1,400	--	590	Yes	Yes

Table F-1
Evaluation of Changes in Chemical-Specific Standards

Operable Unit (matrix and units)	COPCs (Final ROD COCs in bold)	ROD-Established RAO for COCs or Former Standard from previous review period	Current Federal MCL	Current Alaska Cleanup Level[5]	Is There A Newly Promulgated Cleanup Level Since Previous Review?	Is the New Level More Stringent than the Previous Standard?
OU4 (Soil, mg/kg) (Cont.)	Fluorene	220	--	36	Yes	Yes
	gamma-BHC (Lindane)	0.0095	--	0.016	Yes	No
	Heptachlor	0.28	--	0.0076	Yes	Yes
	Indeno(1,2,3-	11[b]	--	15	Yes	No
	Isophorone	3.1	--	2.7	Yes	Yes
	Lead	400	--	400	No	N/A
	Magnesium	--	--	--	No	N/A
	Manganese	3,000	--	--	No	N/A
	Methyl Ethyl Ketone (2-	59	--	15	Yes	Yes
	Methylene Chloride	0.016	--	0.33	Yes	No
	Molybdenum	--	--	--	No	N/A
	Naphthalene	20	--	0.038	Yes	Yes
	Nickel	51[g]	--	340	Yes	No
	Octachlorodibenzodioxin	N/A	--	--	No	N/A
	Phenanthrene	3,000	--	39	Yes	Yes
	Potassium	N/A	--	--	No	N/A
	Pyrene	1,000	--	87	Yes	Yes
	Selenium	3.4	--	6.9	Yes	No
	Tetrachloroethylene	0.024	--	0.19	Yes	No
	Thallium	1.9	--	0.19	Yes	Yes
	Toluene	6.5	--	6.7	Yes	No
	Trichloroethylene (TCE)	0.020	--	0.011	Yes	Yes
	Vanadium	3,400	--	510	Yes	Yes
	Xylenes, total	63	--	1.5	Yes	Yes
	Zinc	4,100	--	4,900	Yes	No
Operable Unit 5						
OU5 (Groundwater, µg/L)	1,1,1-Trichloroethane	200	200	200 (B)	No	N/A
	1,1,2,2-Tetrachloroethane	4.3	--	0.76 (A)	Yes	Yes
	1,1-Dichloroethane	7,300	--	28 (A)	Yes	Yes
	2-Methylnaphthalene	150	--	36 (A)	Yes	Yes
	Aluminum	50-200[c]	--	--	No	N/A
	Barium	2,000	2,000	2,000 (B)	No	N/A
	Benzene	5	5	4.6 (A)	Yes	Yes
	Bis(2-	6	6	6 (B)	No	N/A
	Calcium	--	--	--	No	N/A
	chloroethane	290	--	21,000 (A)	Yes	No
	Dibutyl Phthalate	3,700	--	900 (A)	Yes	Yes
	Diethyl Phthalate	29,000	--	15,000 (A)	Yes	Yes
	Ethylbenzene	700	700	15 (A)	Yes	Yes
	Iron	--	--	--	No	N/A
	JP-4 (RRO)	1,100	--	1,100 (A)	No	N/A
	Manganese	50[c]	--	--	No	N/A
	Naphthalene	730	--	1.7 (A)	Yes	Yes

Table F-1
Evaluation of Changes in Chemical-Specific Standards

Operable Unit (matrix and units)	COPCs (Final ROD COCs in bold)	ROD-Established RAO for COCs or Former Standard from previous review period	Current Federal MCL	Current Alaska Cleanup Level[5]	Is There A Newly Promulgated Cleanup Level Since Previous Review?	Is the New Level More Stringent than the Previous Standard?
4,000	N-Nitrosodiphenylamine	170	--	120 (A)	Yes	Yes
	Selenium	50	50	50 (B)	No	N/A
	Tert-butyl methyl ether	--	--	140	Yes	Yes
	TFH-Diesel (TAH)[3]	10[a]	--	10[a] (B)	No	N/A
	TFH-Gas (TAqH)[3]	10	--	2,200 (A)	Yes	No
	Toluene	1,000	1,000	1,000 (B)	No	N/A
	Trichloroethylene	5	5	2.8 (A)	Yes	Yes
	Vanadium	260	--	86 (A)	Yes	Yes
	Xylenes, total	10,000	10,000	190 (A)	Yes	Yes
OU5 (Soil, mg/kg)	2-Methylnaphthalene	--	--	1.3	Yes	Yes
	4-nitrophenol	--	--	--	No	N/A
	Aluminum	--	--	--	No	N/A
	Anthracene	3,000	--	390	Yes	Yes
	Aroclor 1260	--	--	--	No	N/A
	Arsenic	3.9	--	0.2	Yes	Yes
	Barium	1,100	--	2100	Yes	No
	Benzene	0.025	--	0.022	Yes	Yes
	Benzo(a)anthracene	3.6	--	0.7	Yes	Yes
	Benzo(a)pyrene	3.6	--	1.5	Yes	Yes
	Benzo(b)fluoranthene	12	--	15	Yes	No
	Benzo(g,h,i)perylene	--	--	2,300	Yes	Yes
	Benzo(k)fluoranthene	49	--	150	Yes	No
	Beryllium	42	--	200	Yes	No
	Bis(2-	13	--	88	Yes	No
	Cadmium	5.0	--	9.1	Yes	No
	Calcium	--	--	--	No	N/A
	Chromium, Total	25	--	--	No	N/A
	Chrysene	360	--	600	Yes	No
	Copper	460	--	370	Yes	Yes
	Dibutyl Phthalate	80	--	16	Yes	Yes
	Diethyl Phthalate	130	--	60	Yes	Yes
	Ethylbenzene	6.9	--	0.13	Yes	Yes
	Fluoranthene	1,400	--	590	Yes	Yes
	Indeno(1,2,3-c,d)pyrene	4.9	--	15	Yes	No
	JP-4 (RRO)	2,000[e]	--	2000[e]	No	N/A
	Lead	400	--	400	No	N/A
	Manganese	--	--	--	No	N/A
	Mercury	1.4	--	0.36	Yes	Yes
	Naphthalene	20	--	0.038	Yes	Yes
	p-Cresol	--	--	--	No	N/A
	Phenanthrene	--	--	--	No	N/A
	Potassium	--	--	--	No	N/A
	Pyrene	1,000	--	87	Yes	Yes

Table F-1
Evaluation of Changes in Chemical-Specific Standards

Operable Unit (matrix and units)	COPCs (Final ROD COCs in bold)	ROD-Established RAO for COCs or Former Standard from previous review period	Current Federal MCL	Current Alaska Cleanup Level[5]	Is There A Newly Promulgated Cleanup Level Since Previous Review?	Is the New Level More Stringent than the Previous Standard?
OU5 (Soil, mg/kg) (Cont.)	Selenium	3.4	--	6.9	Yes	No
	Silver	11	--	11	Yes	Yes
	Sodium	--	--	--	No	N/A
	TFH-Diesel (DRO)	1,000[e]	--	1000[e]	No	N/A
	TFH-Gas (GRO)	500[e]	--	500[e]	No	N/A
	Thallium	1.9	--	0.19	Yes	Yes
	Toluene	6.5	--	6.7	Yes	No
	Xylenes, total	63	--	1.5	Yes	Yes
	Zinc	4,100	--	4,900	Yes	No
OU5 (Surface Water µg/L)	1,1,1-Trichloroethane	200 (A)	200	200 (A)	No	N/A
	1,1,2,2-Tetrachloroethane	--	--	0.76 (A)	Yes	Yes
	1,1-Dichloroethane	7.3 (B)	--	28 (A)	Yes	No
	1,2-Dichloroethane	5 (A)	5	1.7 (A)	Yes	Yes
	Benzene	5 (A)	5	4.6 (A)	Yes	Yes
	Bromomethane	51	--	48 (A)	Yes	Yes
	Ethylbenzene	700 (B)	700	15 (A)	Yes	Yes
	JP-4 (TAH)	10[a]	--	10[a] (B)	No	N/A
	Naphthalene (TAqH)	700[a]	--	700[a]	No	N/A
	p-Cresol	180 (B)	--	1,900 (A)	Yes	No
	TFH-Gas (TAH/TAqH)[3]	10[a]	--	10/15[c] (B)	No	N/A
	Toluene	1,000 (A)	1,000	1,000 (B)	No	N/A
	trans-1,2-	100 (A)	100	100 (B)	No	N/A
	Trichloroethylene (TCE)	5 (A)	5	2.8 (A)	Yes	Yes
	Xylenes, total	10,000 (B)	10,000	190 (A)	Yes	Yes
Operable Unit 6						
OU6 (Groundwater, µg/L)	1,1,1-Trichloroethane	200	200	200 (B)	No	N/A
	1,1,2,2-	4[h]	--	0.76 (A)	Yes	Yes
	1,1,2-Trichloroethane	5	5	0.41 (A)	Yes	Yes
	1,1-Dichloroethane	7,300	--	28 (A)	Yes	Yes
	1,1-Dichloroethene	7	7	7 (B)	No	N/A
	1,2-Dichlorobenzene	600	600	300 (A)	Yes	Yes
	1,2-Dichloroethane	5	5	1.7 (A)	Yes	Yes
	1,2-Dichloropropane	5	5	5 (B)	No	N/A
	2,4-Dimethylphenol	730	--	360 (A)	Yes	Yes
	2-Hexanone	--	--	38 (A)	Yes	Yes
	2-Methylnaphthalene	150	--	36 (A)	Yes	Yes
	4,4-DDD	3.5	--	0.06 (A)	Yes	Yes
	4,4-DDE	2.5	--	0.46 (A)	Yes	Yes
	4,4-DDT	2.5	--	2.3 (A)	Yes	Yes
	Acenaphthene	2,200	--	530 (A)	Yes	Yes
	Acenaphthylene	2,200	--	260 (A)	Yes	Yes
	Acetone	33,000	--	14,000 (A)	Yes	Yes
	Aldrin	0.05	--	0.0092 (A)	Yes	Yes

Table F-1
Evaluation of Changes in Chemical-Specific Standards

Operable Unit (matrix and units)	COPCs (Final ROD COCs in bold)	ROD-Established RAO for COCs or Former Standard from previous review period	Current Federal MCL	Current Alaska Cleanup Level[5]		Is There A Newly Promulgated Cleanup Level Since Previous Review?	Is the New Level More Stringent than the Previous Standard?
OU6 (Groundwater, µg/L) (Cont.)	Alpha-	0.14	--	0.072	(A)	Yes	Yes
	Anthracene	11,000	--	43	(A)	Yes	Yes
	Antimony	6	6	6	(B)	No	N/A
	Barium	2,000	2,000	2,000	(B)	No	N/A
	Benzene	5	5	4.6	(A)	Yes	Yes
	Benzo(b)fluoranthene	1.2	--	2.5	(A)	Yes	No
	Benzo(g,h,i)perylene	--	--	0.26		Yes	Yes
	Benzoic Acid	150,000	--	75,000	(A)	Yes	Yes
	Beryllium	4	4	4	(B)	No	N/A
	Beta-	0.47	--	0.25	(A)	Yes	Yes
	Bis(2-	6	6	6	(B)	No	N/A
	Cadmium	5	5	5	(B)	No	N/A
	Carbon disulfide	--	--	810		Yes	Yes
	Carbon Tetrachloride	5	5	4.6	(A)	Yes	Yes
	Chlorobenzene	100	100	78	(A)	Yes	Yes
	chloroethane	290	--	21,000	(A)	Yes	No
	Chloroform (TTHM)	140	80[d]	2.2	(A)	Yes	Yes
	Chloromethane	66	--	190	(A)	Yes	No
	Chrysene	120	--	2	(A)	Yes	Yes
	cis-1,2-Dichloroethylene	70	70	36	(A)	Yes	Yes
	Cobalt	--	--	--		No	N/A
	Dichloroethene	--	--	--		No	N/A
	Dieldrin	0.053	--	0.018	(A)	Yes	Yes
	Diethyl phthalate	29,000	--	15,000	(A)	Yes	Yes
	Dimethylphthalate	370,000	--	16,000	(A)	Yes	Yes
	di-n-octyl phthalate	1,500	--	22	(A)	Yes	Yes
	Endosulfan I	220	--	100	(A)	Yes	Yes
	Endosulfan II	--	--	100		Yes	Yes
	Endrin	2	2	0.76	(B)	Yes	Yes
	Endrin Aldehyde	--	--	--		No	N/A
	Ethylbenzene	700	700	15	(A)	Yes	Yes
	Fluoranthene	1,500	--	260	(A)	Yes	Yes
	Fluorene	1,500	--	290	(A)	Yes	Yes
	Gamma-	0.2	0.2	0.2	(B)	No	N/A
	Gasoline (GRO)	2,200	--	2,200	(A)	No	N/A
	Heptachlor	0.4	0.4	0.014	(A)	Yes	Yes
	Heptachlor epoxide	0.2	0.2	0.014	(A)	Yes	Yes
	Jet fuel (JP-4; DRO)	1,500	--	1,500	(A)	No	N/A
	Methyl ethyl ketone (2-	22,000	--	5,600	(A)	Yes	Yes
	Methyl isobutyl ketone (4-	2,900	--	6,300	(A)	Yes	No
	Methylene chloride	5	5	5	(B)	No	N/A
	Molybdenum	--	--	--		No	N/A
	Naphthalene	730	--	1.7	(A)	Yes	Yes

Table F-1
Evaluation of Changes in Chemical-Specific Standards

Operable Unit (matrix and units)	COPCs (Final ROD COCs in bold)	ROD-Established RAO for COCs or Former Standard from previous review period	Current Federal MCL	Current Alaska Cleanup Level[5]	Is There A Newly Promulgated Cleanup Level Since Previous Review?	Is the New Level More Stringent than the Previous Standard?
OU6 (Groundwater, µg/L) (Cont.)	o-Cresol	1,800	--	930 (A)	Yes	Yes
	Phenanthrene	11,000	--	170 (A)	Yes	Yes
	Phenol	11,000	--	5,800 (A)	Yes	Yes
	Pyrene	1,100	--	120 (A)	Yes	Yes
	Selenium	50	50	50 (B)	No	N/A
	Styrene	--	100	1200	Yes	Yes
	Tetrachloroethylene	5	5	5 (B)	No	N/A
	Toluene	1,000	1,000	1,000 (B)	No	N/A
	trans-1,2-	100	100	100 (B)	No	N/A
	Trichloroethylene	5	5	2.8 (A)	Yes	Yes
	Vanadium	260	--	86 (A)	Yes	Yes
	Vinyl Chloride	2	2	0.19 (A)	Yes	Yes
	Xylenes, total	10,000	10,000	190 (A)	Yes	Yes
OU6 (Soil,[4] mg/kg)	1,1,2,2-Tetrachloroethane	0.017	--	0.003	Yes	Yes
	1,1-Dichloroethane	25	--	0.092	Yes	Yes
	1,1-Dichloroethene	0.030	--	1.2	Yes	No
	1,2,3-trichloropropane	--	--	3.10E-05	Yes	Yes
	2-Methylnaphthalene	6.1	--	1.3	Yes	Yes
	4,4-DDD	7.2	--	0.098	Yes	Yes
	4,4-DDE	5.1	--	0.72	Yes	Yes
	4,4-DDT	7.3	--	5.1	Yes	Yes
	Acetone	88	--	38	Yes	Yes
	Aldrin	0.070	--	0.0099	Yes	Yes
	Alpha-	0.0064	--	0.0029	Yes	Yes
	Anthracene	3,000	--	390	Yes	Yes
	Antimony	3.6	--	4.6	Yes	No
	Arsenic	9.31[g]	--	0.2	Yes	Yes
	Barium	196.45[g]	--	2100	Yes	No
	Benzene	0.025	--	0.022	Yes	Yes
	Benzo(a)anthracene	3.6	--	0.7	Yes	Yes
	Benzo(a)pyrene	3.6	--	1.5	Yes	Yes
	Benzo(b)fluoranthene	4.9	--	15	Yes	No
	Benzo(g,h,i)perylene	1,400	--	2,300	Yes	No
	Benzo(k)fluoranthene	49	--	150	Yes	No
	Benzoic Acid	410	--	200	Yes	Yes
	Benzyl alcohol	--	--	5.7	Yes	Yes
	Beryllium	0.76[g]	--	200	Yes	No
	Beta-	0.022	--	0.01	Yes	Yes
	Bis(2-	13	--	88	Yes	No
	Butyl benzyl phthalate	920	--	16	Yes	Yes
	Chloroform	0.46	--	0.0071	Yes	Yes
	Chromium, Total	48.44[g]	--	--	No	N/A
	Chrysene	360	--	600	Yes	No

Table F-1
Evaluation of Changes in Chemical-Specific Standards

Operable Unit (matrix and units)	COPCs (Final ROD COCs in bold)	ROD-Established RAO for COCs or Former Standard from previous review period	Current Federal MCL	Current Alaska Cleanup Level[5]	Is There A Newly Promulgated Cleanup Level Since Previous Review?	Is the New Level More Stringent than the Previous Standard?
OU6 (Soil,[4] mg/kg) (Cont.)	cis-1,2-Dichloroethylene	0.24	--	0.12	Yes	Yes
	Cobalt	--	--	--	No	N/A
	Copper	460	--	370	Yes	Yes
	Delta-BHC	--	--	--	No	N/A
	Dibenz(a,h)anthracene	4.0	--	1.5	Yes	Yes
	Dibenzofuran	11	--	0.97	Yes	Yes
	Dieldrin	0.0076	--	0.0047	Yes	Yes
	Diesel (DRO; Other	1,000[e]	--	1000[e]	No	N/A
	Diesel (DRO; Site	2,000[e]	--	2000[e]	No	N/A
	Diethyl Phthalate	130	--	60	Yes	Yes
	Dimethylphthalate	1,100	--	48	Yes	Yes
	di-n-octyl phthalate	3800	--	370	Yes	Yes
	Endosulfan I	--	--	9.3	Yes	Yes
	Endosulfan II	--	--	9.3	Yes	Yes
	Endrin	0.29	--	0.61	Yes	No
	Endrin Aldehyde	--	--	--	No	N/A
	Ethylbenzene	6.9	--	0.13	Yes	Yes
	Fluoranthene	1400	--	590	Yes	Yes
	Fluorene	220	--	36	Yes	Yes
	Gamma-	0.0095	--	0.016	Yes	No
	Gasoline(GRO)	500[e]	--	500[e]	No	N/A
	Heptachlor	0.28	--	0.0076	Yes	Yes
	Heptachlor epoxide	0.014	--	0.0019	Yes	Yes
	HpCDD Totals	--	--	--	No	N/A
	HpCDF Totals	--	--	--	No	N/A
	HxCDD Total	--	--	--	No	N/A
	Indeno(1,2,3-c,d)pyrene	4.9	--	15	Yes	No
	Jet fuel (DRO)	2,000[e]	--	2000[e]	No	N/A
	Lead[4]	10.13[g]	--	400	Yes	No
	Manganese	--	--	--	No	N/A
	Methoxychlor	--	--	13	Yes	Yes
	Methyl ethyl ketone (2-	59	--	15	Yes	Yes
	Methyl isobutyl ketone (4-	8.1	--	18	Yes	No
	Methylene Chloride	0.21	--	0.33	Yes	No
	Molybdenum	--	--	--	No	N/A
	Naphthalene	20	--	0.038	Yes	Yes
	Nickel	71.79[g]	--	340	Yes	No
	Octachlorodibenzodioxin	--	--	--	No	N/A
	o-Cresol	15	--	6.2	Yes	Yes
	p-Cresol	--	--	12	Yes	Yes
	Phenanthrene	3,000	--	39	Yes	Yes
	Pyrene	1,000	--	87	Yes	Yes
	Selenium	0.54[g]	--	6.9	Yes	No

Table F-1
Evaluation of Changes in Chemical-Specific Standards

Operable Unit (matrix and units)	COPCs (Final ROD COCs in bold)	ROD-Established RAO for COCs or Former Standard from previous review period	Current Federal MCL	Current Alaska Cleanup Level[5]	Is There A Newly Promulgated Cleanup Level Since Previous Review?	Is the New Level More Stringent than the Previous Standard?
OU6 (Soil[4] , mg/kg) (Cont.)	Silver	1.68[g]	--	11	Yes	No
	Styrene	0.96	--	10	Yes	No
	Tetrachloroethylene	0.024	--	0.19	Yes	No
	Thallium	1.9	--	0.19	Yes	Yes
	Toluene	6.5	--	6.7	Yes	No
	Trichloroethylene (TCE)	0.020	--	0.011	Yes	Yes
	Vanadium	101.64[g]	--	510	Yes	No
	Xylenes, total	63	--	1.5	Yes	Yes
	Zinc	90.01[g]	--	4,900	Yes	No
OU6 (Surface Water, µg/L)	1,2-Dichloroethane	5 (A)	5	1.7 (A)	Yes	Yes
	Arsenic	10 (A)	10	0.52 (A)	Yes	Yes
	Barium	2,000 (A)	2,000	2,000 (B)	No	N/A
	Benzene	5 (A)	5	4.6 (A)	Yes	Yes
	Benzo(b)fluoranthene	0.31	--	2.5 (A)	Yes	No
	Benzo(k)fluoranthene	0.31	--	0.8 (A)	Yes	No
	Beryllium	4 (A)	4	4 (B)	No	N/A
	Chromium, Total	100 (A)	100	100 (B)	No	N/A
	Chrysene	120 (A)	--	2 (A)	Yes	Yes
	Ethylbenzene	700 (B)	700	15 (A)	Yes	Yes
	Gasoline (TAqH)	15[a]	--	15a (B)	No	N/A
	Nickel	100 (A)	9	390 (A)	Yes	No
	Phenol	11,000 (B)	--	5,800 (A)	Yes	Yes
	Styrene	100 (A)	100	100 (B)	No	N/A
	TAH	10[a]	--	10a (B)	No	N/A
	Toluene	1,000 (A)	1,000	1,000 (B)	No	N/A
	Xylenes, total	10,000 (B)	10,000	190 (A)	Yes	Yes
DP098						
DP098 (Groundwater, µg/L)	**1,1-Dichloroethene**	7	7	7 (B)	No	No
	Benzene	5	5	4.6 (A)	Yes	Yes
	Chloroform (TTHM)	100	80	2.2 (A)	Yes	Yes
	Chloromethane	66	--	190 (A)	Yes	No
	cis-1,2-Dichloroethylene	70	70	36 (A)	Yes	Yes
	DRO	1,500	--	1,500 (A)	No	No
	Gamma-	0.2	0.2	0.2 (B)	No	No
	GRO	1,300	--	2,200 (A)	No	No
	Methylene chloride	5	5	5 (B)	No	No
	RRO	1,100	--	1,100 (A)	No	No
	Tetrachloroethylene	5	5	5 (B)	No	No
	trans-1,2-	100	100	100 (B)	No	No
	Trichloroethylene	5	5	2.8 (A)	Yes	Yes
	Vinyl Chloride	2	2	0.19 (A)	Yes	Yes
	Xylenes, total	10,000	10,000	190 (A)	Yes	Yes
DP098 (Sediment, mg/kg)	**cis-1,2-Dichloroethylene**	0.2	--	0.12	Yes	Yes
	Trichloroethylene	0.027	--	0.011	Yes	Yes

Table F-1
Evaluation of Changes in Chemical-Specific Standards

Operable Unit (matrix and units)	COPCs (Final ROD COCs in bold)	ROD-Established RAO for COCs or Former Standard from previous review period	Current Federal MCL	Current Alaska Cleanup Level[5]	Is There A Newly Promulgated Cleanup Level Since Previous Review?	Is the New Level More Stringent than the Previous Standard?
DP098 (Soil, mg/kg)	**1,1-Dichloroethene**	0.030	--	1.2	Yes	No
	Benzene	0.025	--	0.022	Yes	Yes
	cis-1,2-Dichloroethylene	0.2	--	0.12	Yes	Yes
	DRO	250	--	250	No	No
	GRO	300	--	300	No	No
	RRO	10,000	--	10,000	No	No
	Tetrachloroethylene	0.030	--	0.19	Yes	No
	Trichloroethylene	0.027	--	0.011	Yes	Yes
DP098 (Surface Water, µg/L)	Benzo(a)pyrene	0.2 (A)	0.2	0.2 (B)	No	No
	cis-1,2-Dichloroethylene	5	70	36 (A)	Yes	Yes
	Dibenz(a,h)anthracene	0.12 (B)	--	0.25 (A)	Yes	No
	Indeno(1,2,3-c,d)pyrene	1.2 (B)	--	0.19 (A)	Yes	Yes
	TAH	10[a]	--	10[a] (B)	No	No
	TAqH	15[a]	--	15[a] (B)	No	No
	Trichloroethylene (TCE)	5	5	2.8 (A)	Yes	Yes

Table F-1
Evaluation of Changes in Chemical-Specific Standards

Operable Unit (matrix and units)	COPCs (Final ROD COCs in bold)	ROD-Established RAO for COCs or Former Standard from previous review period	Current Federal MCL	Current Alaska Cleanup Level[5]	Is There A Newly Promulgated Cleanup Level Since Previous Review?	Is the New Level More Stringent than the Previous Standard?

Notes:

[1] Identified in the ROD as a final COC; however, no cleanup level was assigned to this chemical.

[2] The more stringent cleanup level for benzene was already assessed in a previous five-year review but the value was not moved to the third column because the ROD established RAO for this compound is still applicable.

[3] The OU5 ROD identified TFH-gas and/or TFH-diesel from 18 AAC 70, which have since become outdated. In 1998, an agreement with ADEC and the U.S. Environmental Protection Agency was made to replace the outdated TFH analyses with TAH and TAqH. Because TFH is no longer used, the current criteria shown are for TAH and TAqH and are consistent with current RAOs for OU5.

[4] Updated soil cleanup levels have been evaluated for all soil contaminant detections for all OU6 sites. However, soil COC cleanup levels in the OU6 ROD are applicable to SD015 only, except for lead at LF002. The OU6 ROD did not specify soil COCs for the other sites that comprise OU6.

[5] ADEC Cleanup Levels in this table were selected as follows:

- For soils, the lower of the under 40-inch zone migration to groundwater from 18 AAC 75 Table B1 Method Two are listed as the current cleanup level; the cleanup level from the previous review period was based on the migration to groundwater for all compounds except petroleum hydrocarbons at Sites within OUs 1, 2, 4, 5, and 6, which were based on the under 40-inch zone value.

- For groundwater and surface water, the more conservative, or lower, of the values available in 18 AAC 70 and 18 AAC 75 was used. Values from 18 AAC 75 are denoted with an (A), and values from 18 AAC 70 are denoted with a (B). Values in 18 AAC 75 may have been updatd since the previous review period; for some COPCs this impacted the source of the selected cleanup value.

Additional COPC-Specific Notes:

[a] TAH in surface water may not exceed 10 µg/L. TAH consists of BTEX (benzene, toluene, ethylbenzene, and xylenes). TAqH in surface water may not exceed 15 µg/L. TAqH consists of TAH and PAH, including naphthalene (700 µg/L is a groundwater standard).

[b] The analyte was identified in the ROD as a COC; however, no cleanup level was assigned. Therefore, the cleanup level from the 2008 five-year review period was utilized to identify any changes in MCLs from the previous review period.

[c] For manganese and aluminum in groundwater, this is a Secondary Drinking Water MCL (18 AAC 80). Secondary criteria mainly affect the aesthetic quality of drinking water. For manganese in surface water, 18 AAC 70 lists 50 µg/L as the standard for human health consumption of water plus aquatic organisms.

[d] The total trihalomethanes (TTHM) MCL is 80 ug/L.

[e] This criteria is from 18 AAC 75 Table C for groundwater and Table A1-Method 1 for soils (See agreements in the OU4 and OU6 RODs to use Category D for OU4 sites and OU6 site SD015, and Category C for the other OU6 sites and OU5). Kerosene and Jet Fuel are compared to DRO, as they were in the RODs.

[f] Cleanup standards for BTEX no longer apply, instead cleanup standards are listed for the individual contaminants.

[g] ROD-specified limit based on elevated background concentrations.

[h] The OU6 ROD-established cleanup level of 0.43 ug/L was revised in a 2003 Explanation of Significant Differences to 4 ug/L.

µg/L - micrograms per liter
AAC - Alaska Administrative Code
ADEC - Alaska Department of Environmental Conserv
COC - contaminant of concern
COPC - contaminant of potential concern
DRO - diesel range organics
GRO - gasoline range organics
MCL - maximum contaminant level
mg/kg - milligrams per kilogram
N/A - not appliable
PCB - polychlorinated biphenyl
ROA - remedial action objective

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Table F-2
Evaluation of Changes for New, More Stringent, Standards

Operable Unit (matrix and units)	COPCs (Final ROD COCs in bold)	ROD-Established RAO for COCs or Former Standard from previous review period	Current Federal MCL	Current Alaska Cleanup Level	Maximum Detected Concentration - Historic	Maximum Detected Concentration - Recent	Risk Evaluation ?	Further Investigation Needed
Operable Unit 1								
OU1 (Groundwater, µg/L)	1,1,2,2-Tetrachloroethane	4.3	--	0.76	23.9	ND	No	No
	Arsenic	10	10	0.52	129	--	No	No
	Benzene	5	5	4.6	0.88	ND	No	No
	cis-1,2-Dichloroethylene	70	70	36	4.6	ND	No	No
	Methyl Ethyl Ketone (2-Butanone)	5,600	--	5600	2.6	ND	No	No
	PCB, Total	0.4	0.5	0.44	ND	--	No	No
	Trichloroethylene (TCE)	5	5	2.8	11	5.24	**Yes**	No
	Vinyl Chloride	2	2	0.19	0.13	ND	No	No
OU1 (Soil, mg/kg)	2-Methylnaphthalene	1.3	--	1.3	ND	--	No	No
	Arsenic	0.2	--	0.2	3	--	No	No
	Benzo(a)anthracene	0.7	--	0.7	ND	--	No	No
	Copper	370	--	370	45.7	--	No	No
	Mercury	0.4	--	0.36	0.29	--	No	No
Operable Unit 2								
OU2 (Groundwater, µg/L)	1,1,2,2-Tetrachloroethane	4.3	--	0.76	ND	--	No	No
	2-Methylnaphthalene	150	--	36	850	--	No	**Yes**
	Arsenic	10[b]	10	0.52	76	--	No	No
	Benzene	5	5	4.6	30,000	6,300	**Yes**	No
	Chloroform	140	80	2.2	0.14	--	No	No
	Ethylbenzene	700	700	15	23,000	1,840	**Yes**	No
	Naphthalene	730	--	1.7	580	--	No	**Yes**
	Thallium	2[b]	2	0.2	13.1	--	No	**Yes**
	Trichlorofluoromethane	11,000	--	5200	0.24	--	No	No
	Vanadium	260	--	86	312	--	No	**Yes**
	Xylenes, total	10,000	10,000	190	34,800	--	**Yes**	No
OU2 (Surface Water, µg/L)	1,2-Dichloroethane	5 (A)	5	1.7	ND	--	No	No
	Arsenic	50[b]	10	0.52	63[5]	--	No	No
	Benzene[2]	10	5	4.6	180	ND	No	No
	Thallium	2[b]	2	0.2	440[5]	--	No	No
OU2 (Soil, mg/kg)	Arsenic	--	--	0.2	16.1	--	No	No
	Lead	--	--	400	118	--	No	No
	Mercury	--	--	0.36	1	--	No	**Yes**
	Pentachlorophenol	--	--	0.0043	0.57	--	No	**Yes**
	2-Methylnaphthalene	--	--	1.3	56	--	No	**Yes**
	Benzo(a)anthracene	--	--	0.28	0.24	--	No	No
	Chrysene	--	--	82	0.25	--	No	No
	Benzo(b)fluoranthene	--	--	2	0.19	--	No	No
	Benzo(k)fluoranthene	--	--	20	0.19	--	No	No
	Benzo(a)anthracene	--	--	0.28	0.21	--	No	No

Table F-2
Evaluation of Changes for New, More Stringent, Standards

Operable Unit (matrix and units)	COPCs (Final ROD COCs in bold)	ROD-Established RAO for COCs or Former Standard from previous review period	Current Federal MCL	Current Alaska Cleanup Level	Maximum Detected Concentration - Historic	Maximum Detected Concentration - Recent	Risk Evaluation ?	Further Investigation Needed
			Operable Unit 4					
OU4 (Groundwater, µg/L)	1,1,2-Trichloroethane	5	5	0.41	39	ND	No	No
	1,1-Dichloroethane	7,300	--	28	84.1	1.95	No	No
	1,2-Dichlorobenzene	600	600	300	3.26	ND	No	No
	1,2-Dichloroethane	5	5	1.7	12.4	ND	No	No
	1,3-Dichlorobenzene	3,300	--	300	0.722	ND	No	No
	1,4-Dichlorobenzene	75	75	4.8	2.19	ND	No	No
	2-Methylnaphthalene	150	--	36	23.9	--	No	No
	Acenaphthene	2,200	--	530	0.26	--	No	No
	Benzene	5	5	4.6	4,400	ND	No	No
	Benzoic Acid	150,000	--	75000	4	--	No	No
	Chloroform (TTHM)	140	80[d]	2.2	2.3	ND	No	No
	cis-1,2-Dichloroethylene	70	70	36	904	28	No	No
	cis-1,3-Dichloropropene	8.5	--	4.7	0.0854	ND	No	No
	Ethylbenzene	700	700	15	ND	--	No	No
	Fluorene	1,500	--	290	0.33	--	No	No
	Methyl Ethyl Ketone (2-Butanone)	22,000	--	5600	230	ND	No	No
	Naphthalene	730	--	1.7	130	ND	No	No
	o-Cresol	1,800	--	930	24	--	No	No
	Phenol	11,000	--	5800	3.11	--	No	No
	Trichloroethylene (TCE)	5	5	2.8	96	35.9	**Yes**	No
	Trichlorofluoromethane	11,000	--	5200	0.514	ND	No	No
	Vinyl Chloride	2	2	0.19	0.23	ND	No	No
	Xylenes, total	10,000	10,000	190	6,400	ND	No	No

Table F-2
Evaluation of Changes for New, More Stringent, Standards

Operable Unit (matrix and units)	COPCs (Final ROD COCs in bold)	ROD-Established RAO for COCs or Former Standard from previous review period	Current Federal MCL	Current Alaska Cleanup Level	Maximum Detected Concentration - Historic	Maximum Detected Concentration - Recent	Risk Evaluation ?	Further Investigation Needed
OU4 (Soil, mg/kg)	2-Methylnaphthalene	6.1	--	1.3	19	--	No	No
	4,4-DDD	7.2	--	0.098	0.082	--	No	No
	4,4-DDE	5.1	--	0.72	0.0078	--	No	No
	4,4-DDT	7.3	--	5.1	0.44	--	No	No
	Acenaphthene	180	--	37	0.42	--	No	No
	Acenaphthylene	1,000	--	18	0.000021	--	No	No
	Acetone	88	--	38	0.00473	--	No	No
	Aldrin	0.070	--	0.0099	0.00060	--	No	No
	alpha-BHC	0.0064	--	0.0029	ND	--	No	No
	Anthracene	3,000	--	390	0.32	--	No	No
	Benzene	0.025	--	0.022	1	--	No	**Yes**
	Benzo(a)anthracene[1]	6[d]	--	0.7	0.36	--	No	No
	beta-BHC	0.022	--	0.01	ND	--	No	No
	Butyl Benzyl Phthalate	920	--	16	0.063	--	No	No
	cis-1,2-Dichloroethylene	0.24	--	0.12	0.19	--	No	No
	Copper	460	--	370	50.4	--	No	No
	Cyanide	27	--	0.2	0.4	--	No	No
	Dibenzofuran	11	--	0.97	0.31	--	No	No
	Dibutyl Phthalate	80	--	16	0.083	--	No	No
	Endosulfan sulfate	64	--	9.3	0.0054	--	No	No
	Ethylbenzene	6.9	--	0.13	61	--	No	No
	Fluoranthene	1,400	--	590	0.91	--	No	No
	Fluorene	220	--	36	0.44	--	No	No
	Heptachlor	0.28	--	0.0076	ND	--	No	No
	Isophorone	3.1	--	2.7	ND	--	No	No
	Methyl Ethyl Ketone (2-Butanone)	59	--	15	0.00826	--	No	No
	Naphthalene	20	--	0.038	9.6	--	No	No
	Phenanthrene	3,000	--	39	1.7	--	No	No
	Pyrene	1,000	--	87	0.89	--	No	No
	Thallium	1.9	--	0.19	0.829	--	No	No
	Trichloroethylene (TCE)	0.020	--	0.011	0.15	--	No	**Yes**
	Vanadium	3,400	--	510	86.6	--	No	No
	Xylenes, total	63	--	1.5	55.7[5]	--	No	**Yes**

Table F-2
Evaluation of Changes for New, More Stringent, Standards

Operable Unit (matrix and units)	COPCs (Final ROD COCs in bold)	ROD-Established RAO for COCs or Former Standard from previous review period	Current Federal MCL	Current Alaska Cleanup Level	Maximum Detected Concentration - Historic	Maximum Detected Concentration - Recent	Risk Evaluation ?	Further Investigation Needed
Operable Unit 5								
OU5 (Groundwater, µg/L)	1,1,2,2-Tetrachloroethane	4.3	--	0.76	12.2	1.51	**Yes**	No
	1,1-Dichloroethane	7,300	--	28	4.7	0.92	No	No
	2-Methylnaphthalene	150	--	36	1	--	No	No
	Benzene	5	5	4.6	16	0.75	No	No
	Dibutyl Phthalate	3,700	--	900	1	--	No	No
	Diethyl Phthalate	29,000	--	15000	15	--	No	No
	Ethylbenzene	700	700	15	2.55	0.37	No	No
	Naphthalene	730	--	1.7	14.4	ND	No	No
	N-Nitrosodiphenylamine	170	--	120	1	--	No	No
	Tert-butyl methyl ether	--	--	140	0.56	ND	No	No
	Trichloroethylene (TCE)	5	5	2.8	64	38.7	**Yes**	No
	Vanadium	260	--	86	113	--	No	No
	Xylenes, total	10,000	10,000	190	12.8	ND	No	No
OU5 (Surface Water µg/L)	1,1,2,2-Tetrachloroethane	--	--	0.76	4.9	1.44	**Yes**	No
	1,2-Dichloroethane	5 (A)	5	1.7	0.41	ND	No	No
	Benzene	5 (A)	5	4.6	2.7	0.35	No	No
	Ethylbenzene	15	700	15	0.88	ND	No	No
	Trichloroethylene (TCE)	5 (A)	5	2.8	18	8.83	**Yes**	No
	Xylenes, total	10,000 (B)	10000	190	6.36	3.4	No	No
OU5 (Soil, mg/kg)	2-Methylnaphthalene	--	--	1.3	0.1	--	No	No
	Anthracene	3,000	--	390	ND	--	No	No
	Arsenic	3.9	--	0.2	4.8	--	No	No
	Benzene	0.025	--	0.022	0.0052	--	No	No
	Benzo(a)anthracene	3.6	--	0.7	ND	--	No	No
	Benzo(g,h,i)perylene	3.6	--	2300	0.1	--	No	No
	Benzo(a)pyrene	--	--	1.5	ND	--	No	No
	Copper	460	--	370	21.1	--	No	No
	Dibutyl Phthalate	80	--	16	0.039	--	No	No
	Diethyl Phthalate	130	--	60	0.041	--	No	No
	Ethylbenzene	6.9	--	0.13	0.638	--	No	No
	Fluoranthene	1,400	--	590	ND	--	No	No
	Mercury	1.4	--	0.36	ND	--	No	No
	Naphthalene	20	--	0.038	ND	--	No	No
	Pyrene	1,000	--	87	ND	--	No	No
	Silver	11	--	11	0.54	--	No	No
	Thallium	1.9	--	0.19	ND	--	No	No
	Xylenes, total	63	--	1.5	1.8	--	No	No

Table F-2
Evaluation of Changes for New, More Stringent, Standards

Operable Unit (matrix and units)	COPCs (Final ROD COCs in bold)	ROD-Established RAO for COCs or Former Standard from previous review period	Current Federal MCL	Current Alaska Cleanup Level	Maximum Detected Concentration - Historic	Maximum Detected Concentration - Recent	Risk Evaluation ?	Further Investigation Needed
			Operable Unit 6					
OU6 (Groundwater, µg/L)	**1,1,2,2-Tetrachloroethane**	4[h]	--	0.76	45.1	ND	No	No
	1,1,2-Trichloroethane	5	5	0.41	6.97	ND	No	No
	1,1-Dichloroethane	7,300	--	28	185	1.24	No	No
	1,2-Dichlorobenzene	600	600	300	44	0.34	No	No
	1,2-Dichloroethane	5	5	1.7	38.7	0.51	No	No
	2,4-Dimethylphenol	730	--	360	1.89	--	No	No
	2-Hexanone	38	--	38	14.4	ND	No	No
	2-Methylnaphthalene	150	--	36	630	15.4	No	No
	4,4-DDD	3.5	--	0.06	0.0908	--	No	**Yes**
	4,4-DDE	2.5	--	0.46	0.0875	--	No	No
	4,4-DDT	2.5	--	2.3	0.0382	--	No	No
	Acenaphthene	2,200	--	530	20.3	0.103	No	No
	Acenaphthylene	2,200	--	260	2.4	ND	No	No
	Acetone	33,000	--	14,000	630	9.11	No	No
	Aldrin	0.05	--	0.0092	0.0519	--	No	**Yes**
	Alpha-hexachlorocyclohexane	0.14	--	0.072	0.0197	--	No	No
	Anthracene	11,000	--	43	0.34	ND	No	No
	Benzene	5	5	4.6	3,870	92.3	**Yes**	No
	Benzo(g,h,i)perylene	--	--	0.26	0.0063	ND	No	No
	Benzoic Acid	150,000	--	75,000	37.2	--	No	No
	Beta-hexachlorocyclohexane	0.47	--	0.25	0.0688	--	No	No
	Carbon disulfide	--	--	810	2.3	ND	No	No
	Carbon Tetrachloride	5	5	4.6	0.58	ND	No	No
	Chlorobenzene	100	100	78	98.9	ND	No	No
	Chloroform (TTHM)	140	80[d]	2.2	11.6	1.9	No	No
	Chrysene	120	--	2	0.27	0.27	No	No
	cis-1,2-Dichloroethylene	70	70	36	55	10.4	No	No
	Dieldrin	0.053	--	0.018	0.0324	--	No	No
	Diethyl phthalate	29,000	--	15,000	0.516	--	No	No
	Dimethylphthalate	370,000	--	16,000	110	--	No	No
	di-n-octyl phthalate	1,500	--	22	49.6	--	No	No
	Endosulfan I	220	--	100	0.0087	--	No	No
	Endosulfan II	--	--	100	0.0102	--	No	No
	Endrin	2	2	0.76 (B)	0.0327	--	No	No
	Ethylbenzene	700	700	15	1,800	481	**Yes**	No
	Fluoranthene	1,500	--	260	0.241	0.00995	No	No
	Fluorene	1,500	--	290	1.49	0.157	No	No
	Heptachlor	0.4	0.4	0.014	0.0177	--	No	No

Table F-2
Evaluation of Changes for New, More Stringent, Standards

Operable Unit (matrix and units)	COPCs (Final ROD COCs in bold)	ROD-Established RAO for COCs or Former Standard from previous review period	Current Federal MCL	Current Alaska Cleanup Level	Maximum Detected Concentration - Historic	Maximum Detected Concentration - Recent	Risk Evaluation ?	Further Investigation Needed
	Heptachlor epoxide	0.2	0.2	0.014	0.0603	--	No	**Yes**
	Methyl ethyl ketone (2-butanone)	22,000	--	5,600	640	ND	No	No
	Naphthalene	730	--	1.7	490	57.9	**Yes**	No
	o-Cresol	1,800	--	930	5.64	--	No	No
	Phenanthrene	11,000	--	170	0.454	0.377	No	No
	Phenol	11,000	--	5800	88.3	--	No	No
	Pyrene	1,100	--	120	0.162	0.142	No	No
	Styrene	--	100	1,200	26	0.41	No	No
	Trichloroethylene (TCE)	5	5	2.8	151	11	**Yes**	No
	Vanadium	260	--	86	1,430	--	No	**Yes**
	Vinyl Chloride	2	2	0.19	0.8	ND	No	No
	Xylenes, total	10,000	10,000	190	7,080	605	**Yes**	No
OU6 (Surface Water, µg/L)	1,2-Dichloroethane	5 (A)	5	1.7	1.87	ND	No	No
	Arsenic	10 (A)	10	0.52	96.3	--	No	No
	Benzene	5 (A)	5	4.6	367	15.2	**Yes**	No
	Chrysene	120 (A)	--	2	0.136	0.053	No	No
	Ethylbenzene	15	700	15	640	90.6	**Yes**	No
	Phenol	11,000 (B)	--	5,800	4.36	--	No	No
	Xylenes, total	190	10,000	190	1,680	107	No	No
OU6 (Soil,[4] mg/kg)	1,1,2,2-Tetrachloroethane	0.017	--	0.003	97.9	--	No	**Yes**
	1,1-Dichloroethane	25	--	0.092	0.881	--	No	No
	1,2,3-trichloropropane	--	--	0.000031	ND	--	No	No
	2-Methylnaphthalene	6.1	--	1.3	9.87	--	No	No
	4,4-DDD	7.2	--	0.098	0.921	--	No	**Yes**
	4,4-DDE	5.1	--	0.72	0.962	--	No	**Yes**
	4,4-DDT	7.3	--	5.1	3.94	--	No	No
	Acetone	88	--	38	4.66	--	No	No
	Aldrin	0.070	--	0.0099	0.126	--	No	**Yes**
	Alpha-Hexachlorocyclohexane	0.0064	--	0.0029	0.0517	--	No	**Yes**
	Anthracene	3,000	--	390	0.641	--	No	No
	Arsenic	9.31[g]	--	0.2	40	--	No	No

Table F-2
Evaluation of Changes for New, More Stringent, Standards

Operable Unit (matrix and units)	COPCs (Final ROD COCs in bold)	ROD-Established RAO for COCs or Former Standard from previous review period	Current Federal MCL	Current Alaska Cleanup Level	Maximum Detected Concentration - Historic	Maximum Detected Concentration - Recent	Risk Evaluation ?	Further Investigation Needed
OU6 (Soil[4], mg/kg) (Cont.)	Benzene	0.025	--	0.022	11.9	--	No	**Yes**
	Benzo(a)anthracene	3.6	--	0.7	0.566	--	No	No
	Benzo(a)pyrene	3.6	--	1.5	0.619	--	No	No
	Benzoic Acid	410	--	200	3.24	--	No	No
	Benzyl alcohol	--	--	5.7	4.3	--	No	No
	Beta-Hexachlorocyclohexane	0.022	--	0.01	0.00996	--	No	No
	Butyl benzyl phthalate	920	--	16	0.403	--	No	No
	Chloroform	0.46	--	0.0071	0.153	--	No	No
	cis-1,2-Dichloroethylene	0.24	--	0.12	0.952	--	No	**Yes**
	Copper	460	--	370	424	--	No	No
	Dibenz(a,h)anthracene	4.0	--	1.5	0.0105	--	No	No
	Dibenzofuran	11	--	0.97	1.2	--	No	No
	Dieldrin	0.0076	--	0.0047	0.114	--	No	**Yes**
	Diethyl Phthalate	130	--	60	0.183	--	No	No
	Dimethylphthalate	1,100	--	48	0.0655	--	No	No
	di-n-octyl phthalate	3800	--	370	0.428	--	No	No
	Endosulfan I	--	--	9.3	0.00423	--	No	No
	Endosulfan II	--	--	9.3	0.00423	--	No	No
	Ethylbenzene	6.9	--	0.13	20,900	--	No	**Yes**
	Fluoranthene	1400	--	590	1.51	--	No	No
	Fluorene	220	--	36	1.35	--	No	No
	Heptachlor	0.28	--	0.0076	0.00534	--	No	No
	Heptachlor epoxide	0.014	--	0.0019	0.00687	--	No	**Yes**
	Methoxychlor	--	--	13	ND	--	No	No
	Methyl ethyl ketone (2-butanone)	59	--	15	0.0596	--	No	No
	Naphthalene	20	--	0.038	7.49	--	No	**Yes**
	o-Cresol	15	--	6.2	0.0951	--	No	No
	p-Cresol	--	--	12	ND	--	No	No
	Phenanthrene	3,000	--	39	3.82	--	No	No
	Pyrene	1,000	--	87	1.22	--	No	No
	Thallium	1.9	--	0.19	5.7	--	No	**Yes**
	Trichloroethylene (TCE)	0.020	--	0.011	1.74	--	No	**Yes**
	Xylenes, total	63	--	1.5	81,400	--	No	No

Table F-2
Evaluation of Changes for New, More Stringent, Standards

Operable Unit (matrix and units)	COPCs (Final ROD COCs in bold)	ROD-Established RAO for COCs or Former Standard from previous review period	Current Federal MCL	Current Alaska Cleanup Level	Maximum Detected Concentration - Historic	Maximum Detected Concentration - Recent	Risk Evaluation ?	Further Investigation Needed
DP098								
DP098 (Groundwater, µg/L)	Benzene	5	5	4.6	124.7	ND	No	No
	Chloroform (TTHM)	100	80	2.2	1.78	0.541	No	No
	cis-1,2-Dichloroethylene	70	70	36	11,900	310	**Yes**	No
	Trichloroethylene (TCE)	5	5	2.8	5,600	277	**Yes**	No
	Vinyl Chloride	2	2	0.19	2,960	1.45	**Yes**	No
	Xylenes, total	10,000	10,000	190	26	ND	No	No
DP098 (Surface Water, µg/L)	cis-1,2-Dichloroethylene	5	70	36	60.5	ND	No	No
	Indeno(1,2,3-c,d)pyrene	1.2 (B)	--	0.19	ND	--	No	No
	Trichloroethylene (TCE)	5	5	2.8	15.3	ND	No	No
DP098 (Sediment, mg/kg)	**cis-1,2-Dichloroethylene**	0.2	--	36	0.26		No	No
	Trichloroethylene (TCE)	0.027	--	2.8	0.037		No	No
DP098 (Soil, mg/kg)	Benzene	0.022	--	0.02	0.0074		No	No
	cis-1,2-Dichloroethylene	0.2	--	0.12	1.8	--	No	**Yes**
	Trichloroethylene (TCE)	0.027	--	0.01	94	--	No	**Yes**

Table F-2
Evaluation of Changes for New, More Stringent, Standards

Operable Unit (matrix and units)	COPCs (Final ROD COCs in bold)	ROD-Established RAO for COCs or Former Standard from previous review period	Current Federal MCL	Current Alaska Cleanup Level	Maximum Detected Concentration - Historic	Maximum Detected Concentration - Recent	Risk Evaluation ?	Further Investigation Needed

Notes:

[1] Identified in the ROD as a final COC; however, no cleanup level was assigned to this chemical.

[2] The more stringent cleanup level for benzene was already assessed in a previous five-year review but the value was not moved to the third column because the ROD established RAO for this compound is still applicable.

[3] The OU5 ROD identified TFH-gas and/or TFH-diesel from 18 AAC 70, which have since become outdated. In 1998, an agreement with ADEC and the U.S. Environmental Protection Agency was made to replace the outdated TFH analyses with TAH and TAqH. Because TFH is no longer used, the current criteria shown are for TAH and TAqH and are consistent with current RAOs for OU5.

[4] Updated soil cleanup levels have been evaluated for all soil contaminant detections for all OU6 sites. However, soil COC cleanup levels in the OU6 ROD are applicable to SD015 only, except for lead at LF002. The OU6 ROD did not specify soil COCs for the other sites that comprise OU6.

[5] ROD value

[a] TAH in surface water may not exceed 10 µg/L. TAH consists of BTEX. TAqH in surface water may not exceed 15 µg/L. TAqH consists of TAH and PAH, including naphthalene (700 µg/L is a groundwater standard).

[b] The analyte was identified in the ROD as a COC; however, no cleanup level was assigned. Therefore, the cleanup level from the 2008 five-year review period was utilized to identify any changes in MCLs from the previous review period.

[c] For manganese and aluminum in groundwater, this is a Secondary Drinking Water MCL (18 AAC 80). Secondary criteria mainly affect the aesthetic quality of drinking water. For manganese in surface water, 18 AAC 70 lists 50 µg/L as the standard for human health consumption of water plus aquatic organisms.

[d] The total trihalomethanes (TTHM) MCL is 80 ug/L.

[e] This criteria is from 18 AAC 75 Table C for groundwater and Table A1-Method 1 for soils (See agreements in the OU4 and OU6 RODs to use Category D for OU4 sites and OU6 site SD015, and Category C for the other OU6 sites and OU5). Kerosene and Jet Fuel are compared to DRO, as they were in the RODs.

[f] Cleanup standards for BTEX no longer apply, instead cleanup standards are listed for the individual contaminants.

[g] ROD-specified limit based on elevated background concentrations.

[h] The OU6 ROD-established cleanup level of 0.43 ug/L was revised in a 2003 Explanation of Significant Differences to 4 ug/L.

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Table F-3
Risk/Hazard Estimates for Chemicals above Revised Standards

Operable Unit and Site	Media and Units	COPCs (Final ROD COCs in bold)	2017 Alaska Cleanup Level	Maximum Detected Concentration - Historic	Maximum Detected Concentration - Recent	Applicable Site Concentration [1]	Hazard Quotient (> 1 listed in bold)	Cancer Risk (>1x10^{-4} listed in bold)	Pathway Utilized for Risk Calculation
Operable Unit 1									
OU1-LF059	Groundwater (µg/L)	**Trichloroethylene (TCE)**	2.8	11	5.24	5.24	**1.9**	**1.1E-05**	Inhalation
OU2-ST041									
OU2-ST041	Groundwater (µg/L)	2-Methylnaphthalene	36	850	NS	RS			Direct
		Benzene	4.6	30,000	6,300	6,300	**190**	**1.4E-02**	Inhalation
		Ethylbenzene	15	23,000	6,100	1,840	**2.3**	**1.2E-03**	Inhalation
		Naphthalene	1.7	580	NS	RS			Inhalation
		Thallium	0.2	13.1	NS	RS			Direct
		Vanadium	86	312	NS	RS			Direct
		Xylenes, total	190	34,800	8,240	8,240	**43**		Inhalation
	Soil (mg/kg)	Mercury	0.36	1	NS	RS			Direct
		Pentachlorophenol	0.0043	0.57	NS	RS			Direct
		2-Methylnaphthalene	1.3	56	NS	RS			Direct
OU4-FT023									
OU4-FT023	Groundwater (µg/L)	**Trichloroethylene (TCE)**	2.8	96	35.9	35.9	**13**	7.3E-05	Inhalation
	Soil (mg/kg)	Benzene	0.022	0.008	NS	RS			Inhalation
		Trichloroethylene (TCE)	0.011	0.15	NS	RS			Inhalation
		Xylenes, total	1.5	55.7	NS	RS			Inhalation
OU4-SD029									
None									
OU4-SD029	Groundwater (µg/L)	**Trichloroethylene (TCE)**	2.8	5.3	8.71	8.71	**3.1**	1.8E-05	Inhalation
	Soil (mg/kg)	Xylenes, total	1.5	55.7	NS	RS		-	Inhalation
OU5-ST037									
OU5-ST037	Groundwater (µg/L)	1,1,2,2-Tetrachloroethane	0.76	12.2	1.51	1.51	0.0042	2.0E-05	Inhalation
		Trichloroethylene (TCE)	2.8	64	38.7	38.7	**14**	7.8E-05	Inhalation
	Surface Water (µg/L)	1,1,2,2-Tetrachloroethane	0.76	4.9	1.44	1.44	0.0040	1.9E-05	Inhalation
		Trichloroethylene (TCE)	2.8	18	8.83	8.83	**3.1**	1.8E-05	Inhalation
OU6-LF002									
OU6-LF002	Groundwater (µg/L)	Benzene	4.6	90	82.3	82.3	**2.5**	**1.8E-04**	Inhalation
		Ethylbenzene	15	850	481	481	0.60	**3.2E-04**	Inhalation
		Naphthalene	1.7	120	57.9	57.9	**9.5**	**3.5E-04**	Inhalation
		Vanadium	86	1,430	NS	RS			Direct
		Xylenes, total	190	605	605	605	**3.1**	-	Inhalation
	Soil (mg/kg)	Benzene	0.022	0.106	NS	RS			Inhalation
		Ethylbenzene	0.13	4.3	NS	RS			Inhalation
		Naphthalene	0.038	1.8	NS	RS			Inhalation
		Thallium	0.19	1.47	NS	RS			Direct
		Trichloroethylene (TCE)	0.011	0.05	NS	RS			Inhalation

Table F-3
Risk/Hazard Estimates for Chemicals above Revised Standards

Operable Unit and Site	Media and Units	COPCs (Final ROD COCs in bold)	2017 Alaska Cleanup Level	Maximum Detected Concentration - Historic	Maximum Detected Concentration - Recent	Applicable Site Concentration [1]	Hazard Quotient (> 1 listed in bold)	Cancer Risk (>1x10^{-4} listed in bold)	Pathway Utilized for Risk Calculation
OU6-LF003									
None									
OU6-LF003	Groundwater (µg/L)	Vanadium	86	254	NS	RS			Direct
	Soil (mg/kg)	Thallium	0.19	3.01	NS	RS			Direct
OU6-LF004									
OU6-LF004	Groundwater (µg/L)	4,4-DDD	0.06	0.0908	NS	RS			Direct
		Aldrin	0.0092	0.0519	NS	RS			Inhalation
		Benzene	4.6	3,870	6.49	6.49	0.20	1.4E-05	Inhalation
		Ethylbenzene	15	1,800	38.7	38.7	0.048	2.6E-05	Inhalation
		Heptachlor epoxide	0.014	0.0603	NS	RS			Inhalation
		Naphthalene	1.7	170	57	57	**9.3**	**3.5E-04**	Inhalation
		Vanadium	86	1,390	NS	RS		-	Direct
	Soil (mg/kg)	1,1,2,2-Tetrachloroethane	0.003	0.923	NS	RS			Inhalation
		4,4-DDD	0.098	0.921	NS	RS			Direct
		Aldrin	0.0099	0.126	NS	RS			Inhalation
		Alpha-Hexachlorocyclohexane	0.0029	0.0517	NS	RS			Direct
		Benzene	0.022	0.694	NS	RS			Inhalation
		cis-1,2-Dichloroethylene	0.12	0.952	NS	RS			Direct
		Dieldrin	0.0047	0.114	NS	RS			Direct
		Ethylbenzene	0.13	2,800	NS	RS			Inhalation
		Heptachlor epoxide	0.0019	0.00687	NS	RS			Inhalation
		Naphthalene	0.038	7.49	NS	RS			Inhalation
		Thallium	0.19	2.41	NS	RS			Direct
		Trichloroethylene (TCE)	0.011	0.697	NS	RS			Inhalation
	Surface Water (µg/L)	Benzene	4.6	367	15.2	15.2	0.46	3.3E-05	Inhalation
		Ethylbenzene	15	640	90.6	90.6	0.11	6.0E-05	Inhalation
OU6-SD015									
OU6-SD015	Groundwater (µg/L)	**Benzene**	4.6	1,430	92.3	92.3	**2.78**	**2.0E-04**	Inhalation
		Trichloroethylene (TCE)	2.8	151	9.34	9.34	**3.3**	1.9E-05	Inhalation
OU6-WP014									
OU6-WP014	Groundwater (µg/L)	Trichloroethylene (TCE)	2.8	44.4	11	11	**4**	2.2E-05	Inhalation
DP098									
DP098	Groundwater (µg/L)	**cis-1,2-Dichloroethylene**	36	11,900	310	310	**8.6**	-	Direct
		Trichloroethylene (TCE)	2.8	5,600	277	277	**98**	**5.6E-04**	Inhalation
		Vinyl Chloride	0.19	2,960	1.45	1.45	0.033	7.7E-05	Direct
	Soil (mg/kg)	**cis-1,2-Dichloroethylene**	0.12	1.8	NS	RS			Direct
		Trichloroethylene (TCE)	0.011	94	NS	RS			Inhalation

Table F-3
Risk/Hazard Estimates for Chemicals above Revised Standards

Operable Unit and Site	Media and Units	COPCs (Final ROD COCs in bold)	2017 Alaska Cleanup Level	Maximum Detected Concentration - Historic	Maximum Detected Concentration - Recent	Applicable Site Concentration [1]	Hazard Quotient (> 1 listed in bold)	Cancer Risk (>$1x10^{-4}$ listed in bold)	Pathway Utilized for Risk Calculation

Notes:

1 - Applicable concentration is the most recent concentration available at each site based on available ERPIMS dataset, unless otherwise noted.

2 - Toxicity values (i.e., RfDO,RfC, SFo, and IUR) were obtained from USEPA's Regional Screening Levels (RSLs) Table (November, 2018). Toxicity values are derived from the following sources, as cited in the USEPA's RSLs Table

3 - Not calculated. OU-wide maximum site concentration exceeded current Alaska cleanup level; however, the site-specific maximum site concentration did not.

a - Maximum detected at the time of the ROD

A - Agency for Toxic Substances and Disease Registry
C - California EPA
E - Extrapolated Value
H - Health Effects Summary Tables
NS - Not sampled
RS - Resample

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APPENDIX G
EPA and ADEC Response to Comments

(To be provided in Final)

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Alaska Department of Environmental Conservation
Comments on the Draft FYR dated January 2019
Commenter: Louis Howard (ADEC) Comments Developed: February 11, 2019

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
1.			**General Comments** ADEC requests AFCEC to add the following new contaminants as part of the long-term monitoring program (as soon as possible): per- and polyfluorinated alkyl substances (PFAS) which include (but not limited to) perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). ADEC has promulgated cleanup levels (18 AAC 75 Table B1 Method Two since November 6, 2016) for PFOS and PFOA that have been detected[1] in various locations during 2016[2] sampling efforts at JBER-E and JBER-R. These locations include State sites, CERCLA source areas, compliance program sites or previously unknown sites which are either active, closed, cleanup complete, or cleanup complete with institutional controls and areas which have never been investigated before. At CERCLA source areas where PFAS has been detected above promulgated standards, the original remedy selections may not be valid for new contaminants [3]such as PFAS. As of now, no long-term groundwater, surface water/seep monitoring is occurring for PFAS contamination at the locations where it was detected or downgradient of the PFAS exceedance on JBER. Rather, AFCEC is choosing to characterize investigation-derived wastes (IDW) for PFAS contamination on a site by site basis until 2020. In 2020, it is anticipated that AFCEC will evaluate the nature and extent of the new PFAS contaminant sources on JBER-E and JBER-R as part of the target analyte list of contaminants of concern in accordance with CERCLA or as part of State oversight in accordance with 18 AAC 75 (most current version) and guidance documents adopted by reference.	**Agree:** Text added to introduction stating "Perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) have been detected in groundwater at several JBER-E locations (USAF, 2018e). These sites will be addressed through ongoing and future expanded site inspection or remedial investigation, in

[1] Site Inspection Report for AFFF areas. May 2018 (Final).

[2] Soil, sediment, surface water, and groundwater field activities were performed at JBER in June through October 2016 in accordance with the approved Work Plan (USAF, 2016a). Additional surface water and groundwater sampling of seeps at LF004 and ST037 was completed in November 2016, with approval by email (Halstead, 2016a; Howard, 2016).

[3] 4.2.4 How should I review RAOs and evaluate their impact? New site conditions, such as discovery of new contaminants, can also impact the RAOs and remedy protectiveness. EPA OSWER 9355.7-03B-P

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
			Additionally, there are contaminants which did not have cleanup levels when the Record of Decision (ROD) documents were signed in the early to mid-1990s which now have cleanup levels (e.g. gasoline range organics/GRO, diesel range organics/DRO and residual range organics/RRO). These contaminants will need to be monitored under State regulatory oversight, if and when the CERCLA process says there is "no further action" for ROD COCs and there is a data gap for petroleum constituents under State regulatory oversight for the applicable source area.	accordance with the CERCLA process.". **Agree:** The FYR addresses contaminants with cleanup values in the ROD. The addition of petroleum analytes to the long-term monitoring program is not part of this FYR.
2.			**Executive Summary**	
3.	ES-1		The text states: "The purpose of this review is to ensure that remedies selected in each of the JBER-E Records of Decision (RODs) have been implemented, are performing effectively, and continue to be protective of human health and the environment." Consistent with reviews conducted at Joint Base Elmendorf-Richardson (e.g. Fourth Five-Year Review 2014), the following addition to the text is requested immediately after the sentence above to read as follows: "The purpose of this review is to ensure that remedies selected in each of the JBER-E Records of Decision (RODs) have been implemented, are performing effectively, and continue to be protective of human health and the environment. The methods, findings, and conclusions of five-year reviews identify issues found through an examination of the data collected in the past five years, if any, and provide recommendations to address them. This report covers activities that have occurred and conditions as they have developed since the previous five-year review for JBER-E, which was conducted in 2014."	**Agree:** The second paragraph has been modified to include the requested additional text.

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4.	9	Table 4-1	**LF059 Contaminants of Concern and ROD Cleanup Levels** The table lists the following as contaminants of concern for OU1 LF059, which are now included as COCs for CG704. 1,2-Dibromoethane 0.05 ug/L MCL, Manganese 9,100 ug/L Background, Trichloroethene 5.0 ug/L MCL and Vinyl chloride 2.0 ug/L MCL. Please note that CG704 will need to add the following (but not limited to) contaminants for monitoring that were screened out historically that exceed 18 AA 75 Table C: 1) BEHP 2) 1,1,2,2 PCA (and all the daughter products of PCA). 3) Lead	**Agree**: Issues and recommendation amended to include these COCs for sampling at CG704. The RI for CG704 was finalized after the July 2018 document review period.
5.	ES-2		**Operable Unit 3** **Cherry Hill Ditch SD052 (AFFF# 10)** PFAS investigation is needed to delineate the nature and extent of contamination at this source area (CS DB Hazard ID 644) in Operable Unit 3. In 2016, soil sample results detected PFOS at concentrations below the EPA risk based screening level (RBSL) and ADEC human health cleanup level (as found in 18 AAC 75 November 6, 2016), but above the ADEC migration to groundwater (MTGW) cleanup level at locations CHD-1, CHD-2, and CHD-4. PFOA was detected in groundwater, during a one-time sampling event, at a concentration above the EPA health advisory (HA), but below the ADEC cleanup level at CHD-2 and CHD-3. PFOS was detected in groundwater at concentrations above the EPA HA but below the ADEC cleanup level at CHD-1, CHD-2, and CHD-3. PFOA was detected in surface water at a concentration above the EPA HA but below the ADEC groundwater	**Agree:** Text added to introduction "OU3 (including sites SD016, SS021, SD031, SD052 and SA100) was previously closed having achieved UU/UE status and was not reviewed under this FYR. The contaminant of concern

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			cleanup level. PFOS was detected at a concentration above both the EPA HA and the ADEC cleanup level[4]. AFEC is currently choosing not to conduct any investigation or any groundwater, surface water, seep monitoring for PFAS until 2020, despite the results of the 2018 Site Inspection Report indicating exceedances of State promulgated cleanup levels for PFOA and PFOS (18 AAC 75 as amended through October 27, 2018). **SD031 Building 7309 (AFFF Area #18 - Hangar 5 Former AFFF Spray Test Area)** PFAS investigation is needed to delineate the nature and extent of contamination at this source area (CS DB Hazard ID 636) in Operable Unit 3. In 2016, soil sample results detected PFOS at concentrations below EPA RBSL and ADEC human health cleanup level, but above the ADEC MTGW cleanup level. PFOA and PFOS were detected in groundwater at concentrations above the EPA HA and the ADEC cleanup level. **SD016 (AFFF Area #7 – Current AFFF Spray Test Area)** PFAS investigation is needed to delineate the nature and extent of contamination at this source area (CS DB Hazard ID 632) in Operable Unit 3. In 2016, PFOA and PFOS were detected in soil at concentrations below the EPA RBSLs and the ADEC human health cleanup level, but above the ADEC MTGW cleanup level. PFOA and PFOS were detected in groundwater at concentrations above the EPA HA and the ADEC cleanup level in new well CASTA-1. In existing well OU5MW-39, PFOA was detected at a concentration greater than the EPA HA but below the ADEC cleanup level, while PFOS was detected at a concentration above the EPA HA and the ADEC cleanup level.	(COC), polychlorinated biphenyls (PCBs), was below the ROD cleanup levels. Under the 2018 Site Inspection (USAF, 2018e), PFOS/PFOA is detected above the EPA drinking water lifetime health advisory levels in surface water located in the Cherry Hill Ditch (SD052), which is within the geographic boundary of OU3. Although surface water in Cherry Hill Ditch is not a known drinking water source, out of an abundance of caution, an interim LUC advising people to avoid contact with the water is recommended until a risk assessment can determine the level of risk to human health. **Agree:** See Comment #1

[4] 3.8.10 AFFF Area #10 – Cherry Hill Ditch Site Inspection Report May 2018 (Final).

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			SS021 (AFFF Area #19 - Hangar 6 (Building 9311) PFAS investigation is needed to delineate the nature and extent of contamination at this source area (CS DB Hazard ID 2791) in Operable Unit 3. In 2016, PFOA was detected in groundwater at a concentration above the EPA HA but below the ADEC cleanup level. PFOS was detected at a concentration above the EPA HA and the ADEC cleanup level. SS021 is downgradient of AFFF #19 and could be potentially impacted by this source area contributing to the Western ST037 Groundwater Plume[5]. **Operable Unit 4** **FT023 (AFFF Area #17 - Fire Training Area)** PFAS investigation is needed to delineate the nature and extent of contamination at this source area (CS DB Hazard ID 1798) in Operable Unit 4. In 2016, no soil borings were completed at FT023, so this is a data gap for PFAS. **SD027 (AFFF Area #20 - Hangar 8 (Building 14410)** PFAS investigation is needed to delineate the nature and extent of contamination at this source area (CS DB Hazard ID 633) in Operable Unit 4. In 2016, PFOS was detected in groundwater at concentrations above the EPA HA, but below the ADEC cleanup level. **SD024 (AFFF Area# 21 Hangar 10 (Bldg. 15455)** PFAS investigation is needed to delineate the nature and extent of contamination at this source area (CS DB Hazard ID 641) in Operable Unit 4. In 2016, PFOA and PFOS were detected in groundwater at concentrations above the EPA HA, but below the ADEC cleanup level.	

[5] 12.3 The Western ST037 plume includes the former Fairchild Avenue Plume, Kenney Avenue Plume, OU3MW-25 Plume, OU5MW-02 Plume, and SP1-02 Plume (2016 Annual RA-O and Monitoring Report CERCLA Sites. May 2018).

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			Operable Unit 5 **ST037** PFAS investigation is needed to delineate the nature and extent of contamination at this source area (CS DB Hazard ID 641) in Operable Unit 5. No soil borings were installed at the seeps, therefore, this is a data gap. In 2016, four groundwater samples were collected from surface seeps OU5SP-01, OU5SP-02, OU5CP-02, and OU5SP-11. PFOA was detected at concentrations above the EPA HA, but below the ADEC cleanup level at OU5SP-01, OU5SP-02, and OU5CP-02, and at a concentration above the EPA HA and the ADEC cleanup level at OU5SP-11. PFOS was detected at a concentrations above the EPA HA, but below the ADEC cleanup level at OU5SP-02 and OU5CP-02, and above the EPA HA and ADEC cleanup level at OU5SP-11. One surface water sample was collected from surface water location WCSW-02 at ST037. PFOA and PFOS were detected at concentrations above the EPA HA and the ADEC groundwater cleanup level. **Operable Unit 6** **LF004** PFAS investigation is needed to delineate the nature and extent of contamination at this source area (CS DB Hazard ID 1804) in Operable Unit 6. No soil borings were installed at the seeps, therefore, this is a data gap. In 2016, PFOS was detected in groundwater seeps at a concentration above the EPA HA and the ADEC cleanup level.	
6.	ES-5 & ES-6		**Protectiveness** **Page ES-5** **Operable Unit: OU4**	

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			Protectiveness Statement **Source Area FT023** Non-contaminants of concern: PFAS-no soil borings were installed as part of the 2016 Site Inspection investigation. PFAS should be assessed by conducting a sampling event (e.g. in.2020) of soil as soon as an EPA approved method is finalized for PFAS. **Source Areas SD024 and SD027** Non-contaminants of concern: These two source areas should be assessed for PFAS contamination in groundwater by conducting a sampling event as soon as possible. **Operable Unit: OU5** **Source Area: ST037** Non-contaminants of concern: PFAS-no soil borings were installed as part of the 2016 Site Inspection investigation. PFAS should be assessed by conducting a sampling event (in.2020) of soil as soon as an EPA approved method is finalized. Groundwater seeps and surface water should be assessed for PFAS by conducting regular sampling events as soon as possible for these contaminants. **Page ES-6** **Operable Unit 6** **Source Area LF004** Non-contaminants of concern: PFAS-no soil borings were installed as part of the 2016 Site Inspection investigation for PFAS. PFAS should be assessed by conducting a sampling event (in.2020) of soil as soon as an EPA approved method is finalized. Groundwater seeps and surface water should be assessed for PFAS by conducting regular sampling events as soon as possible for these contaminants.	**Agree:** See Comment #1.

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7.	ES-8, ES-9, & ES-10		**Page ES-8** **Operable Unit 4** **Source Areas SD024 and SD027** PFAS contamination will not naturally attenuate in groundwater. Additional studies are needed to fully characterize the nature and extent of contamination from PFAS at these source areas. **Page ES-9** **Operable Unit 5** **Source area ST037** PFAS contamination will not naturally attenuate in groundwater seeps or surface water. Additional studies are needed to fully characterize the nature and extent of contamination from PFAS at this source area. **Source Area LF004** PFAS contamination will not naturally attenuate in groundwater seeps. Additional studies are needed to fully characterize the nature and extent of contamination from PFAS at this source area.	**Agree:** See Comment #1.
8.	ES-12 & ES-13		**Other Findings Not Affecting Remedy Performance** **Page ES-12** ADEC requests the source areas also include the specific operable unit (OU), where applicable, with the recommendations. For example: "OU4, source area LF059: LUCs should remain…"	**Agree**: Added source areas to the figures, tables and titles where applicable (e.g. OU4-LF059)

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			Page ES-13 **Last three bulleted items** • LF002: cancer risks exceed 1 x 10^{-4} or noncancer HQs are greater than 1 for the following non-COC chemicals: (in groundwater) benzene, ethylbenzene, naphthalene, TCE, vanadium, and total xylenes; and (in soil) ethylbenzene, naphthalene, thallium, and TCE. Since LUCs will remain in place indefinitely, the protectiveness of the remedy is not affected; however, groundwater, surface water (seep), and soil sampling should be conducted for these chemicals in order to assess current concentrations. • LF004: the 2014 FYR recommended investigation for the presence of 1,4-dioxane in conjunction with TCE contamination at the site. A 1,4-dioxane investigation was conducted at JBER in 2017; however, no samples were collected at LF004. Risk and hazard calculations performed as part of this FYR resulted in a noncancer HQ for TCE in groundwater greater than 1, and it is recommended in this FYR that TCE be investigated for potential inclusion as a remedy COC. It is recommended that 1,4-dioxane in groundwater be assessed at LF004 to address the 2014 recommendation. • SD015: the 2014 FYR recommended investigation for the presence of 1,4-dioxane in conjunction with TCE contamination at the site. A 1,4-dioxane investigation was conducted at JBER in 2017; however, no samples were collected at SD015. It is recommended that 1,4-dioxane in groundwater be assessed at SD015 to address the 2014 recommendation. ADEC requests clarification on why these are not included in the "Issues and Recommendations Identified in the Five-Year Review" since they would affect protectiveness depending on the groundwater and/or soil sample results.	**Agree:** The AF recommends that, at a minimum, two sampling events are conducted for the listed COCs to calculate risks. The AF recommends installation of additional monitoring wells to have at a minimum 3 wells per OU, if the site does not currently have three wells. However, for perched aquifers, additional wells will need to be addressed on a site-specific basis. **Agree:** Moved sampling at LF002 and SD015 to "Issues and Recommendations Identified in the Five-Year Review" table, as it may affect future protectiveness. Upon review LF004 1,4 Dioxane did not require investigation.

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9.	2	1	**Introduction** The text states: "The review began in July 2017, with data acquired through July 2018 included in the review." The redline version of the Site Inspection (SI) Report for AFFF Areas on JBER was accepted by ADEC for finalization on February 8, 2018. EPA provided an approval letter to finalize the SI May 21, 2018. The SI was finalized soon after the EPA approval letter in May 2018 which should have been immediately passed on to Stantec Consulting Inc. by AFCEC prior to the July 2018 "deadline" for data acquisition into the Fifth Five-Year Review. It was not. Now that the draft Fifth Five-Year Review has been received by ADEC in January 2019, it is too late to capture this SI data set and will have to be addressed by follow-up investigations in the year 2020 and beyond. The subsequent data collection effort for PFAS contamination will need to be fully addressed in the Sixth Five-Year Review in 2024. I wish you luck in your endeavors on that matter since I will be retired from the State of Alaska employment by that time (my last day at ADEC will be 04/30/2020).	**Agree:** PFAS contamination issues will be incorporated in a future FYR (see comment #1).
10.	3	3.1	**Site Interviews** **2nd Bullet** **PFOS/PFOA comments** The text states: "Note: PFOS/PFOA sampling was conducted at JBER in 2016. These activities are briefly noted in this FYR (Section 6.5.3); however, results were not available at the time of the report, and results will be addressed in the next FYR." AFECE and their contractor had at least two months to incorporate the data from the FINAL version (May 2018) before the self-imposed deadline of July 2018 for data acquisition for this Five-Year Review. The results were available as of May 2018, it appears	**Agree:** See response to comments #1 and #9.

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			that AFCEC has chosen not to incorporate them into this review and it will be addressed in 2024 for the next Five-Year Review.	
11.	5	II	**Site-Specific Five-Year Reviews** The text states: Sites that achieved NFA status and were closed under CERCLA prior to the review period for this FYR are not included in this review." Source areas formally closed (cleanup complete in the CS DB) or achieved No Further Action (NFA) status (cleanup complete with institutional controls in the CS DB) and were closed under CERCLA may need to be reopened or given a new site ID for PFAS contamination that was detected above cleanup levels as listed in 18 AAC 75 (as amended through October 27, 2018 or the must current version in effect). These areas will be included in the Sixth Five-Year review as reopened source areas or new site IDs for the same location as the "closed" source areas to be investigated in accordance with CERCLA or State authority in accordance with the most current version of 18 AAC 75.	**Agree:** Text added to Site Specific Five Year Reviews section stating "Source areas formally closed or achieved NFA status and were closed under CERCLA may need to be reopened or given a new site ID for PFAS contamination, if they require to be investigated under CERCLA."
12.			**Operable Unit 1**	
13.	10 & 11	4.2.3	**Status of Implementation** **Page 10** **Last sentence** The text states: "Groundwater sampling has been discontinued at LF059 and transferred to CG704." ADEC requests clarification on whether a memo to the site file was prepared for transferring groundwater monitoring from Operable Unit 1 LF059 to CG704. The 1994 Operable Unit 1 Record of Decision (ROD) states for the Description of the Selected Remedy as:	

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			"... the selected remedy includes institutional controls specifically aimed at restricting use of the shallow aquifer as well as groundwater monitoring to ensure protection of human health and the environment. The major components of the selected remedy are: • monitoring groundwater for five years, or until the groundwater no longer poses an unacceptable health risk; • five-year review to assess the protectiveness of the remedial action; • periodic evaluation of monitoring results to determine if there is need for further remedial action; and • maintaining institutional controls restricting access to shallow groundwater." There needs to be something in the administrative file so if someone is tracing the groundwater sampling located at LF059, they will know that from now on they need to look at the administrative file for CG704. Usually that is a memo to the file that deals solely with LF059 and the transferring of monitoring to CG704. Please explain where in the administrative file they alert the public to the transfer of monitoring from LF59 to CG704 **Page 11** The text states: "Because the seep sample represents surface water quality, the TCE result was also compared against the National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Tables (SQuiRTs) criteria for freshwater." Please provide a better reference (i.e. month and year of publication) for the SQuiRTs critera by NOAA.	**Agree:** This action was documented in the Interim Remedial Action Completion Report for LF059 (USAF, 2017a) and will be added to the Administrative Record.

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			Per NOAA's website[6]: "The SQuiRT cards are intended for preliminary screening purposes only: They do not represent official NOAA policy and do not constitute criteria or cleanup levels. NOAA does not endorse their use for any purpose other than preliminary screening. Many of the benchmarks presented were originally published with similar caveats. The SQuiRT tables provided here were developed in 2008 and are no longer being maintained. Please be aware that in some cases, they may contain outdated or broken links."	**Agree:** The reference relates to previous actions and are no longer relevant. Reference to SQuiRT standards removed.
14.	12	4.2.4	**LUC Summary** The text states: "Compliance with LUCs applies to all soil-disturbing activities on JBER and is reviewed annually." Add reference to the last review of land use controls for JBER[7].	**Agree**: Added reference to 2016 annual RA-O Report (USAF, 2018c).
15.	15	4.4.2	**Data Review** The text states: "All historical data available in ERPIMS (21 July 1992 through 27 July 2017) were reviewed to support a technical assessment of chemical specific toxicity changes since the ROD was signed." ADEC would add that the review should look at potential contaminants of concern that were dropped during the RI stage due to not having an applicable cleanup level at the time (and now there is a promulgated cleanup level) or were dropped during data review due to not exceeding a cleanup level or not exceeding risk based screening levels at the time but do now (and now the cleanup level is more stringent due to more recent toxicity data). A limited field investigation (LFI) report for CG704 – Southern Plume was finalized as of 8/24/2018. Groundwater results maximum detections were as follows: Lead 92.5 µg/L (15 µg/L), trichloroethylene 19 µg/L (2.8 µg/L).	**Agree**: Chemical that did not become COCs were investigated and where appropriate recommended for a sampling event to establish recent concentrations. **Disagree:** Site CG704 is a site under investigation and was not included in this FYR.

[6] https://response.restoration.noaa.gov/environmental-restoration/environmental-assessment-tools/squirt-cards.html
[7] CY2017 Annual Land Use Control (LUC) and Institutional Control (IC) Monitoring at Joint Base Elmendorf-Richardson (JBER)

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16.	16	4.5.2	**Question B – Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?** **<u>Changes in Standards</u>** The text states: "It is recommended that 1,1,2,2-PCA be included in the next round of sampling for CG704 to assess current concentrations at that site." ADEC concurs, however, it is requested that the daughter products and all VOCs reported by EPA Method SW8260 be sampled for and reported as part of ongoing monitoring that is now taking place under the source area referred to as CG704. Calculations of cumulative risk for LF059 should include the results from the August 2018 LFI report yields the following results: 28.3 hazard index (HI) and carcinogenic risk of 2.85 x 10^{-3} and any data (maximum detections only from 2014-present) collected since the 2014 Fourth Five-Year Review.	**Agree:** Recommendation for sampling for CG704 was made, however this does not affect protectiveness of LF059 (see also Comment #4) **Disagree:** LFI was finalized after the July 2018 document review period.
17.			**Operable Unit 2**	
18.	19	5.2.1	**Basis for Taking Action** The text states: "The OU2 ROD identified BTEX as the groundwater COCs for ST041, and benzene, toluene, and ethylbenzene as surface water and seep COCs." The contaminants of concern listed in the Operable Unit 2 Record of Decision (ROD) with a cleanup level are all petroleum, which is excluded under CERCLA[8]. ADEC requests that AFCEC and EPA consider transferring ST041 out of CERCLA oversight to State oversight (18 AAC 75) as soon as possible.	**Agree:** Recommendation added to Sections 5.5.2 and 5.6 "It is recommended that AFCEC and EPA should

[8] The term [hazardous substance] does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under subparagraphs (A) through (F) of this paragraph, and the term does not include natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas). 42 U.S.C: §9601(14).

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			The text states: "It is recommended that 2-methylnaphthalene, naphthalene, vanadium, and thallium be investigated for potential inclusion as groundwater COCs by conducting a sampling event since these chemicals exceed acceptable risk and hazard thresholds." ADEC concurs with the recommendations. However, if the source area ST041 is transferred from CERCLA to State oversight, there will likely be additions to the monitoring requirements [i.e. full list of PAHs analyzed either by SW8260 or SW8270-SIM, total lead, EDB, 1,2-DCA, petroleum-related VOCs, diesel range organics (DRO), gasoline range organics (GRO), residual range organics (RRO), total aqueous hydrocarbons (TAqH), in addition to total aromatic hydrocarbons (TAH)]. Soil in the 0 to 15 foot interval would need to be investigated as well. Section 5.2.5 Subsurface Soil Contamination of the 1995 OU2 ROD for ST41 states: " The RI effort did not investigate the presence of contamination in the upper 10 feet of soil with the exception of surface soil sampling." If the site is not transferred to State oversight, then once ROD cleanup levels are achieved and the site is closed out under CERCLA, ADEC would require further monitoring of groundwater as a State petroleum contaminated site for those contaminants (regardless if a ROD COC or not) that exceed current cleanup levels as listed in 18 AAC 75 Table C (currently amended as of October 27, 2018).	consider transferring ST041 out of CERCLA oversight to State oversight (18 AAC 75) as soon as possible." **Agree:** Additional soil investigation recommended.
19.	28	5.4.2	**Data Review** The text states: "All historical data available in ERPIMS for ST041 (18 September 1991 through 13 September 2016) were reviewed to support a technical assessment of chemical-specific toxicity changes since the ROD was signed." Historical data was available after September 13, 2016. The final Supplemental Site Characterization Report ST041 – Four-Million Gallon Hill (June 2018) was available for this review and should have been included.	**Agree:** Toluene will be added to Table 5-5 with recent sample result.

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			ADEC would add that the review should look at potential contaminants of concern that were dropped during the RI stage due to not having an applicable cleanup level at the time (and now there is a promulgated cleanup level) or were dropped during data review due to not exceeding a cleanup level or risk based screening level at the time (and now the cleanup level is more stringent due to more recent toxicity data). For example, the maximum detection at ST20 for ethylbenzene at 210 µg/L[9] and the cleanup level used during the RI[10] was 700 µg/L. This is above the current level of 15 µg/L (18 AAC 75 Table C October 27, 2018) which is based on 10^{-5} risk. Xylenes were detected at ST20 at a maximum concentration of 1,000 µg/L and the cleanup level used during the RI was 10,000 µg/L. This is above the current level of 190 µg/L (18 AAC 75 Table C October 27, 2018). Using just ethylbenzne and xylenes in groundwater and the ADEC online cumulative risk calculator reveals a total hazard index of 5 (rounded to closest single digit from 5.44) and a carcinogenic risk of 1.4×10^{-4} which is greater than ADEC's acceptable risk level of 1×10^{-5}. Maximum detections in groundwater (18 AAC 75 Table C October 27 2018) greater than Table 5-5. <u>Well ST41-16</u>[11] Toluene 5,780 µg/L (1,100 µg/L)	**Agree**: Table 5-5 list COPCs that were investigated, but did not require a ROD cleanup level. **Disagree:** ST020 is not included in this FYR
20.	29	5.5.2	**Question B – Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?**	

[9] Table 5-4 Summary of Constituents Detected in Groundwater at ST20 (OU2 ROD March 1995)
[10] Table 4.3.1–1 Operable Unit 2 - Source Area ST20 - Fall 1990 Organic Analytical Results For Groundwater Samples Elmendorf Air Force Base, Alaska
[11] ST041 South Plume Site Map With Groundwater Analytical Data Fig. 5 (ST041 Supplemental Site Characterization Report June 2018).

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			Changes in Standards The text states: "All available ERPIMS data for ST041 were evaluated against the new ADEC standards. Calculations were performed for chemicals with detections above the new standards to determine exposure risk (Appendix F, Tables F-1 through F-3). These calculations, based on maximum site concentrations and the residential exposure assumption, result in noncancer HQs ranging from 2.4 to 2,200 and cancer risks ranging from 4.0×10^{-4} to 6.6×10^{-2}." Please recalculate risk including the more recent toluene groundwater concentration from the ST041 Supplemental Site Characterization Report (June 2018).	**Agree:** Table 5-5 has had column titles modified to clarify that the hazard risk values were calculated for chemicals where standards have been revised (tightened) but for screening purposes only historic high values were used. These do not represent the current values that a HHRA would develop.
21.			**Operable Unit 4**	
22.	37	Table 6-2	**FT023 Remedy Status** **Status** The text states: "Soils meet cleanup levels at all OU4 sites" ADEC requests the text state: "Soils meet ROD cleanup levels at all OU4 sites."	**Agree:** 'ROD' added to sentence, as suggested.
23.	38	6.2.3	**Status of Implementation**	

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			Add text: "In 2016, a Site Inspection of Aqueous Film Forming Foam areas was conducted at JBER, which included source area FT023. No soil samples were taken to sample for PFAS at FT023. However, samples obtained from monitoring well FP-56 did not detect PFOS in groundwater and PFOA was detected below the EPA HA and ADEC cleanup level. "	**Disagree:** The emerging contaminants PFOA and PFOS are not included in this FYR, however will be in future see Comment #1.
24.	42, 43, and 44	6.5.1	**Page 42** **Question A – Is the remedy functioning as intended by the decision documents?** The text states: "The selected remedy for soils at FT023 included LUCs, bioventing to treat contamination in deep soils, and periodic monitoring of shallow and deep soils, as long as contamination remains above cleanup levels. Both shallow and deep soils have met cleanup levels at all OU4 sites." PFAS in soils has not been investigated at this source area and bioventing is not the recommended action for remediation for PFAS. Restate text as follows: "The selected remedy for soils at FT023 included LUCs, bioventing to treat contamination in deep soils, and periodic monitoring of shallow and deep soils, as long as contamination remains above cleanup levels. Both shallow and deep soils have met ROD cleanup levels at all OU4 sites." **Page 43** **Changes in Standards** The text states: "It is recommended that ethylbenzene, total xylenes, 1,1,2-TCA, and naphthalene be investigated for potential inclusion as groundwater COCs, and that MNA be continued at the site." Restate text: "It is recommended that ethylbenzene, total xylenes, 1,1,2-TCA, and naphthalene be investigated for potential inclusion as groundwater COCs, PFAS for soil COCs and that MNA be continued at the site."	**Disagree:** PFAS is not part of the selected remedy, but is included in Question C for information that could affect future protectiveness. **Agree:** 'ROD' added to sentence, as suggested. **Disagree:** PFAS not added in this sentence but at a site wide, see comment #1.

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
			Page 43 and 44 The text states: "The 2014 LSI recommended conducting additional work in order to better delineate the extent of the chlorinated solvent contamination by collecting soil samples and installing a downgradient monitoring well. Since, based on maximum site concentrations, chemicals in soil have calculated risks and hazards which exceed thresholds, this FYR supports these recommendations of additional soil investigation. The soil investigation should also include analysis for total xylenes, cis-1,2-DCE, and TCE." ADEC requests the all recommendations be implemented and AFCEC is requested to install the downgradient monitoring well and add PFAS contaminants to full suite analysis of VOCs in groundwater for source area FT023.	**Agree:** No change to text
25.	44	6.5.3	**Question C – Has any other information come to light that could call into question the protectiveness of the remedy?** "Yes. FT023 was included in a 2016 JBER-wide investigation into the presence or absence of PFOS/PFOA (ADEC, 2018a). Final conclusions from the investigation were unavailable at the time of this FYR; however, data available in ERPIMS indicate that maximum detections were below ADEC cleanup levels. Maximum detected concentrations of PFOS and PFOA in groundwater were non-detect and 0.03 µg/L, respectively (ADEC cleanup level of 0.4 µg/L for both compounds)." Also state in this section that the investigation of FT023 did not include any soil samples for PFAS. This is a data gap.	**Agree**: This paragraph has been amended to highlight that PFAS is not included in this FYR but could affect protectiveness.
26.	48	7.2.1	**Basis for Taking Action** **Remedy Components** The text states: "The OU4 ROD-selected remedy included natural attenuation and LUCs for groundwater contamination (USAF, 1995b)."	

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
			ADEC interprets the phrase "natural attenuation" and "intrinsic remediation" to mean the degradation of tetrachloroethylene and trichloroethylene into daughter products [e.g. cis-1-2-dichloroethylene (cis-1,2-DCE, trans-1,2-dichloroethylene (trans-1,2-DCE), 1,1-dichloroethelene (1,1-DCE) and vinyl chloride to carbon dioxide] which should also be monitored and reported to demonstrate any attenuation or remediation is occurring. There are other processes such as volatilization and dispersion which contribute to any observed decreases in chemical concentration, but this does not negate the need to analyze and report for any biodegradation daughter products that may be occurring in groundwater at OU4.	**Disagree:** These are not COCs identified in the OU4 ROD for SD029. The USAF monitors for and reports the COCs in the ROD.
27.	49	Table 7-2	**SD029 Remedy Status** **Groundwater** **Remedy Component** There should be an entry for "All groundwater is expected to be cleaned up within 13 years" like there is in the previous Table 6-2 FT023 Remedy Status. **Status** There should be an entry for "The 13-year timeframe was not achieved; groundwater concentrations remain above ROD cleanup levels."	**Agree:** Added to Table 6-2. For FT023 (OU4).
28.	51	7.4.2	**Data Review** The text states: "All historical data available in ERPIMS (31 May 2001 through 27 September 2016) were reviewed to support a technical assessment of chemical-specific toxicity changes at SD029 since the ROD was signed. See Section 7.5.2." The OU4 RI Report states: "Chronic RfD values were not available for benzo(a)anthracene, benzo-(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, alpha-BHC, delta-BHC, chrysene, cobalt, 1,3-dichlorobenzene, 2-chloroethyl vinyl ether, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene benzene, chloromethane, OCDD, PCB-	

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
			1260, 1,1,2,2-tetrachloroethane, 4,4'-DDD,3,3-dichlorobenzidine, 1,2-dichloroethane, or vinyl chloride" Please ensure that the review covered those chemicals which were not included in the toxicity review during the RI are in the Five-Year Review. See Table 6-5 "Contaminants of Potential Concern in Soil Evaluated in the OU 4 Risk Assessment contaminants that were "Not Evaluated due to Lack of Toxicity Data" (i.e. Footnote 2). There may be toxicity data for these contaminants since they were evaluated. These contaminants need to be reviewed for any toxicity changes that may have occurred since the September 1995 ROD was signed.	**Agree:** Where sampling data for the listed chemicals was available on ERPIMS it was included in table F1 -F3 as part of the Risk Evaluation. **Agree:** Table 7-4 presents 'SD029 Risk/Hazard Estimates for Chemicals Above Revised ADEC Standards', have been revised to show both ROD clean up level and 2017 ADEC clean up level
29.	61	Table 8-2	**ST037 Remedy Status** **Remedy Component** The text states: "Groundwater will be monitored to estimate the rate of natural attenuation, to provide an early warning of potential offsite contaminant migration, and to ensure protection of human health and the environment." Please add text in this table as a new entry consistent with SD029 Remedy Status for achieving cleanup levels in groundwater (i.e. All groundwater is expected to be cleaned up within thirteen years.)	**Agree:** No timeline was established in the OU ROD or subsequent reports. Groundwater cleanup timelines should be reestablished using groundwater modeling. A recommendation was added to the following sections: 5.6, 6.6, 7.6, 11.6, and 13.5 to reestablish groundwater

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
				cleanup timelines using modeling,
30.			**Operable Unit 6**	
31.	88	9.6	**LF002** **Issues and Recommendations** The text states: "Cancer risks exceed 1 x 10^{-4} or noncancer HQs are greater than 1 for the following non-COC chemicals: (in groundwater) benzene, ethylbenzene, naphthalene, TCE, vanadium, and total xylenes; and (in soil) ethylbenzene, naphthalene, thallium, and TCE. Since LUCs will remain in place indefinitely, the protectiveness of the remedy is not affected; however, groundwater, surface water (seep), and soil sampling should be conducted for these chemicals in order to assess current concentrations." Please add text stating that land use controls are in place at LF002 for soil and groundwater indefinitely. As a "restricted use area" this designation provides for recreational use of the parcel (e.g., cross-country skiing) and for construction of unmanned facilities, such as a parking lot, storage building, or taxiway, but prohibits the construction of any sort of manned facility, such as an office building or a residence.	**Agree**: Requested text has been added to report.
32.	113	11.6	**LF004** **Issues and Recommendations** The text states: • "The 2014 FYR recommended investigation for the presence of 1,4-dioxane in conjunction with TCE contamination at the site. A 1,4-dioxane investigation was conducted at JBER in 2017; however, no samples were collected at LF004. Risk and hazard calculations performed as part of this FYR resulted in a noncancer HQ for TCE in groundwater greater than 1, and it is recommended in this FYR that TCE be investigated for potential inclusion as a	**Agree:** This recommendation has changes, and sampling at LF004 and it was determined that 1,4-

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
			remedy COC. It is recommended that 1,4-dioxane in groundwater be assessed at LF004 to address the 2014 recommendation." Please elaborate more on why this is not included as an issue affecting protectiveness.	dioxane did not need to be evaluated. The explanation has been added to Table 11-3
33.	128	12.6	**SD015** **Issues and Recommendations** The text states: "The 2014 FYR recommended investigation for the presence of 1,4-dioxane in conjunction with TCE contamination at the site. A 1,4-dioxane investigation was conducted at JBER in 2017; however, no samples were collected at SD015. It is recommended that 1,4-dioxane in groundwater be assessed at SD015 to address the 2014 recommendation." Please elaborate more on why this is not included as an issue affecting protectiveness.	**Agree:** This issue has been added Issues and recommendation that affect protectiveness (see comment #8).

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EPA Comments: Draft Fifth Five Year Review Report for CERCLA Sites, Joint Base Elmendorf, Alaska, January 2019

Number	Page	Section	Comment	Response to Comment
Originally distributed on 1/14/19 for review. Due to partial government shutdown, document received by EPA for review on 1/28/19. EPA comments submitted on March 11, 2019 and include those of the EPA R10 senior policy advisor, legal counsel, primary JBER RPM and EPA R10 CERCLA management. Risk assessors reviewed Appendix F for the updates toxicity and risk evaluation. EPA FFRRO office contributed to the discussion for national consistency on Five Year Review issues, including PFAS and protectiveness determinations. EPA provides a letter to Congress on the Five Year Review. EPA's letter was based on the draft Fifth Five Year Review and was signed by March 17, 2019.				
General Comments				
1.		OU 1 Protectiveness Determination/Statement	Short-Term Protective. The EPA disagrees with the AF's determination that the remedy at OU1 is protective. The EPA determines that the remedy at OU 1 (Sites LF059, LF005, LF007, LF013) currently protects human health and the environment because Land Use Controls restrict access to groundwater and subsurface debris, and residential use of the site is not permitted. However, for the remedy to be protective in the long term, further investigation into the source and extent of groundwater contamination within OU1 must occur.	**Agree.** Protectiveness changed to Short-Term Protective. Groundwater plumes designated as CG703 and CG704 were agreed to be incorporated into the OU1 ROD by a ROD amendment and/or ESD.
2.		OU 2 Protectiveness Determination/Statement	Short-Term Protective. The EPA concurs that the remedy for OU 2, site ST041 (4 Million Gallon Hill) currently protects human health and the environment because Land Use Controls are preventing exposure to contaminated groundwater and soil. However, for the remedy to be protective in the long term, alternative remedies should be	**Agree:** A contingent remedy has been evaluated in the ST041 supplemental Site Characterization Report (USAF, 2018d). The recommendation will now state 'The contingent remedy should be determined if appropriate for implementation. Additionally, OU2 is recommended for transfer to State

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			evaluated, including the contingent remedy that was developed in the ROD. Groundwater contaminants at site ST041 are showing decreasing trends, but the levels will not meet cleanup goals within the 21-year timeframe (by 2016) as specified in the ROD for OU2.	oversight and removal from the CERCLA FFA based on the Petroleum Exclusion Rule.
3.		OU 3 Protectiveness Determination/Statement	Short Term Protective. The AF did not include OU3 in the FYR. The EPA concludes that OU3 should be evaluated in the FYR because PFAS contamination is present at levels that do not allow for UU/UE. The EPA determines that the remedy for OU 3, site SD052 (Cherry Hill Ditch) currently protects human health and the environment because Land Use Controls are preventing exposure to contaminated groundwater and soil. However, for the remedy to be protective in the long term, the EPA requires additional PFAS investigation at Cherry Hill Ditch	**Agreed:** Language added to Changes in Issues since 2014 FYR to recognize that PFOS/PFOA has been detected in Cherry Hill Ditch SD052.
4.		OU 4 Protectiveness Determination/Statement	Short-Term Protective. The EPA concurs that the remedy for OU 4, sites SD029 and FT023 currently protects human health and the environment because Land Use Controls are preventing exposure to contaminated groundwater and soil. However, for the remedy to be protective in the long term, additional studies should be conducted at SD029 to optimize remediation goals and assess current conditions of chemicals with risk and hazard exceedances.	**Agree:** OU4 is short term protective. No change to text

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5.	OU 5 Protectiveness Determination/Statement		Short-Term Protective. The EPA concurs that the remedy for OU 5 (site ST037, Slammer Plume, and the Western ST037 Plume). currently protects human health and the environment because Land Use Controls are preventing human exposure to contaminated groundwater at the site. However, for the remedy to be protective in the long term, further investigation and delineation of the contaminated groundwater plumes and seeps should be conducted	**Agree:** OU5 is short term Protective, No change to text
6.	OU 6 Protectiveness Determination/Statement		Short-Term Protective**.** The EPA concurs that the remedy for OU 6 (sites LF002, LF003, LF004, WP014, and SD014) currently protects human health and the environment because Land Use Controls are preventing exposure to contaminated groundwater and soil. However, for the remedy to be protective in the long term, alternative remedies should be evaluated under the process established in the FFA to accelerate attainment of cleanup levels in groundwater at OU6. Groundwater contaminants at sites LF004 South, WP014, and SD015 do not consistently exhibit decreasing trends, and the levels will not meet cleanup goals by 2020 as specified in the ROD.	**Agree:** OU6 is short Term Protective, No change to text
7.	OU 9 (DP098) Protectiveness Determination/Statement		Short-Term Protective**.** EPA tracks AF site designation DP098 as OU 9.	**Agreed:** USAF concurs with this management approach.

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			The EPA disagrees with the AF's determination that the remedy at OU 9 (DP098) is protective. The EPA determines that the remedy for OU 9 (Site DP098) currently protects human health and the environment because Land Use Controls are preventing exposure to contaminated groundwater and soil. However, for the remedy to be protective in the long term, additional investigation on source area control and plume stability should be conducted.	**Agree**: DP098 changed to Short-Term protective, with the plume migration added to the issue, and recommendation of additional technology.
8.	2016 PFAS investigation results		The Air Force has not consistently included the new information obtained from the *Site Inspection Report for Aqueous Film Forming Foam Areas at Joint Base Elmendorf-Richardson, Alaska (SI AFFF)*, finalized in May 2018, in the remedy review of each Operable Unit (OU). The SI AFFF report provides absence/presence results for PFOA and PFOS at 26 Areas of Concern across JBER. Specifically, sites within OU 3, OU4, OU 5, and OU6 were sampled for PFOA/PFOS. OU 1 Landfills were not included in the site investigation effort and are a data gap. EPA comments and letter reflect the results from the SI AFFF report for each OU. The Draft 5YR states (Introduction, pg 2) that 'data acquired through July 2018' was included in the report; therefore the PFAS data should be consistently	**Agree:** The USAF will remove PFOS/PFOA sample results from OU4 (FT023) from this Five-Year Review. Language added to Executive summary and Section I – as follows: "Perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) have been detected in groundwater at several JBER-E locations and at sites within OU3, OU4, OU5, and OU6 (USAF, 2018e). These sites will be addressed through ongoing and future expanded site inspection or remedial investigation, in accordance with the CERCLA process. Future investigation may also include the OU1 Landfill sites" "OU3 (including sites SD016, SS021, SD031, SD052 and SA100) was previously closed

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			incorporated and discussed for each OU as appropriate.	having achieved UU/UE status and was not reviewed under this FYR. The contaminant of concern (COC), polychlorinated biphenyls (PCBs), was below the ROD cleanup levels. Under the 2018 Site Inspection (USAF, 2018e), PFOS/PFOA is detected above the EPA drinking water lifetime health advisory levels in surface water located in the Cherry Hill Ditch (SD052), which is within the geographic boundary of OU3. Although surface water in Cherry Hill Ditch is not a known drinking water source, out of an abundance of caution, an interim LUC advising people to avoid contact with the water is recommended until a risk assessment can determine the level of risk to human health. Additional investigation at OU3 Cherry Hill Ditch will occur in the future."
			Strike the note in Section 3.1 Site Interviews that describes PFAS sampling data was not available in time for this review.	**Agree:** Comment removed.
			EPA concluded the protectiveness determinations for OUs at JBER in areas with PFAS above EPA Health Advisories or State of Alaska cleanup levels is short term protective. Prohibition on the use of groundwater as a source of drinking water on JBER prevents exposure through this risk scenario.	**Agree:** See Response to PFOS/PFOA above in Comment #8.

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			Add an Issue for applicable sites in OUs 3,4,5, and 6 that PFAS is present at levels exceeding EPA Health Advisories and/or State of Alaska cleanup levels. This issue affects future protectiveness. Add a recommendation for applicable sites in OUs 3,4,5,6 for further characterization of PFAS, and add a recommendation in OU 1 for initial characterization of PFAS.	**Agree:** See Response to PFOS/PFOA above in Comment #8. **Agree:** See Response to PFOS/PFOA in Comment #8 above.
9.	Updated Toxicity and Risk Evaluation		Throughout the Draft 5YR, the updated toxicity and risk evaluation is unclear. EPA will not make specific comments on the new potential COCs at an OU until the risk evaluation process is better defined. Appendix F does not indicate if risk-based screening levels and toxicity criteria have been established for any detected compounds that were not evaluated in the original Human Health Risk Assessments (HHRAs) due to the absence of toxicity information. Appendix F of the Draft FYR Report should document those compounds and indicate whether inclusion of	**Agree:** The Risk/Hazard Estimates will be recalculated based on only on data that was collected in the past 5 years, beginning January 2013. If a compound has had a regulatory change since the previous FYR (2014) and has not been sampled within the previous five years (2013), this will be noted as a data gap, and a Risk/Hazard estimate will not be calculated, even if previous data, prior to 2013, exists for that compound. **Agree:** Risk and hazard estimates have been recalculated are presented in Tables F-3 were compared to the U.S. Environmental Protection Agency (EPA) management decision risk range of 1 × 10-6 to 1 × 10-4 for carcinogens, and hazard quotient criterion of 1 for noncarcinogens. The chemicals identified in Appendix F3 for further investigation are then listed in section x.5.2. Table x-5 has been

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			the additional detected compounds potentially impacts the protectiveness of the remedy. Also, Appendix F should clarify if such compounds should be added to the list of current contaminants of concern (COCs) on the basis of new toxicity information. If new compounds are included, the Draft FYR Report should demonstrate that the remedy remains protective, even when the additional compounds are considered. Revise Appendix F of the Draft FYR Report to indicate if risk-based screening levels and toxicity criteria have been established for any detected compounds that were not evaluated in the original HHRA. Please also revise Appendix F of the Draft FYR Report to clarify if such compounds should be added to the list of current COCs. Lastly, if new compounds are included, please revise the Draft FYR Report to demonstrate that the remedy remains protective.	modified to list chemicals which currently have ROD cleanup levels. **Agree**: Appendix F3 identifies those chemicals that could be considered COPCs for the site, protectiveness is discussed in the discussion of Question B. Samples used for this analysis are from various locations and of differing age so should only be used for screening purposes. **Agree**: As discussed above, Table x-5 has been modified to clarify which chemicals require further investigation.
10.	All Tables for Question B Risk/Hazard Estimates for Chemical Above New Standards		The presentation of the information in these tables is confusing. The cleanup level should be identified as the concentration selected in the ROD. Newly promulgated Alaska standards are not the cleanup level. Present both the ROD cleanup levels and the Alaska standards in the table, and clarify if the risk levels are a	**Agree:** The tables and headings have been modified to clearly identify ROD cleanup levels and revised ADEC cleanup levels. The risk levels are now only stated in the Appendix F.

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			comparison to the Alaska standard or the ROD cleanup level.	
11.		Data to support remedy evaluation	Data used to support the technical assessment should be presented in the FYR. Generally the data review appears to be included in the 'Status of Implementation' section. A sentence should be added to each Data Review section pointing back to the specific section where the data is summarized. Example section 11.4.2 Data Review would refer back to section 11.2.3 Status of Implementation for the summary of data since the last Five Year Review. The report contains figures with data but there is no reference to figures in the Data Review or Status of Implementation sections. Please include references to the data figures or summarize the data used to support remedy evaluation for each OU and site.	**Agree:** References to the sources of data is in section x.4.2 Data Review. "A summary of data since the 2014 FYR is presented in Section x.2.3". **Agree:** A sentence was added to the end of the first paragraph in x.4.2 as follows "Data is presented in Figure x-1" in each section.
12.		Issues and Recommendations	Issues and recommendations are discussed several times in the FYR. Ensure that the discussion is consistent in all the places discussed for an OU/site from the Executive Summary, Summary Tables, and the individual sections in the OU sections. For any Issue /Recommendation which may change COCs or change a remedy, ensure that the recommendation includes to document the change (COC, remedy) in a decision document.	**Agree:** Text was revised to ensure discussion of issues and recommendations are consistent in the sections of the report and the executive summary. **Agree**: Where missing, the following text will be added to the recommendation table: "Document any changes to COCs in a modification to the decision document."

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			This is presented inconsistently in the Issues and Recommendations Table (examples of where it needs to be added for potential COC includes OU 6 Site WP014; OU DP098). If additional studies to optimize the approach in meeting remediation goals result in a recommendation to change the remedy in the ROD, these should also be documented in a decision document. (Examples include OU4 FT023, OU4 SD029, OU 5 ST037, OU 6 LF004, OU6 SD015, OU6 WP014).	**Agree:** Where a change is required to a ROD, text will be added that it will be documented in a modification to the decision document.
13.		Soil LUCs	OU2 and OU5 contain recommendations to codify soil LUCs to prevent exposure at the sites. Explain how the remedy is currently protective even though soil LUCs are not in place. It may be rationalized that no one is currently using the site per the residential risk scenario on which the ADEC levels are based. If human health exposure is a risk from contaminated surface soils, provide justification for how a 'no soil disturbance LUC' is protective. Are additional physical barriers necessary in that case?	**Agree:** The issue/recommendation for institutional controls was changed for OU2 and OU5. The subsurface soil with the COPCs is currently protective with existing controls, the text will be revised to 'no site-specific soil LUC is in place, however base wide dig permits restrict access to this area.'
14.		Air Force Use of Sites instead of Operable Units	The Air Force increasingly is using site designations instead of Operable Units for Records of Decision that are signed post-2000 era. EPA Superfund Enterprise Management System (SEMS) requires an Operable Unit designation. For this reason, EPA will assign	**Agree:** Once remedies are selected for CG703 and CG704 in a ROD Amendment and/or ESD to the OU1 ROD, those remedies will be evaluated in a future Five-Year Review under OU1.

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			Operable Units to the Air Force site designation for tracking purposes. Creation of new sites, sometimes within the land use boundary of an OU (example CG703 and CG704 at the OU1 landfill complex) complicates the protectiveness determination for the OU.	
15.	OU 1		Figure 4-2 identifies the CG703 North Plume and CG704 South Plume as "Estimated OU 1 North Groundwater (Solvent) Plume" and "Estimated OU 1 South Groundwater (Solvent) Plume" respectively. This figure illustrates the difficulty in accepting the protective determination for OU1 when there is clearly information missing about plume boundaries and source areas with the two new sites CG703 and CG704 that are under investigation.	**Agree**: The names of the groundwater plumes in Figure 4-2 were changed to "CG703 Plume" and "CG704 Plume".
16.	OU 3		List OU3. State that some OUs and sites are not included because they are UU/UE. The OU 3 discussion should include 'new information' regarding the detection of PFOA/PFOS in surface and groundwater in multiple locations at OU 3 SD052 Cherry Hill Ditch. The recommendation should include additional PFAS sampling and characterization at the site.	**Agree:** See response to Comment #3.
17.	Date of the next Five Year Review		In various locations in the document, the Air Force states the next Five Year Review will be conducted five years after the Air Force signature date on this fifth Five Year Review.	**Agree:** Text has been removed from Page 1.

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			To be consistent with EPA's August 1, 2011 memorandum "Program Priorities for Federal Facility Five-Year Reviews", the Five-Year Review Guidance Section 1.3 3 has been superseded and the future Five-Year Review will not change if the reports are early or late. The due date for the sixth Five-Year Review is March 17, 2024. Strike the following sentence on page 1 " Per Defense Environmental Restoration program manual 4715.20, subsequent FYRs shall be signed by the responsible USAF official no later than 5 years after the signature date of the previous FYR report. Please change the due date on page 159 and other locations where it may occur as a vague due date document to March 17, 2024.	**Agree:** Text has been modified on Page 159 to clarify due date of the next FYR as March 17, 2024.
18.	All	Protectiveness Statements Form	If the protectiveness determination is Short Term Protective, a planned addendum completion date is unnecessary. Please delete the planned addendum date for the short term protective OUs. An Addendum is needed only if the protectiveness determination is "protectiveness deferred".	**Agree:** Planned Addendum Completion Dates were changed to 'Not Applicable' for Short-term Protective sites (OU2, OU4, OU5, OU6) on the table of Protectiveness Statements in the Executive Summary.
19.	All	Protectiveness Statements Form	Many of the protectiveness statements include actions to re-evaluate COCs and/or add Land Use Controls to the OU. Any changes to the remedy, COCs or LUCs should be documented in a decision document. Please state that any changes made to the original remedy, including the addition of COCs or LUCs, will be documented in a decision document.	**Agree**: The following statement was added to the table of Protectiveness Statements in the Executive summary for OU2, OU4, OU5, and OU6: "Any changes made to the original remedy, including the addition of COCs or LUCs, will be documented in a decision document."

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20.		Question B	Is it worth bringing information from the vapor intrusion study (2018) into the exposure pathway discussion on relevant OUs?	**Agree**: The information for the VI studies has already been incorporated into the relevant sites covered in this FYR: OU4-FT023, OU4-SD029, OU5-ST037 and DP098.
21.		Question C	The SI AFFF report (2018) should be included as 'new information' for the relevant OUs. EPA considers OU 1 as a data gap for PFAS as no wells associated with the OU 1 landfills were sampled during the 2016 PFAS Site Assessment.	**Agree**: See response to Comment #8.
22.		EPA Interview form	EPA provided a revised interview form to the AF on 2/9/2018 (see attached email pdf and questionnaire pdf). Please replace the interview form with the 2/9/2018 version.	**Agree:** Interview form has been replaced in Appendix C.
23.	ES-1	Bullet list of ESD, RODAs, Memo to Site File	Add the interim Remedial Action Completion Reports for OU 4 SD024 and OU 4 SD028	**Agree:** The Interim Remedial Action Completion Reports for OU4-SD024 and OU4-SD028 were added as requested by reference under the Changes in Status since 2014 FYR heading.
24.	ES-4	Five Year Review Summary Form	Although a contractor can assist in writing a FYR, the "author affiliation" should be someone from the AF.	**Disagree**: Disagree the author is Stantec on behalf of Ellen Godden.
25.	ES-7	Issues and Recommendations	OU 1 – The OU 1 Landfills have not obtained UU/UE status and have two groundwater plumes under current investigation. Add an issue that affects future protectiveness: Investigation into the source and extent of groundwater contamination within OU1	**Agree:** See comment #1.

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			associated with AF designated sites CG703 and CG704.	
26.	ES-7	Issues and Recommendations	OU 2, Site ST041: The recommendation is for a soil LUC at ST041. The site cannot be short term protective if the issue affects current protectiveness. Either change the protectiveness to not protective, or change the affect current protectiveness to not protective. The soil COPCs are likely to change when the risk evaluation is revised.	**Agree:** See response to comment #13. There are no current COC in surface-soil but COPCs should be investigated in the subsurface soil. Protectiveness will be changed to Short Term Protective.
27.	ES-8	Issues and Recommendations	OU 4, SD029: Add a recommendation to investigate TCE as a COC since SS109 RI Report (June 2018) attributes all of the human health risk from TCE to the adjacent site SD029.	**Agree:** There is an issue/ recommendation already to conduct additional studies for the existing COCs (TCE and PCE) for SD029. This study should optimize the approach to achieve remediation goals and model the plume. This will identify if TCE contamination in the groundwater is impacting other sites.
28.	ES-9	Issues and Recommendations	OU 5, Site ST037: The recommendation is for a soil LUC at ST037. The site cannot be short term protective if the issue affects current protectiveness. Either change the protectiveness to not protective, or change the affect current protectiveness to not protective. The soil COPCs are likely to change when the risk evaluation is revised.	**Agree:** There are no current COC in surface-soil but COPCs should be investigated in the subsurface soil. Protectiveness should remain Short Term Protective. Any changes made to the original remedy, including the addition of COCs or LUCs, will be documented in a decision document.
29.	ES-12	Issues and Recommendations	OU 9 DP098: Add an issue TCE and cis-1,2-DCE are increasing at in concentration at the downgradient/leading edge of the plume in both groundwater and surface water. Add a recommendation to conduct additional	**Agree:** An additional issue and recommendation has been added that the groundwater plume should be investigated: 'The groundwater plume should be

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			characterization or studies to determine if source areas are controlled to restrict plume mobility.	investigated and modelled, and the plume boundary revised regularly.'
30.		Other Findings Not Affecting Protectiveness	Please add the OU designation along with each site designation.	**Agree:** Added the OU designation along with each site designation.
31.	ES-12	Other Findings Not Affecting Protectiveness	OU 1 LF059: Clarify why there is a finding that LUCs should remain in place? Were LUCs proposed to be removed?	**Agree:** LUCs were not proposed to be removed so the recommendation was unnecessary. Recommendation deleted.
32.	ES-13	Other Findings Not Affecting Protectiveness	OU 6 LF002: Clarify why cancer risks for non-COCs this site are not a recommendation that affects future protectiveness? Similar evaluation of other OUs for non-COCs with LUCs in place were added in the Recommendations table that affects future protectiveness.	**Agree:** The new COPCs require investigation and this could affect future protectiveness, and has been moved to the table
33.	ES-13	Other Findings Not Affecting Protectiveness	OU 6 LF004: Clarify why the sampling for 1,4-dioxane at this site is not a recommendation that affects future protectiveness.	**Agree:** The conclusion from the 2016 RA-OM Report stated that the LF004 South Plumes are monitored at one monitoring well (OU6MW-61 – installed in a perched aquifer) and one seep (LF04SP-02) as the groundwater plume has migrated past monitoring well OU6MW-63 and daylights at the seep. Monitoring well OU6MW-63 has been below cleanup levels for COCs (benzene, ethylbenzene, toluene and 1,2-DCA) since 2011. Groundwater samples collected at OU6MW-61 are analyzed for benzene, ethylbenzene, toluene and 1,2-DCA (1,2-DCA has been ND since 2011). Seep samples are

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				analyzed for benzene, ethylbenzene, toluene, TAH, TAqH, and 1,2-DCA at LF04SP-02 (1,2-DCA has been ND since 2014). Since 1,4-dioxane is typically associated with 1,1,1-TCA and the only other chlorinated solvent formerly in the area (1,2-DCA) is ND, it was determined that 1,4-dioxane did not need to be evaluated for these plumes (2016 Remedial Action-Operations and Monitoring for Selected CERCLA Sites Annual Report). This text was added to Table 11-3
34.	ES-13	Other Findings Not Affecting Protectiveness	OU 6 SD015: Clarify why the sampling for 1,4-dioxane at this site is not a recommendation that affects future protectiveness.	**Agree:** The new COPCs require investigation and this could affect future protectiveness, and has been moved to the table
35.	1 and 2	Introduction	For the list of "Other areas at JBER-E with a history of contamination that are not included in the FYR", be explicit if the sites have achieved UU/UE status. If they have not, they should be discussed in the FYR.	**Agree:** have added "have achieved UU/UE status" to those sites Table 1-1 added with all sites and their current status.
36.	2	Introduction	The lists of sites under investigation appears to be truncated. Include all sites at JBER-E that are included in the FFA under CERCLA investigation.	**Agree:** The list of sites under investigation now lists: SS022, SS109, SA110, SS116, CG703, CG704 and DA115
37.	2	Introduction	The lists of sites under state oversight appears to be truncated. Include all sites at JBER-E that are under state program oversight and clarify if they are exempt from CERCLA due to the petroleum exemption.	**Disagree**: A full list of state sites is not required in the CERCLA FYR.

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38.		3.0	The community notification should also notify the public of the expected completion date of the FYR and where the final report can be accessed.	**Agree:** The public notice announces the start of the consultation period. The Five-Year Review will be made available to the public and a fact sheet summarizing the results of the Five-Year Review for both JBER-E and JBER-R will be prepared and distributed to the community (email/mail) once the reviews have been completed.
39.	p. 7-8	4.2.1	The sentence about TCE, VC and EDB does not make sense as written. MCLs are risk-based so why would a risk assessment based on residential use come up with a higher number? Suggest to change the sentence to "Risks for TCE, VC, and EDB were identified based on MCLs…"	**Agree:** Sentence changed as suggested. 'Risks for TCE, VC, and EDB were identified based on maximum contaminant levels (MCLs) to comply with federal or state Applicable or Relevant and Appropriate Requirements (ARARs)'
40.		4.2.1	Clarify the land use that was used to eliminate lead as a COC. Would lead pose a risk under UU/UE conditions? Are LUCs needed for protectiveness?	**Agree:** have added that current land use designation is 'outdoor recreational use area'.
41.	9	4.2.2.	Cite a reference for removal of OU 1 landfills from the CERCLA program. As the landfills have not obtained UU/UE status, they should be evaluated in FYRs.	**Agree:** Reference (USAF, 2004a) added for 2004 Closure Report for LF sites
42.	15	4.5.1	Question A. This is the remedy review for OU 1, not just LF059. Please evaluate if the remedy is working as intended in light of the two groundwater plumes, CG703 and CG704, which have TCE, an OU 1 ROD COC, above remediation goals.	**Agree:** See response to Comment #1.

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43.		4.6	See earlier comments regarding EPA determination for short term protective at OU 1 due to undefined TCE groundwater plumes.	**Agree:** See response to Comment #1.
44.	21	5.5.2	The remedy component discussion mentions toluene above ROD goals, however benzene is 3 orders of magnitude above RAGs in well ST41-16. Include a discussion of benzene.	**Agree:** Eight groundwater COCs or COPCs (2-methylnaphthalene, benzene, ethylbenzene, naphthalene, toluene, thallium, vanadium, and total xylenes) are listed requiring further investigation. There is no specific discussion of benzene since only a small potential change in clean-up goal.
45.		Table 5-2	Remedy component free product recovery system. Although the recovery system was shut down in 1999, free product continues to be seen in monitoring wells ST41-68 and ST41-16 into 2016. Should this remedy component be re-evaluated?	**Agree:** Text in Section 5.6 first Issue and Recommendation states that the contingent remedy was reevaluated in the Supplemental Site Characterization Report (USAF 2018 This should be determined if appropriate for implementation. Groundwater cleanup timelines should be reestablished using groundwater modelling (See also comment #2)
46.	31	5.6	OU 2 Recommendations that do not affect protectiveness: consider adding a recommendation to transfer this site via an ESD from CERCLA to State of Alaska petroleum cleanup oversight. Contaminants at the site are the result of release of petroleum product, not waste oils or fuels, and therefore should be subject to the CERCLA petroleum exemption.	**Agree:** A recommendation will be added to transfer site under petroleum exclusion from CERCLA to State oversight. See also ADEC Comment #18.
47.	33	6.0	OU 4 Site SD027 Hangar 8 and SD024 Hangar 10 have PFAS greater than screening levels. AF designated site SS109 F22 WRS is in the	**Agree:** See comment #8.

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			Feasibility Study stage, overlaps in site boundary and attributes all risk to SD029. EPA requests the AF reopen the OU 4 ROD to re-evaluate the NFA and closure status of SD024 and SD027, respectively, and incorporate information from SS109 investigations to support further evaluation at SD029.	
48.		6.2.2	Why is the figure reference to the big overall map I-1 instead of Figure 7-1?	**Agree**: Figure reference changed to 7-1
49.	38 and 44	6.2.3 and 6.5.3	The second paragraph on page 38 contains a reference to the 2016 SI AFFF report and states the results were not available for incorporation in the report. Then in Section 6.5.3 Question C, the AF presents the data for FT023 from the SI AFFF report, thereby contradicting earlier statements the data was not available. The SI AFFF report was finalized in May 2018, within the period of time for document review in this 5YR, and the EPA letter incorporated the SI AFFF report in its remedy review as a part of Question C. See General Comment #8 regarding incorporation of the presence/absence results of the SI AFFF report into the document for all sites where it is applicable. Remove the contradictory language on page 38.	**Agree:** See response to comment #8. References to the report being unavailable were incorrect.
50.		6.6	Add a recommendation for further characterization of PFAS at FT023. Sample	**Agree:** See Response to Comment #8 regarding PFOS/PFOA recommendations.

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			results from an existing groundwater well may not be optimally placed to delineate source or downgradient concentrations, and no soil samples were obtained at FT023 during the 2016 sampling event.	
51.	55	7.5.3	Incorporate results from the adjacent site, SS109 (F-22 WEAPONS RELEASE SHOP) REMEDIAL INVESTIGATION AND HUMAN HEALTH RISK ASSESSMENT REPORT, FINAL JUNE 2018 into Question C. The FYR makes a recommendation to conduct further studies, and this should be adequate to encompass issues related to risk at adjacent site SS109.	**Disagree:** The results from SS109 RI will not be incorporated directly into this FYR as it does not have a finalized decision document and remains under investigation. A recommendation is made to conduct additional studies to optimize the approach to achieve remediation goals, since limited natural attenuation in the groundwater is occurring at OU4-SD029 and RAOs were not be achieved within the projected time frame. (see Section 7.6).
52.	66	8.2.3	EPA had not received a copy of the referenced report: *Data Compilation and Remedial Action Evaluation Report (USAF, 2017j)* until calling it to the AF attention during the FYR. EPA will review the report for the source area data gaps identified at OU 5 to focus any future investigations.	**Agree:** No change to text
53.		8.4.2 and 8.5.3	Include the results of the SI AFFF report in relation to OU 5. PFAS is present in locations co-located or in close proximity with the OU 5 groundwater plumes and seeps.	**Agree:** 8.5.3 Question C has had the following texted added “Yes. Sites within OU5 were included in a 2016 JBER-wide investigation into the presence or absence of PFOS/PFOA (USAF, 2018)”

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54.	74	8.5.2	Clarify the following sentence:" Additionally, the EPA's TCE industrial Indoor Air Response Action Levels were slightly exceeded during field screening events. LUCs currently in place restricting the use of groundwater from the shallow aquifer are preventing exposures, and the vapor intrusion study concluded that no risk or hazard thresholds were exceeded." If TCE Industrial Air Response actions were exceeded, how were no risk or hazard thresholds exceeded? The Air Response action levels are risk based. Additionally, LUCs prevent exposures to dermal or ingestion pathways not the vapor intrusion pathway.	**Agree:** sentence revised "Additionally, the EPA's TCE industrial Indoor Air Response Action Levels ~~were slightly~~ was exceeded during field screening ~~events~~ in Building 4230. ~~LUCs currently in place restricting the use of groundwater from the shallow aquifer are preventing exposures, and the vapor intrusion study concluded that no risk or hazard thresholds were exceeded~~. Further investigation suggested that a commercial product being used/stored in the trailer is the likely source to high TCE concentrations in the indoor air samples. The results of the VI study indicate that there is not a short-term risk from a VI source attributing to the concentrations in the trailers"
55.	101	11.2.2	LF004 Groundwater South, 3rd bullet: EPA recent groundwater guidance, *OSWER Directive 9283.1-44: Recommended Approach for Evaluating Completion of Groundwater Restoration Remedial Actions at a Groundwater Monitoring Well, August 2014,* recommends that completion of the attainment monitoring phase be based on two lines of evidence, in general, a more robust data set using a visual or statistical (trend test and mean test) evaluation is typically used to make the final attainment determination. Therefore, it is recommended that a minimum of eight data points normally be used for	**Disagree: (**4th Bullet) states the current agreed criteria "Groundwater monitoring will be discontinued if contaminant levels are below cleanup levels during two consecutive monitoring events, in which case, no further action for groundwater will be required." This is a condition agreed upon prior to signing the ROD with the understanding that this could be renegotiated once the USAF believes they have met the RAOs for this site (per the ROD)." This change can't be made without an amendment to the ROD, an ESD, or a memorandum to the site file.

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			analysis done during the attainment monitoring phase. If the data analysis demonstrates that the UCL on the mean contaminant value is at or below the COC cleanup level, it generally is appropriate to conclude that the COC cleanup level has been met. A trend analysis is recommended to provide additional support for concluding that future COC concentrations will remain at or below the COC cleanup level in the well. If both the UCL value is at or below the COC cleanup level and the time-dependent trend line has a zero or statistically significant negative slope, it may be appropriate to conclude that the attainment monitoring phase has been completed for the COC being evaluated. In an issue that does not affect protectiveness, EPA recommends a discussion on the path forward to change the ROD groundwater completion requirements from "2 samples below cleanup levels" to the more robust, statistically-derived attainment procedures outlined in the 2014 guidance.	
56.	101	11.2.2	The following bullet for North LF004 states: • Removal of fallen debris from LF004 is expected to continue once every 3 years for 30 years, or as long as the landfill remains, subject to erosional action by tides. FYRs will assess the protectiveness of the remedial action,	

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			including an evaluation of any changed site conditions. In the event of a significant weather or seismic event, inspection and/or collection activities may occur more frequently than the 3-year schedule. Not an issue to be addressed during this FYR, but the planned debris survey in summer 2019 should satisfy both the time interval and the impact following a significant seismic event.	**Agree.** No change to text
57.	105	11.2.3	Revisit and clarify this sentence: "Evaluation of MNA parameters in Monitoring Wells OU6MW-61 and OU6MW-67 in 2015 did not indicate a strong reducing, anaerobic environment (USAF, 2017b)." As the main contaminant is benzene, it degrades best in an aerobic environment (in the presence of oxygen).	**Agree:** The reference stated is correct, however to avoid confusion paragraph will be deleted.
58.	112	11.5.3	Question C: mention LF004 seeps with PFAS	**Agree**: Text changed to "Yes. Sites within OU 6 LF004 were included in a 2016 JBER-wide investigation into the presence or absence of PFOS/PFOA (USAF, 2018)".
59.	127	12.5.2	Is a site specific soil LUC necessary if postwide soil disturbance prohibitions are in effect?	**Agree**: Sentence recommending LUC be implemented changed to state 'that base wide soil disturbance controls exist', requirement for site-specific ones has been deleted.
60.		Figure 12-1	Why isn't there a downgradient well at SD015? Well OU6MW-18 was abandoned with the last sample result in June 2010 above TCE cleanup goals.	**Disagree:** Contaminated groundwater at SD015 is thought to be in a perched aquifer; therefore, all other wells previously installed at SD015 have been abandoned in place.

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61.		Table 13-2	WP014 Remedy Status describes 2 consecutive samples below cleanup level will result in no further action. See comment #55.	**Disagree:** (see Response to Comment #55). This is the agreed cleanup requirements.
62.	142	14.2.1	Is the following statement still true using the updated TCE risk values? "TCE is not a concern for wetland surface water or sediment, because the RME cumulative cancer risk and noncancer HI were below the EPA and ADEC target health goals (USAF, 2004)."	**Agree**: The statement referenced is still true. This section '14.2.1 Basis for Taking Action' is the original basis for taking action at DP098 as agreed in the ROD. However, as no data within the previous 5 years is available for soil or sediment, the calculation of risk will be removed from Table 14-5. TCE and cis 1,2-dichloroethylene (DCE) will be listed as a data gap with regards to changes incleanup levels since the previous FYR. Additionally, there was a historical soil removal completed in 2005 as stated in 14.2.2 - **"**Source material removal was limited to soil within a 25-foot radius of historical soil Boring DP098-SB01, where the greatest TCE concentrations were detected, adjacent to the end of the drain tile northwest of Building 18224."
63.	142	14.2.1	Why is the reference for this VI exposure scenario a 2004 report? If the recent VI study information is used, it should be referenced. "However, recent air sampling conducted in Building 18224 identified no significant health risk to personnel based on the building's current usage. If the use of Building 18224 increases in the future, additional air sampling	**Disagree:** This section '14.2.1 Basis for Taking Action' is the original basis for taking action at DP098. Section 14.2.3 Status of Implementation, refers to the more recent VI studies at this building (Reference: USAF, 2018b) in the 1st paragraph on Page 151).

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			may be required to ensure that levels of indoor air remain safe for building occupants (USAF, 2004)."	
64.	146	14.2.2	Bullet regarding 2 samples below groundwater cleanup threshold: see comment #55	**Disagree:** (see Response to Comment #55). This is the agreed cleanup requirements.
65.	155	14.4.3	The demo of the "elephant cage" is scheduled to happen, as was the demo of a staircase at DP98. Was any soil disturbed in these activities and if so, was it sampled and/or shipped out of state?	**Agree:** Only the antenna array (elephant cage) is scheduled to be removed. The removal of the concrete pad and disturbance of the soil is not planned.
66.	159	III	The Air Force has expressed desire to combine the FYR reports for Fort Richardson and Elmendorf AFB into one FYR. JBER can sync the two 5YRs but would have to meet the Fort Richardson schedule of 2/22/2023, pushing the Elmendorf deadline up by at least a year.	**Agree:** Attempting to coordinate timelines of FYRs continues to be an AF objective.
67.		Figure I-2	The OU 1 Landfill LUC boundaries should be included on the map. The landfills have not met UU/UE criteria and should be evaluated in the FYR.	**Agree**: The OU1 LUC boundaries as shown on Figure I-2. LF059 is the only site in OU1 included in this FYR.
68.		Figure 4-2	This figure illustrates the difficulty in accepting the protective determination for OU1 when there is clearly information missing about plume boundaries and source areas with the two new sites under investigation labeled as Estimated OU 1 North Solvent Groundwater Plume (CG703) and Estimated OU 1 South Solvent Groundwater Plume (CG704).	**Agree:** The ground water plumes being investigated are associated with sites CG703 and CG704. See comment #1 regarding adding these sites to OU1 by ROD amendment and/or ESD.

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69.		Figure 5-1	The narrative for ST041 doesn't mention the benzene above cleanup levels as shown by the data in this figure.	**Agree:**. Benzene is shown on the figure above cleanup levels (highlighted in red) and discussed in section 5.5.1 that COCs (Benzene not mentioned specifically) remain above ROD cleanup levels. The LTM sample results have also been added to Table 5-5.
70.		Figure 6-1	Define what the grey shading represents. GW contours should be updated. It is theorized that the SD029 groundwater may move to the NE as reported in the SS109 RI.	**Agree:** This figure has been updated and replaced and definitively shows the LUC boundary in dashed black and white outline. The grey shading has been removed. The groundwater flow direction remains the same in a southwesterly direction.
71.		Figure 7-1	Clarify how the inferred groundwater plume boundary is estimated with only one well to delineate concentration?	**Agree** The figure shows the current plume boundary as derived in previous study (and reproduced in this report). A recommendation has been added that this should be revised: 'The groundwater plume should be modelled, and the boundary revised regularly. This should be used to establish groundwater cleanup timelines.'
72.		Figure 8-2	Consider changing the color of the sentry wells. At first glance it appears they are all exceedances as they are colored red.	**Agree** This figure was reproduced based on a previous report. For this FYR the colors for the sentinel wells were revised to blue.
73.		Figure 8-6	The eastern edge of the inferred Western plume boundary and the groundwater contours do not adequately represent the TCE concentrations in seeps OU5SP-10 and OU5SP-11. A cross-section diagram with well depth would be very illustrative of the TCE concentrations in this area.	**Agree:** The plume boundary was derived in previous study. It Section 8.6, Bulleted list after Table, is recommended to: "Optimize the early warning, sentry, and groundwater monitoring well network as recommended in the *2016 Annual Remedial*

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				Action-Operations and Monitoring Report for Select CERCLA Sites (USAF, 2018c)."
74.		Appendix C	Interview responses Halstead as a date of 11/03/17. An updated version was provided to the AF with a 2/9/2018 date. Please replace the November 2017 form with the February 2018 version. See comment 22 for the email to the AF and also a copy of the February 2018 form.	**Agree:** Appendix C Interview form has been replaced with the updated copy.
75.	ES-11	OU6 WP14	Formatting issue - don't let the header break across the page	**Agree:** Table has been modified so headers don't break across the page.
76.	7	4.1	Typo: The current land use designation at ~~L~~LF059 is "Open Space."	**Agree:** Text has been corrected.
77.	34	6.2.1	Typo: Groundwater risks for future onsite ~~works~~ workers were 1.5x 10-5, with a noncancer HI below 1 (USAF, 1995b).	**Agree:** Text has been corrected 'works' to 'workers'.
78.	66	8.2.3	The report *Data Compilation and Remedial Action Evaluation Report (USAF, 2017j)* is also referenced as USAF, 2017d. Clarify the correct citation (j or d?) and correct.	**Agree:** The correct reference is 2017d and has been modified in the text.
79.	72	8.4.1	The last bullet for site interviews follows the status table. The format should be changed so the bullet occurs with its corresponding section.	**Agree**: Bullet moved to be before table with rest of section.
80.		Figures	Many of the figure data tables repeat the last line as the first line in the lower table for a well. The numbers match – it's just an odd format.	**Agree:** The duplicate table headers will be removed and data reorganized.

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81.		Figure 8-5	Very busy slide.	**Agree:** The data will be rearranged however the quantity of data will make figure crowded.
82.		Appendix E	Louis Howard's name is misspelled as Luis on the section for regulatory contacts on many of the site inspection forms.	**Agree:** Appendix E site inspection forms have been replaced and Louis' name corrected.

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