ATTACHMENT 6

Interview Records

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INTERVIEW DOCUMENTATION FORM
Fort Wainwright

The following is a list of individuals interviewed for this five-year review. See the attached contact record(s) for a detailed summary of the interviews.

Name	Title/Position	Organization	Date
Joseph Malen	*Restoration Program Manager*	*FWA*	*Aug 10-13, 2015*
Brian Adams	*Restoration Project Manager*	*FWA*	*Aug 10-13, 2015*
Sandra Halstead	*Federal Facilities RPM*	*USEPA*	*Jun 27, 2016*
Guy Warner	*ADEC RPM*	*ADEC*	*No response*
Craig Martin	*President*	*FES*	*No response*
Bob Hazlett	*Environmental Scientist*	*USACE, Alaska District*	*Feb 26, 2016*
Melvin Dennis Shepard	*Environmental Program Specialist*	*ADEC*	*Jun 7, 2016*

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FORT WAINWRIGHT FIVE-YEAR REVIEW INTERVIEW QUESTIONNAIRE

INTERVIEW RECORD						
Name: Joseph Malen						
Title: Chief, Environmental Restoration Branch			Organization: Directorate of Public Works, Environmental Div			
Telephone No: 907-361-4512			E-Mail Address: joseph.s.malen.civ@mail.mil			
Street Address:1046 Marks Street			City, State, Zip: Fort Wainwright, AK 99703			
Interview Date: 29 February 2016			Site Name: **Fort Wainwright**			
Interview Type:	☐ Telephone	X Visit	X Email	X Questionnaire (by mail)		
Specific Site Involvement						
Operable Unit(s) Worked:	X OU1	X OU2	X OU3	X OU4	X OU5	X OU6
Date(s) of Involvement: 1993-1999, 2006 to Present Day						
Title / Position (with respect to sites): Lead Remedial Project Manager / Chief, Environmental Restoration Program						

The following general questions were adapted from the EPA's Comprehensive Five-Year Review Guidance. Please answer any questions that are applicable; if you need more space, you may attach a separate sheet.

INTERVIEW QUESTIONS

1. What is your overall impression of the work conducted at the site? *(general sentiment)*

The Army has been very proactive in maintaining Land Use Controls/Institutional Controls; conducting sampling and analyses at source areas as required by a Record of Decision (ROD); conducting investigations and remediation at newly discovered potential source areas; and not afraid of conducting Innovative Treatability Studies when appropriate and minimizing negative impacts to the environment when possible. The Army Environmental Command has provided additional assets to ensure the installation program remains viable and productive.

2. From your perspective, what effect have remedial operations at the site had on the surrounding community?

The Army has expended an incredible amount of time, effort, and resources to ensure areas of known contamination that have been noted in RODs are dealt with according to the appropriate laws/regulations. The most notable achievement has been the investigation and remediation of Operable Unit 6 (OU6) soils and ground water such that this housing area was approved for residential occupancy in the OU6 ROD. Occupants are required to attend briefings about the investigations and clean-up work that was accomplished from 2004-2013. The vast majority of the occupants are very pleased to hear of all the work and appreciate the Army's efforts on their behalf. Most people who come into the Environmental Division to ask questions are favorably impressed by all that has happened over the years.

3. Are you aware of any concerns from the local community regarding the site, operation, administration, implementation, or overall protectiveness of the remedies in the Record of Decision?

Most people who come into the Environmental Division to ask questions are favorably impressed by all that has happened over the years. I am only aware of one person who voiced his opinion that based on his personal experience, he would never trust Government sponsored work for anything.

4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities?

For contaminated sites that have RODs in place, I am only aware of one location. Prior to the removal of the Above Ground Storage Tanks at the Fairbanks Terminal (part of OU5), people would cut the installation boundary fence to play on and around the tanks. Since the tanks were removed, there has been only one breach of the fence.

Otherwise, I am aware of one other trespass location. At the area now known as the Tanana River OB/OD site, a group of individuals had trespassed and set up an encampment along the Tanana River in an area that contained buried munitions in order to mine brass from the munitions. FWA security forces, BLM Special Investigators, and Environmental Division responded. The area is within the FWA Active Range Impact Area and Dud Impact Area; and since the time of the discovery of trespassers, FWA Range Control has increased patrols, added an additional gate to eliminate an access route, and inspected signs to ensure measures are in place to warn the public of the dangers associated with this active range area. The site is undergoing a Time Critical Removal Action to remove any immediate hazards/risks.

5. Are you aware of any changes in land use, access, or other site conditions that have occurred since the last 5-Year Review (2011) that you feel may impact the protectiveness of the remedy(s)?

There is no information at this time to indicate the protectiveness of the remedies has been impacted by activities at the site.

6. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years?

FWA continues to repair and replace groundwater monitoring wells due to frost jacking caused by permafrost and extreme temperature variation; it is a fact of life in the Interior of Alaska that must be dealt with constantly.

7. Are the remedies functioning as intended?

The Army believes that remedies are functioning as intended. The Army has initiated data gap analyses to determine if anything else can be done at FTWW-055, FTWW-083, FTWW-084, and FTWW-096 to address Petroleum constituents in ground water.

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

The exposure assumptions, toxicity data, cleanup levels and remedial action objectives used at the site at the time of the remedy are still valid.

9. Have there been opportunities to optimize the operation, maintenance, or sampling efforts? Please describe changes, cost savings, and/or improved efficiency.

The Army continues to run MAROS and present results to the RPMs with recommendations on which Monitoring Wells to remove from the program. CoCs and frequency of sampling events are also evaluated by the RPMs.

10. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

Site management would be greatly enhanced if additional permanent personnel could be hired for the program. Despite the reduced number of CERCLA sites being evaluated, the list of Two-Party sites being addressed by the program has grown substantially. Contract document creation, review, and subsequent review of new data, increased number of meetings, and other staffing requirements continue to limit the effectiveness of the Army project managers especially when it comes to completing the Army's internal reporting requirements.

INTERVIEW RECORD

Site Name: Fort Wainwright		**EPA ID No.:** AK210022426	
Subject: Fourth Five-Year Review of Remedial Actions Conducted at Fort Wainwright (OU-1, OU-2, OU-3, OU-4, and OU-5)		**Time:**	**Date:** 10 August 2015
Type: ☐ Telephone ☒ Visit ☐ Other **Location of Visit:** Fort Wainwright Department of Public Works Offices		☐ Incoming ☐ Outgoing	

Contact Made By:

Name: Holly Akers, PE	**Title:** Project Engineer	**Organization:** US Army Corps of Engineers, Buffalo District

Individual Contacted:

Name: Brian Adams	**Title:** Restoration Project Manager	**Organization:** Ft Wainwright
Telephone No: **Fax No:** (907) 361-9867 **E-Mail Address:** brian.m.adams.civ@mail.mil		**Street Address:** 1060 Gaffney Road, #4500 **City, State, Zip:** Ft Wainwright, AK 99703-4500

Summary Of Conversation

1. How long and in what capacity have you been involved with the restoration activities at Fort Wainwright?
Employee of Fort Wainwright since 1995. Worked in Water and Solid Waste Program from 1995-2012 when I transitioned to current role as an RPM.
2. What is the current status of CERCLA (three party) restoration activities at Fort Wainwright?
The restoration activities are going well. Recent activities include site maintenance due to vandalism of fencing at the Birch Hill Tank Farm and OU-4 Landfill, and contracted groundwater monitoring and IC inspections.
3. Have there been any complaints, violations, or other incidents related to the site included in this review?
No, Fort Wainwright maintains a good relationship with regulators regarding OU-1 through OU-6.
4. Have there been any challenges with the sites?
Trespassing and vandalism have been an issue for the Birch Hill Tank Farm and OU-4 Landfill. Fencing repairs are made as necessary. The off-site removal of trees (downgradient of the Birch Hill Tank Farm) is a concern due to the melting of permafrost and potential groundwater plume migration.
5. Are the remedies functioning as intended?
Yes.
6. Has any other information come to light that could call into question the protectiveness of the remedy?
No.
7. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?
None.

FORT WAINWRIGHT FIVE-YEAR REVIEW INTERVIEW QUESTIONNAIRE

<table>
<tr><th colspan="2">INTERVIEW RECORD</th></tr>
<tr><td colspan="2">Name: Sandra Halstead</td></tr>
<tr><td>Title: Remedial Project Manager</td><td>Organization: USEPA</td></tr>
<tr><td>Telephone No: 907-271-1218</td><td>E-Mail Address: halstead.sandra@epa.gov</td></tr>
<tr><td>Street Address: 222 w. 7th Ave</td><td>City, State, Zip: Anchorage, AK, 99513</td></tr>
<tr><td>Interview Date: 6/27/2016</td><td>Site Name: Fort Wainwright</td></tr>
<tr><td colspan="2">Interview Type: □ Telephone □ Visit x Email □ Questionnaire (by mail)</td></tr>
<tr><th colspan="2">Specific Site Involvement</th></tr>
<tr><td colspan="2">Operable Unit(s) Worked: x OU1 x OU2 x OU3 x OU4 x OU5 x OU6</td></tr>
<tr><td colspan="2">Date(s) of Involvement: June 2013 to present</td></tr>
<tr><td colspan="2">Title / Position (with respect to sites): USEPA CERCLA Project Manager</td></tr>
</table>

The following general questions were adapted from the EPA's Comprehensive Five-Year Review Guidance. Please answer any questions that are applicable; if you need more space, you may attach a separate sheet.

INTERVIEW QUESTIONS

1. What is your overall impression of the work conducted at the site? *(general sentiment)*

Overall the long term groundwater monitoring program at Fort Wainwright is robust and credible to assess if the groundwater remedies implemented at the site are effective in meeting cleanup goals. The institutional control portion of the remedies have improved with increased attention to the dig permit process and annual site inspection reports.

2. From your perspective, what effect have remedial operations at the site had on the surrounding community?

I have not had a chance to interact with any of the community in regard to the environmental restoration program as the Restoration Advisory Board was disbanded prior to my involvement at Fort Wainwright.

3. Are you aware of any concerns from the local community regarding the site, operation, administration, implementation, or overall protectiveness of the remedies in the Record of Decision?

No, there have not been any public meetings for Fort Wainwright Environmental Restoration Program since I joined the site team in June 2013.

4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities?

Yes, vandalism and minor trespass are documented in the annual inspection reports. The major trespass event at the Tanana River OBOD site, near the OU5 OB/OD site, was first reported to EPA in a written technical memorandum 16 months after the notification time period for discovery of a new site.

5. Are you aware of any changes in land use, access, or other site conditions that have occurred since the last 5-Year Review (2011) that you feel may impact the protectiveness of the site?

For OU5, the removal of the above-ground storage tanks may impact the protectiveness in allowing for additional characterization of the soil sources and possible re-evaluation of the soil and OU3 groundwater remedies. For OU5 OBOD, the discovery of the nearby Tanana River OB/OD River site (CC-FTWW-068) in June 2013 and the subsequent creation of an access road to the site provides potential access to the OU5 OBOD area from the river.

6. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years?

Yes, there have been some missed Long Term groundwater monitoring events due to contracting issues. Additionally, there have been costs associated with treatability studies at OU2, OU5 that have not been well documented.

7. Are the remedies functioning as intended?

For many of the OUs, physical source removal and/or the selected remedies of Air Sparge/Soil Vapor Extraction to reduce source area concentrations have worked well but have reached a point where the energy to operate the system outweighs extraction of any remaining residual soil contamination. The Army implemented post-ROD treatability studies at OU2 and OU5 which seem to have been effective in dropping concentrations near remedial goals. The groundwater remedies which include Monitored Natural Attenuation are well documented through groundwater geochemistry in addition to contaminant concentrations.

For most sites which had both active treatment and MNA as groundwater remedies, contaminant concentrations have declined but have not met cleanup goals in the 'reasonable timeframe', which were not specified in most RODs but are approaching 20 years post ROD for most OUs.

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

Vapor intrusion from volatile organic contaminants in soils and groundwater is an exposure pathway that has not been assessed for OU1-5 sites.

USEPA drinking water program published a health advisory level for the emerging contaminant of the poly- and per- fluorinated compounds in June 2016, and the Army released a directive to identify any potential human exposures to the PFAS compounds in drinking water on June 10, 2016. OU4 Fire Training Area is the site most obviously impacted by this directive, but there may be additional areas where the Aqueous Fire Fighting Foams were used at Fort Wainwright that should be investigated.

The exposure assumptions that OU5 OBOD was restricted access due to its location on the edge of an operational range was called into question with the trespass event at the nearby Tanana River OBOD site, also within the restricted access operational range.

9. Have there been opportunities to optimize the operation, maintenance, or sampling efforts? Please describe changes, cost savings, and/or improved efficiency.

Fort Wainwright has been very pro-active in assessing groundwater monitoring networks using MAROS and reducing monitoring wells or events if the analysis suggests redundancy.

The discovery of the previously unknown Tanana River OBOD site, within 1000 ft of the known OU5 OBOD site, casts uncertainty on the characterization and extent of the OU5 OBOD site during the sampling effort conducted under the RI in the mid-1990s.

10. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

The institutional control program at Fort Wainwright should be re-evaluated in light of the failure to detect the major trespass event at the Tanana River Site, near OU5 OBOD, in 2013. Annual IC inspections reports since 2012 are a positive step towards improving IC enforcement at the installation, however in 2012, an on-site inspection of OU5 OBOD was not performed which may have revealed trespass activity at the nearby Tanana River site.

At OU2 and OU5, the post-ROD treatability studies should be documented with summary reports.

Interim Remedial Action Completion Reports could be developed for individual sites within OUs that have achieved RAOs and will no longer be actively monitoring groundwater, however ICs remain a component of the remedies at these sites.

More frequent communication between Fort Wainwright and the regulators would allow for more flexible decisions. The revival of at least quarterly RPM meetings (starting Jan 2016) and the quarterly report as required by the FFA has helped to increase communication and discussion of issues early.

FORT WAINWRIGHT FIVE-YEAR REVIEW INTERVIEW QUESTIONNAIRE

INTERVIEW RECORD			
Name: Bob Hazlett			
Title: Environmental Scientist		Organization: U.S. Army Corps of Engineers	
Telephone No: 907-753-2623		E-Mail Address: bob.c.hazlett@usace.army.mil	
Street Address: 2204 3rd St		City, State, Zip: JBER, AK 99518	
Interview Date: 26 February 2016		Site Name: **Fort Wainwright**	
Interview Type:	☐ Telephone ☐ Visit	☐ Email	X Questionnaire (by mail)
Specific Site Involvement			
Operable Unit(s) Worked:	X OU1 X OU2	X OU3 X OU4	X OU5 X OU6
Date(s) of Involvement: 2002 through present			
Title / Position (with respect to sites): Technical Lead			

The following general questions were adapted from the EPA's Comprehensive Five-Year Review Guidance. Please answer any questions that are applicable; if you need more space, you may attach a separate sheet.

INTERVIEW QUESTIONS

1. What is your overall impression of the work conducted at the site? *(general sentiment)*

   The Army has been very proactive regarding investigation and remediation of contaminated sites. Because of the challenging conditions, the Army has tried many innovative technologies, and numerous sites have been effectively remediated. Most notably, sites in OU3 and OU5 with extensive contaminant plumes have been successfully cleaned up. Although there are still many contaminated sites remaining on Ft Wainwright and a lot of work still to do, my impression is that the Ft Wainwright environmental program is doing its best to minimize any threat to the people living and working on the Base, as well as the surrounding community.

2. From your perspective, what effect have remedial operations at the site had on the surrounding community?

   The Army's biggest concern is to ensure contamination is not migrating off-site that could affect the general public. To the best of my knowledge, this has only happened a few times and the Army has been successful in fixing the problem. I am not aware of any lasting adverse effects on the surrounding community.

3. Are you aware of any concerns from the local community regarding the site, operation, administration, implementation, or overall protectiveness of the remedies in the Record of Decision?

   The Army has reached out to the community in the form of Public Meetings and formation of a Restoration Advisory Board (which was disbanded due to lack of interest). I am not aware of any community concerns regarding environmental issues at Ft Wainwright.

4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities?

   There was a problem with vandalism at the Birch Hill Tank Farm (kids breaking through the fence and writing graffiti on the tanks), but since the tanks have been removed, this has stopped. I'm not aware of any response being taken by local authorities, or of any other issues at existing operable unit sites.

5. Are you aware of any changes in land use, access, or other site conditions that have occurred since the last 5-Year Review (2011) that you feel may impact the protectiveness of the site?

   I'm not aware of any such changes that would impact the protectiveness of the remedies implemented at any of the existing operable units.

6. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years?

   There have been some unexpected minor costs (wells needing to be replaced, etc), but to the best of my recollection there have not been any significant unexpected costs related to the established operable units in the last five years.

7. Are the remedies functioning as intended?

   The remedies appear to be functioning as intended, however site conditions at the OU3 Birch Hill Tank Farm and the OU3 FEP Milepost sites have made remedial efforts challenging. The Army is currently conducting studies to determine what can be done at each of these sites to ensure continued protectiveness.

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

   Yes, I believe that the remedial objectives for the existing operable units are still valid.

9. Have there been opportunities to optimize the operation, maintenance, or sampling efforts? Please describe changes, cost savings, and/or improved efficiency.

   Yes, remedial efforts at each of the operable units have been consistently optimized to provide improvements and cost savings to the Army. Treatment systems have been shut down and decommissioned when appropriate. The monitoring program at each site is evaluated annually, and has been continually revised to ensure only appropriate wells and analytical parameters are being sampled.

10. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

    The FTW environmental program has been understaffed for many years, which is the root cause of most of the problems now facing the program (regulatory issues, etc). Given the existing workload, the most significant thing that could be done to improve site management and operations would be to hire more people.

FORT WAINWRIGHT FIVE-YEAR REVIEW INTERVIEW QUESTIONNAIRE

INTERVIEW RECORD	
Name: Melvin Dennis Shepard	
Title: Environmental Program Specialist	Organization: Alaska Dept. of Environmental Conservation
Telephone No: 907-451-2180	E-Mail Address: dennis.shepard@alaska.gov
Street Address: 610 University Avenue,	City, State, Zip: Fairbanks, AK 99709
Interview Date: 7-21-2016	Site Name: **Fort Wainwright**
Interview Type: ☐ Telephone ☐ Visit X Email Questionnaire (by mail)	
Specific Site Involvement	
Operable Unit(s) Worked: X OU1 X OU2 X OU3 X OU4 X OU5 X OU6	
Date(s) of Involvement: November 25, 2015 – present. ADEC RPM.	
Title / Position (with respect to sites): ADEC Restoration Project Manager / State regulatory oversite	

The following general questions were adapted from the EPA's Comprehensive Five-Year Review Guidance. Please answer any questions that are applicable; if you need more space, you may attach a separate sheet.

INTERVIEW QUESTIONS

1. What is your overall impression of the work conducted at the site? *(general sentiment)*

   In general, the Army has made a major effort to investigate and cleanup environmental contamination in compliance with State and Federal Environmental cleanup standards and regulations at the Fort Wainwright NPL site. The environmental program is mature and remedial actions are nearing completion for the majority of sites though long-term monitoring of groundwater contaminant plumes is ongoing.

   Although the bulk of the remedial actions are complete, there is a need for increased attention to operations and maintenance, institutional controls and oversight of new releases and newly discovered historic contamination. Recent enforcement actions and regulatory fines are indicative of the fact that these activities require greater attention by Garrison environmental personnel.

2. From your perspective, what effect have remedial operations at the site had on the surrounding community?

   Fort Wainwright remedial operations have a positive effect on human health and the environment as well as the local economy.

3. Are you aware of any concerns from the local community regarding the site, operation, administration, implementation, or overall protectiveness of the remedies in the Record of Decision?

   The Chena River boom area at OU-5 is a visual feature that indicates to the community that contaminates may be entering the surface water of the Chena River. The Department of Environmental Conservation (DEC) has expressed some concerns for the site and potential for contaminant migration from the OU-5 source areas. Site monitoring has documented a number of exceedances of the Alaska Water Quality Standards.

4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities?

A trespass violation at the OU-5 OB/OD – River site required the Army to undertake a Time Critical Removal Action to address potential military munitions and related constituents. Also, there have been instances of trespass at the Birch Hill Tank Farm (OU-3 & OU-5) documented in recent Institutional Control Inspection reports.

5. Are you aware of any changes in land use, access, or other site conditions that have occurred since the last 5-Year Review (2011) that you feel may impact the protectiveness of the site?

Removal of vegetation during the Time Critical Removal Action conducted in response to the trespass violation at the OU-5 OB/OD – River site created easy access to the OU-5 OB/OD area and the active range fans from the Tanana River. Strengthening the institutional controls and addition of engineering controls may be necessary to stop further incidence of trespass to the area due to the change in site conditions.

6. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years?

Yes several compliance failures resulted in unanticipated fines from the regulatory agencies. The trespass violation at the OU-5 OB/OD – River site has resulted in unforeseen costs to the Army and has resulted in a RCRA violation and EPA RCRA concerns. Costs for this removal effort are ongoing and additional site inspections may be required.

Several RCRA violations were discovered in 2014 for UST protections including failure to provide release detection for tanks and piping; failure to operate and maintain cathodic protection; failure to report a suspected release; failure to investigate and confirm a release; and failure to comply with temporary closure requirements. These violations resulted in RCRA fines.

In 2015, DEC issued a Notice of Intent to issue a Mandatory Compliance Order concerning corrective actions at the Former AFFES PX Gas Station (Building 3562 – UST numbers 177, 179 and 180). DEC and the Army settled the matter in January 2016 with a Compliance Order by Consent and Agreement Settling Liability. DEC issued a fine for these violations and required removal of the USTs and cleanup of soil contamination which resulted in significant cost to the Army.

Army oversight of transport, storage and disposal of regulated soil is a concern. The most notable lapse of oversight was an incidence of unauthorized soil disposal to an off Garrison residence. Army oversight and coordination with contractors is an O&M area where improvements can be made.

7. Are the remedies functioning as intended?

For many of the Operable Units (OUs) there is concern for the timelines of the remedies. At OU-3 and OU-5 many sites are projected to have increased timelines to achieve the remedial action goals and remedial action objectives that were identified in the Records of Decision.

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

EPA health advisories have been issued for emerging contaminants (Perfluorinated compounds – PFOS & PFOA) and the Army provided a memorandum/policy for Installation Management of PFCs on June 10, 2016. The policy requires the Army to sample drinking water systems and identify locations where PFOS and PFOA are known or suspected to have been released. Investigation of these contaminants may change protectiveness determinations for some OUs or necessitate the creation of new OUs.

Additional toxicity data have become available for many contaminants. In response DEC has proposed and is in the process of promulgating revised cleanup levels. Presuming the new cleanup levels are promulgated, protectiveness of the remedies will need to be re-evaluated during the 2021 Five Year Review.

9. Have there been opportunities to optimize the operation, maintenance, or sampling efforts? Please describe changes, cost savings, and/or improved efficiency.

The Army has voluntarily contracted for site inspections and removal of obsolete tank and pipeline infrastructure within the Army Garrison. This proactive effort may prevent additional releases from residual petroleum in those structures and offset the need for further expenditures related to site releases of contaminants.

10. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

The Army environmental program appears to be under staffed and struggling to meet regulatory requirements and manage its environmental contractors.

DEC would like to see increased attention to documentation, communication and oversight of environmental activities, an accurate Site Management Plan and maintenance of enforceable schedules for primary documents and after action reports. The lack of timely communication and follow-through on newly discovered contamination and soil transport has resulted in regulatory agencies questioning of the Army Environmental Programs capacity to meet regulatory requirements.

Army staff are working to improve communication with the regulators and have resumed monthly FFA meetings, however DEC has requested the Army contract an impartial third party facilitator to assist with coordination of meetings and tracking of action items, deadlines and document schedules.

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ATTACHMENT 7

ARAR Evaluation

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ARAR Evaluation

BACKGROUND

Section 121 (d)(2)(A) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) specifies that remedial actions must meet federal standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate requirements (ARARs). ARARs are those standards, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. To-Be-Considered criteria (TBCs) are non-promulgated advisories and guidance that are not legally binding, but should be considered in determining the necessary level of cleanup for protection of human health or the environment.

The final remedies selected for the site were designed to meet all chemical-specific, action-specific, and location-specific ARARs and consider all TBCs. Chemical-specific ARARs are health- or risk-based numerical values for individually listed contaminants in specific media. Action-specific ARARs are technology- or activity-based limitations or requirements that are selected to accomplish a remedy. Location-specific ARARs are restrictions placed on the concentration of chemicals or conduct of operations based on the location of a site.

OBJECTIVE

This evaluation is prepared to address Question B of the statement of service, "Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?"

This is the fourth Five-Year Review Report for Operable Units (OUs) 1, 2, 3, 4, and 5. The Record of Decision (ROD) for OU6 was signed in 2014, and therefore is included in this ARAR review.

EVALUATION

ARARs associated with remedial actions implemented at the following OUs at Fort Wainwright were evaluated to determine if cleanup levels and remedial action objectives (used at the time of the remedy selection) are still valid.

OU	Site Description	Media of Concern
1	801 Drum Burial Site	Soil and Groundwater
2	Defense Reutilization Maintenance Operation (DRMO) Yard	Groundwater
	Former Building 1168 Leach Well	Groundwater
3	Remedial Area 1b - Birch Hill Tank Farm	Groundwater
	Remedial Area 2 – Valve Pits and Railcar Off-Loading Facility	Groundwater

OU	Site Description	Media of Concern
	Remedial Area 3 - Fairbanks-Eielson Pipeline (FEP) Mileposts 2.7, 3.0, and 15.75	Groundwater
4	Landfill	Groundwater
	Coal Storage Yard (CSY)	Groundwater
5	West Quartermaster's Fueling System (WQFS)	Groundwater
	East Quartermaster's Fueling System (EQFS)	Groundwater
	Chena River	Surface Water
	Open Burn/Open Detonation (OB/OD) Area	Unexploded Ordnance
6	Former Communications Site (FCS)	Soil and Groundwater

As part of this fourth Five-Year Review, significant ARARs for each ROD were reviewed for changes or the promulgation of new laws since the ROD was signed that might be considered ARARs if the RODs were to be written today. New laws that might be considered ARARs today are applicable for Fort Wainwright only if they are essential to ensure protectiveness of the remedies.

OPERABLE UNIT 1 (OU-1)

OU-1 is comprised of one site: 801 Drum Burial Site.

801 Drum Burial Site (OU-1)

The Record of Decision for Operable Unit 1, Fort Wainwright, Fairbanks Alaska [United States Army (U.S. Army) 1997c] addressed potential risks to future hypothetical site users posed by soil and groundwater contamination.

Remedial Action Objectives (RAOs) for groundwater at the 801 Drum Burial Site, identified in Section 5.2.1.1 of the ROD for OU-1 [U.S. Army 1997c] were to:

- Ensure that groundwater use at the 801 Drum Burial Site meets federal and state standards.
- Minimize potential migration of contaminated groundwater to the Chena River and down gradient drinking water wells.
- Establish and maintain institutional controls (ICs) to ensure that the groundwater will not be used until federal and state MCLs are attained, except for activities undertaken to initiate the selected remedies.

RAOs for soil at the 801 Drum Burial Site, identified in Section 5.2.1.2 of the ROD for OU-1 [U.S. Army 1997c] were to:

- Prevent further leaching of contaminants from soil to groundwater.

- Reduce risks associated with exposure to contaminated soil and drums.
- Prevent migration of soil contaminants to groundwater, which could result in groundwater contamination and exceedances of state and federal MCLs and Alaska Water Quality Standards (AWQS; 18 Alaska Administrative Code [AAC] 70).

The selected remedy for the 801 Drum Burial Site in OU-1 at Fort Wainwright consisted of:

- Locating potential buried drums and, if found, removing and disposing of drums and contaminated soils, while restricting access to the source area during this work.
- Establishing and maintaining ICs to ensure that the groundwater will not be used until federal and state MCLs are attained, except for activities undertaken to initiate the selected remedies. ICs include restrictions governing site access, construction and well development or placement as long as hazardous substances remain on site that preclude unrestricted use.
- Natural attenuation of groundwater with long-term groundwater monitoring/evaluation.
- A groundwater contingent remedy which includes an air sparging/soil vapor extraction (AS/SVE) system to specifically treat VOCs. This remedy will be implemented if the plume shows an increasing trend over any three consecutive sampling events, or if designated monitoring points indicate the plume is migrating.

Section 5.4 of the ROD for OU-1 [U.S. Army 1997c] identified the most significant ARARs for the remedy selections for the 801 Drum Burial Site to be:

- ➢ Federal (40 Code of Federal Regulations [CFR] 141) and State of Alaska (18 Alaska Administrative Code [AAC] 80) Maximum Contaminant Levels (MCLs) – relevant and appropriate for groundwater and sets the active groundwater remediation goals. The Alaska Water Quality Standards (AWQS; 18 AAC 70) also apply.
- ➢ National Oil and Hazardous Substances Pollution Contingency Plan (NCP) off-site disposal rules – applicable for disposal of drums and contaminated soil.

<u>Groundwater ARAR Evaluation</u>

Five groundwater chemicals of concern (COCs) were identified in Table 7-1 of the Record of Decision (ROD) for OU-1 [U.S. Army 1997c]: aldrin, dieldrin, 1,1-dichloroethene (1,1-DCE) benzene, and vinyl chloride. A note to Table 7-1 of the OU-1 ROD stated that "Diesel-range organics will be cleaned up to levels consistent with proposed State of Alaska regulations (18 AAC 75)." Additionally, footnote "a" in the OU-1 ROD states, "Monitoring and sampling will follow EPA protocols and will not be limited to the specific contaminants of concern." The Draft 2015 Monitoring Report [FES 2016] indicates that "the EPA requested that cis-1,2-dichlorothene (cis-1,2-DCE) be added to the list of compounds tracked at the site." This is likely due to the fact that cis-1,2-DCE currently exceeds federal and State of Alaska MCLs. Therefore, both DRO and cis-1,2-DCE are listed as groundwater COCs for OU-1 in Table A.7-1 with ARAR-based cleanup goals to ensure the protectiveness of the groundwater remedy.

Risk-based concentrations (RBCs) equivalent to an excess lifetime cancer risks of $1x10^{-6}$ for residential exposure scenarios were adopted as groundwater cleanup goals for the pesticides aldrin and dieldrin since there were no Federal or State of Alaska MCLs for these contaminants at the time that the ROD for OU-1 was issued [U.S. Army 1997c]. Soil cleanup goals for the pesticides aldrin and dieldrin were RBCs equivalent to an excess lifetime cancer risks of $1x10^{-4}$ for residential exposure scenarios. A review of toxicity and risk assessment methodology changes to these risk-based groundwater cleanup goals is included in Attachment 8 of this Five-Year Review Report.

After the ROD for OU-1 was issued, the State of Alaska promulgated MCLs for the pesticides aldrin and dieldrin (18 AAC 75 Table C), as listed in Table A.7-1. However, these State of Alaska MCLs are an order of magnitude higher than the RBCs for groundwater that were adopted in the ROD for OU-1.

Federal and State of Alaska drinking water MCLs were adopted as groundwater cleanup goals for 1,1-DCE, benzene, and vinyl chloride at the 801 Drum Burial Site. Table 2-1 of the OU-1 Feasibility Study [U.S. Army 1997b] listed a groundwater cleanup goal of 15 µg/L for DRO, based upon the State of Alaska regulations (18 AAC 75) at that time. As summarized in Table A.7-1, the groundwater cleanup goal for DRO increased from 15 µg/L to 1500 µg/L. Since the cleanup goal increased, this change does no impact the protectiveness of the groundwater remedy. Since neither the Feasibility Study [U.S. Army 1997b], nor the ROD [U.S. Army 1997c] for OU-1 listed a groundwater cleanup goal for cis-1,2-DCE, a comparison to the current groundwater cleanup goals could not be made for this five-year review.

As summarized in Table A.7-1, there have been no changes to these MCL-based groundwater cleanup goals since the ROD for OU-1 [U.S. Army 1997c].

The AWQS can be found in 18 AAC 70 under (5) Petroleum Hydrocarbons, Oil and Grease, for Freshwater Uses. The cleanup level for groundwater that is hydraulically connected to surface water in total aromatic hydrocarbons (TAH) is 10 µg/L and total aqueous hydrocarbons (TAqH) is 15 µg/L. TAH is defined as the sum of benzene, toluene, ethylbenzene, and xylene (BTEX). Benzene was the only TAH identified as a COC for OU-1, with a cleanup criteria (MCL) of 5 µg/L. Therefore, the MCL for benzene is sufficiently protective to meet the AWQS.

Groundwater monitoring began after the ROD for OU-1 [U.S. Army 1997c] was signed. Currently, eight groundwater monitoring wells are included in the program, which have been sampled every five years since 2010. The 2010 Monitoring Report for the 801 Drum Burial Site [FES 2011] indicates that the five groundwater COCs listed in the ROD for OU-1, DRO, and cis-1,2-dichloroethene, which was added at the request of the United States Environmental Protection Agency (USEPA), are included in the groundwater monitoring program. Conclusions from the 2010 Monitoring Report for the 801 Drum Burial Site [FES 2011] include:

- Benzene has consistently exceeded the federal/state MCL of 5µg/L in monitoring well AP-6327 (located in the former source area) since 1997. Although a decreasing trend in benzene concentration is observed, the 2010 result is six times greater than the cleanup level.
- Dieldrin exceeded the risk-based cleanup goal (0.004 µg/L) established in the ROD for OU-1 [U.S. Army 1997c] in four wells (AP-6326, AP-10042MW [replacement well for AP-7163], AP-7282, and AP-6331).
- DRO exceeded the state MCL of 1500 µg/L in monitoring well AP-6327. The 2010 result was nearly two times greater than the cleanup level.

Cis-1,2-DCE has consistently exceeded the federal/state MCL of 70 µg/L in monitoring well AP-6326, however, this well was not sampled for volatile organic compounds in the 2010 sampling program. Since groundwater at the 801 Drum Burial Site has not attained the federal and state MCLs for 1,1-DCE, benzene, DRO, and vinyl chloride, and cis-1,2-DCE and risk-based cleanup goals for aldrin and dieldrin, ICs and continued groundwater monitoring are required to ensure the protectiveness of the groundwater remedy.

Soil ARAR Evaluation

Two soil COCs were identified in Table 7-1 of the ROD for OU-1 [U.S. Army 1997c]: aldrin and dieldrin. Additionally, a note to Table 7-1 of the OU-1 ROD stated that "Diesel-range organics will be cleaned up to levels consistent with proposed State of Alaska regulations (18 AAC 75)." As stated in Section 5.3 of the ROD for OU-1 [U.S. Army 1997c], these cleanup levels were protective of down gradient residential, commercial, and municipal utility system (MUS) well users.

Table 2-1 of the OU-1 Feasibility Study [U.S. Army 1997b] listed a subsurface soil cleanup goal of 200 mg/kg for DRO, based upon the State of Alaska regulations (18 AAC 75) at that time. As summarized in Table A.7-1, there have been changes to this state of Alaska ARAR-based soil cleanup goal since the ROD for OU-1 [U.S. Army 1997c]. The soil cleanup goal for DRO increased from 200 mg/kg to 250 mg/kg. Since the cleanup goal increased, this change does no impact the protectiveness of the soil remedy.

There are no newly promulgated or modified requirements of federal and state environmental laws that would change the protectiveness of the groundwater and soil remedies.

Since there were no cleanup goals for aldrin and dieldrin at the time of the ROD for OU-1, RBCs equivalent to an excess lifetime cancer risks of $1x10^{-4}$ for residential exposure scenarios were adopted as soil cleanup goals for the pesticides aldrin and dieldrin. After the ROD was issued, the State of Alaska promulgated soil cleanup levels for the pesticides aldrin and dieldrin that are protective of groundwater in the under 40 inch annual precipitation zone (18 AAC 75 Table B1), as listed in Table A.7-1. The new soil cleanup levels for aldrin and dieldrin are an order of magnitude lower than the RBCs for soil that were adopted in the ROD for OU-1. A review of toxicity and risk assessment methodology changes to the risk-based soil cleanup goals identified in the ROD for OU-1 is included in Attachment 8 of this Five-Year Review Report.

OU-1 CONCLUSIONS

There are no newly promulgated or modified requirements of federal and state environmental laws that would change the protectiveness of the groundwater and soil remedies implemented at the 801 Drum Burial Site at Fort Wainwright.

OPERABLE UNIT 2 (OU-2)

OU-2 is comprised of two sites: Defense Reutilization and Marketing Office (DRMO) Yard and Building 1168 Leach Well.

DRMO Yard (OU-2) and Building 1168 Leach Well (OU-2)

The Record of Decision for Operable Unit 2, Fort Wainwright, Fairbanks Alaska [U.S. Army 1997a] addressed potential risks to current and future hypothetical site users posed by groundwater contamination.

RAOs for groundwater and soil at the DRMO Yard and 1168 Leach Well, identified in Section 5.2 of the ROD for OU-2 [U.S. Army 1997a], were to:

Groundwater

- Restore groundwater to its beneficial use of drinking water quality within a reasonable time frame through source control.
- Reduce or prevent further migration of contaminated groundwater from the sources areas;
- Prevent use of groundwater containing contaminants at levels above Safe Drinking Water Act and State of Alaska Drinking Water Standard MCLs and Alaska Water Quality Standards.
- Use natural attenuation to attain Alaska Water Quality Standards (18 AAC 70) after reaching state and federal MCLs.

Soil

- Prevent migration of soil contaminants to groundwater, which could result in groundwater contamination and exceedances of state and federal MCLs and AWQS (18 AAC 70).

The selected remedy for the DRMO Yard in OU-2 at Fort Wainwright consisted of:

Soil Vapor Extraction and Air Sparging

- *In-situ* treatment of groundwater via AS to remove volatile organic compounds, thereby attaining RAOs.
- *In-situ* treatment of soil via SVE to prevent contaminated soil from acting as an ongoing source of contamination to groundwater.
- Treatment system evaluation and modification as necessary to optimize effectiveness.
- Periodic monitoring and evaluation of air emissions from the soil vapor AS/SVE treatment system to meet air emission requirements.
- Periodic groundwater monitoring and off-gas measurements to determine attainment of RAOs.

Natural Attenuation and Groundwater Monitoring

- Achieve AWQS through natural attenuation after active treatment attains state and federal maximum contaminant levels

Institutional Controls

Maintain ICs, including restricted access, well development restrictions and prohibition against refilling fire suppression water tank from the on-site well, as long as hazardous substances remain on site at levels that preclude unrestricted use.

The selected remedy for the Building 1168 Leach Well in OU-2 at Fort Wainwright consisted of:

Soil Vapor Extraction (SVE) and Air Sparging (AS)

- In situ treatment of groundwater via air sparging to attain state and federal drinking water standards.
- In situ treatment of soil via soil vapor extraction to prevent contaminated soil from acting as an ongoing source of contamination to groundwater.
- Treatment system evaluation and modification as necessary to optimize effectiveness.

- Periodic monitoring and evaluation of air emissions from the SVE/AS treatment system to meet air emission requirements.
- Periodic groundwater monitoring and off-gas measurements to determine attainment of RAOs.

<u>Natural Attenuation and Groundwater Monitoring</u>

- After active treatment achieves state and federal maximum contaminant levels, natural attenuation will be relied on to achieve Alaska Water Quality Standards.

<u>Institutional Controls</u>

- Maintaining ICs, including restricted access and well development restrictions, and as long as hazardous substances remain on site at levels that preclude unrestricted use.
- Additional ICs to prohibit refilling the DRMO Yard fire suppression water tank from the existing DRMO Yard potable water supply well until state and federal maximum contaminant levels are met (except in emergency situations).

Section 5.3 of the ROD for OU-2 [U.S. Army 1997a] identified the most significant ARARs for the remedy selections for the DRMO Yard and Building 1168 Leach Well to be:

- ➢ Federal (40 Code of Federal Regulations [CFR] 141) and State of Alaska (18 Alaska Administrative Code [AAC] 80) Maximum Contaminant Levels (MCLs) – relevant and appropriate for groundwater and sets the active groundwater remediation goals. The Alaska Water Quality Standards (AWQS; 18 AAC 70) also apply.
- ➢ Alaska oil pollution regulations (18 AAC 75) are applicable, and Alaska guidelines for non-UST petroleum-contaminated soil are to be considered. These guidelines require cleanup of petroleum-contaminated soils to protect groundwater quality.

<u>Groundwater ARAR Evaluation</u>

Six groundwater COCs were identified in Section 7.1.2.1 for the DRMO Yard and Section 7.2.3 for the Building 1168 Leach Well Site in the ROD for OU-2 [U.S. Army 1997a]: benzene, trichloroethene (TCE), tetrachloroethene (PCE), vinyl chloride (VC), 1,1-dichloroethene (1,1-DCE), and 1,2-dichloroethene (cis 1,2-DCE).

Federal and State of Alaska drinking water MCLs were adopted as groundwater cleanup goals for benzene, TCE, PCE, VC, 1,1-DCE, and cis 1,2-DCE at the DRMO Yard and Building 1168 Leach Well Sites. As summarized in Table A.7-2, there have been no changes to these MCL-based groundwater cleanup goals since the ROD for OU-2 [U.S. Army 1997a].

The AWQS can be found in 18 AAC 70 under (5) Petroleum Hydrocarbons, Oil and Grease, for Freshwater Uses. The cleanup level for groundwater that is hydraulically connected to surface water in total aromatic hydrocarbons (TAH) is 10 µg/L and total aqueous hydrocarbons (TAqH) is 15 µg/L. TAH is defined as the sum of benzene, ethylbenzene, toluene, and xylene (BETX). Benzene was the only TAH identified as a COC for OU-1, with a cleanup criteria (MCL) of 5 µg/L. Therefore, the MCL for benzene is sufficiently protective to meet the AWQS.

Since 2010 [FES 2015d], annual groundwater monitoring data for the Building 1168 Leach Well Site showed that benzene concentrations have been consistently below the MCL, therefore, further groundwater monitoring is not required to ensure the protectiveness of the groundwater remedy.

Annual groundwater sampling results since 2012 [FES 2015d] at the DRMO Yard indicate that biodegradation of PCE is occurring and PCE concentrations are stable or decreasing. However, since PCE concentrations continue to exceed MCLs, groundwater monitoring and ICs are required to ensure the protectiveness of the groundwater remedy.

Soil ARAR Evaluation

Three soil COCs were identified for the Buildings 1186 Leach Well Sites in Table 7-3 of the ROD for OU-2 [U.S. Army 1997a]: diesel range organics (DRO), gasoline range organics (GROs), and BTEX. Soil cleanup goals listed in Table 7-3 of the ROD for OU-2 (based upon 18 AAC 78) were considered guidance for the treatment of in situ soil.

One soil COC was identified for the DRMO Yard in Table 7-1 of the ROD for OU-2 [U.S. Army 1997a]: DRO. The soil cleanup goal listed in Table 7-2 of the ROD for OU-2 (based upon 18 AAC 78) was considered guidance for the treatment of in situ soil.

The soil remedy of in situ treatment via soil vapor extraction, to prevent contaminated soil from acting as an ongoing source of contamination, is in place. Therefore, these soil cleanup goals have been achieved and only the groundwater remedy continues.

OU-2 CONCLUSIONS

There are no newly promulgated or modified requirements of federal and state environmental laws that would change the protectiveness of the groundwater and soil remedies implemented at the DRMO Yard and Building 1168 Leach Well Sites at Fort Wainwright.

OPERABLE UNIT 3 (OU-3)

OU-3 is comprised of the following remedial areas (RAs): the Birch Hill Tank Farm (RA 1b), the Railroad Off-Loading Facility (RA 2), and Mileposts 2.7, 3.0, and 15.75 of the Fairbanks-Eielson Pipeline (RA 3).

The Record of Decision for Operable Unit 3, Fort Wainwright, Fairbanks Alaska [U.S. Army 1996b] addressed potential risks to current and future hypothetical site users posed by soil groundwater contamination.

RAOs for all source areas in OU-3 area, identified in Section 7.2 of the ROD for OU-3 [U.S. Army 1996b], were as follows:

Groundwater

- Restore groundwater to its beneficial use of drinking water quality within a reasonable time frame.
- Reduce or prevent further migration of contaminated groundwater.
- Prevent use of groundwater containing contaminants at levels above Safe Drinking Water Act levels.

Soil

- For petroleum-contaminated soil, prevent migration of contaminants from soil into groundwater that would result in groundwater contamination and exceedance of Safe Drinking Water Act standards.

The selected remedies for all source areas within OU-3 at Fort Wainwright, as listed in Section 10.0 of the ROD for OU-3 [U.S. Army 1996b] are described below.

Remedial Area 1b (Birch Hill Tank Farm)

- Soil vapor extraction of petroleum-contaminated soil and air sparging of petroleum-contaminated groundwater in permafrost-free areas to achieve Safe Drinking Water Act levels and natural attenuation to meet Alaska Water Quality Standards.

Remedial Area 2 (Railroad Off-Loading Facility)

- Soil vapor extraction of petroleum-contaminated soil and air sparging of petroleum-contaminated groundwater at known contaminant sources and at locations where MCLs are exceeded (i.e., "hot spots") to achieve Safe Drinking Water Act levels and natural attenuation to meet Alaska Water Quality Standards.

Remedial Area 3 (Mileposts 2.7, 3.0, and 15.75)

- Soil vapor extraction of petroleum-contaminated soil and air sparging of petroleum-contaminated groundwater in permafrost-free areas at Milepost 2.7 and 3.0, and known source areas where MCLs were exceeded at Milepost 15.75, to achieve Safe Drinking Water Act levels and natural attenuation to meet Alaska Water Quality Standards.

Section 11.2.2 of the ROD for OU-3 [U.S. Army 1996b] identified the following chemical-specific ARARs for the remedy selections at RAs 1b, 2, and 3 in OU-3:

- Federal (40 Code of Federal Regulations [CFR] 141) and State of Alaska (18 Alaska Administrative Code [AAC] 80) Maximum Contaminant Levels (MCLs) – relevant and appropriate for cleanup of groundwater that may be used for a drinking water supply and sets the active groundwater remediation goals.
- Alaska Water Quality Standards (AWQS; 18 AAC 70) also apply for the protection of a Class 1(A) water supply for groundwater and must be met through natural attenuation after active remediation achieves MCLs.
- Alaska oil pollution regulations (18 AAC 75) are applicable, and Alaska guidelines for non-UST petroleum-contaminated soil are to be considered. These guidelines require cleanup of petroleum-contaminated soils to protect groundwater quality.
- Alaska Underground Storage Tank regulations (18 AAC 78) are relevant and appropriate to the active treatment of soil and groundwater until MCLs are achieved.

An explanation of significant differences (ESD) for OU-3 [U.S. Army 2002] was issued in 2002 to address more total volume and lateral extent of contamination in OU-3 than was previously documented in the ROD for OU-3 [U.S. Army 1996b]. The ESD concluded that significant changes to the scope of remedies selected in the ROD for OU-3 [U.S. Army 1996b] were required to fully achieve the RAOs. The ESD [U.S. Army 2002] did not change the RAOs and only provided clarification for ARARs in the ROD [U.S. Army 1996b].

Groundwater ARAR Evaluation

Seven groundwater COCs were identified for all source areas in OU-3 in Section 7.3.1 of the ROD for OU-3 [U.S. Army 1996b]: benzene, toluene, ethylbenzene, 1,2-dibromoethane, 1,2-dichloroethane, 1,2,3-trimethylbenzene, and 1,3,5-trimethylbenzene.

Federal and State of Alaska drinking water MCLs were adopted as groundwater cleanup goals for benzene, toluene, ethylbenzene, 1,2-dibromoethane, and 1,2-dichloroethane. Risk-based cleanup goals for 1,2,3-trimethylbenzene and 1,3,5-trimethylbenzene are further evaluated in Attachment 8 of this Five-Year Review Report.

As summarized in Table A.7-3, there have been no changes to these MCL-based groundwater cleanup goals since the ROD for OU-3 [U.S. Army 1996b]. Groundwater monitoring in OU-3 [FES 2015a] indicates that the three primary COCs (i.e., benzene, 1,2-dichloroethane, and 1,2-dibromoethane) generally remain above federal and state MCLs and therefore continued groundwater monitoring and ICs are necessary for the remedy to remain protective.

Soil ARAR Evaluation

The remedial action goal for in situ soils contaminated with volatile organic and petroleum compounds is the protection of groundwater. Because the soils are acting as a continuing source of contamination to groundwater, active remediation of the soils will continue until Safe Drinking Water Act levels are consistently met. Natural attenuation will continue until Alaska Water Quality Standards are achieved.

Petroleum contaminated soils that are treated ex-situ will be treated to State of Alaska Matrix Level A standards[1] before they are returned to the source area.

Although the ROD did not identify specific groundwater cleanup goals for petroleum hydrocarbons, AWQS and other applicable Alaska environmental regulations are referenced as ARARs. The ROD stated that active remediation would be used to achieve Safe Drinking Water Act levels and that natural attenuation would be used to achieve AWQS[2]. Natural attenuation will also be utilized to achieve other State of Alaska groundwater cleanup levels including diesel range organic (DRO) and gasoline range organic (GRO) concentrations.

OU-3 CONCLUSIONS

There are no newly promulgated or modified requirements of federal and state environmental laws that would change the protectiveness of the groundwater and soil remedies implemented at the Birch Hill Tank Farm (RA 1b), the Railroad Off-Loading Facility (RA 2), and Mileposts 2.7, 3.0, and 15.75 of the Fairbanks-Eielson Pipeline (RA 3) in OU-3 at Fort Wainwright.

OPERABLE UNIT 4 (OU-4)

OU-4 is comprised of two sites: Landfill and Coal Storage Yard.

Landfill (OU-4) and Coal Storage Yard (OU-4)

*The Record of Decision for Operable Unit 4, Fort Wainwright, Fairbanks Alaska [*U.S. Army 1996a] addressed potential risks to current and future hypothetical site users posed by soil and groundwater contamination.

[1] These standards are now calculated under Method One and can be found in Table A1 in 18 AAC 75.
[2] These standards can be found in 18 AAC 70 under (5) Petroleum Hydrocarbons, Oil and Grease, for Freshwater Uses. The cleanup level for groundwater that is hydraulically connected to surface water in total aromatic hydrocarbons (TAH) is 10 µg/L and total aqueous hydrocarbons (TAqH) is 15 µg/L. Wells that are hydraulically connected to the river are only located at the Railroad Off-Loading Facility (RA 2).

RAOs for groundwater at the Landfill and Coal Storage yard, identified in Sections 5.2.1.1 and 5.2.2.1 of the ROD for OU-4 [U.S. Army 1996a] are described below.

Groundwater

- Restore groundwater to its beneficial use of drinking water quality within a reasonable time frame.
- Reduce or prevent further migration of contaminated groundwater from the sources areas;
- Prevent use of groundwater containing contaminants at levels above Safe Drinking Water Act and State of Alaska Drinking Water Standard MCLs and Alaska Water Quality Standards.
- Use natural attenuation to attain Alaska Water Quality Standards (18 AAC 70).

In addition, a RAO for soil at the Coal Storage Yard, as identified in Section 5.2.2.2 of the ROD for OU-4 [U.S. Army 1996a], was to:

- Prevent migration of soil contaminants to groundwater that could result in groundwater contamination and exceedances of federal MCLs and AWQS (18 AAC 70).

The selected remedy at the Landfill consisted of:

- Capping with engineering controls of the inactive portion of the Landfill.
- ICs to prevent the use of contaminated groundwater and restrict site access (via fencing).
- Natural attenuation to attain Alaska Water Quality Standards (AWQS).
- A phased approach, implementation of an active groundwater treatment system (Phase 2), will be considered if capping does not result in a significant reduction of groundwater contaminants when evaluated at the five-year review.

The selected remedy at the Coal Storage Yard consisted of:

- In situ soil vapor extraction and air sparging of groundwater to remove solvent contaminants to a level that attains Safe Drinking Water Act levels.
- ICs to prevent the use of contaminated groundwater and restrict site access.
- Natural attenuation to attain AWQS.

Section 5.4 of the ROD for OU-4 [U.S. Army 1996a] identified the most significant ARARs for the remedy selections for the Landfill and Coal Storage yard to be:

- Federal (40 Code of Federal Regulations [CFR] 141) and State of Alaska (18 Alaska Administrative Code [AAC] 80) Maximum Contaminant Levels (MCLs) – relevant and appropriate for groundwater and sets the active groundwater remediation goals. The Alaska Water Quality Standards (AWQS; 18 AAC 70) also apply.
- Alaska oil pollution regulations (18 AAC 75) are applicable, and Alaska guidelines for non-UST petroleum-contaminated soil are to be considered. These guidelines require cleanup of petroleum-contaminated soils to protect groundwater quality.

Groundwater ARAR Evaluation for the Landfill

Seven groundwater COCs were identified for the Landfill in Table 5-1 of the ROD [U.S. Army 1996a]: benzene, cis-1,2-dichloroethene (cis-1,2-DCE), 1,1,2,2,-tetrachloroethane, 1,1,2-trichloroethane, trichloroethene, vinyl chloride, and bis(2-ethylhexylphthalate).

Federal and State of Alaska drinking water MCLs were adopted as groundwater cleanup goals for benzene, cis-1,2-dichloroethene (cis-1,2-DCE), trichloroethene, vinyl chloride, and bis(2-ethylhexylphthalate) at the Landfill. As summarized in Table A.7-4, there have been no changes to these MCL-based groundwater cleanup goals since the ROD for OU-4 [U.S. Army 1996a]. Groundwater monitoring in OU-4 [FES 2015c], performed at the Landfill since 1997, indicates that the generally remain above federal and state MCLs and therefore continued groundwater monitoring and ICs are necessary for the remedy to remain protective.

A risk-based concentration was identified as a cleanup goal for 1,1,2,2,-tetrachloroethane and is evaluated in Attachment 8 of this Five-Year Review Report.

Groundwater ARAR Evaluation for the Coal Storage Yard

Four groundwater COCs were identified for the Coal Storage Yard in Table 5-2 of the ROD [U.S. Army 1996a]: benzene, bis(2-ethylhexylphthalate), trichloroethene (TCE), and toluene. Federal and State of Alaska drinking water MCLs were adopted as groundwater cleanup goals for these COCs. As summarized in Table A.7-4, there have been no changes to these MCL-based groundwater cleanup goals since the ROD for OU-4 [U.S. Army 1996a]. As discussed in the 2012 Monitoring Report for OU-4 [FES 2013], the Coal Storage Yard source area has been designated as a no further action (NFA) site. Therefore groundwater monitoring and ICs are no longer necessary for the remedy to remain protective.

Soil ARAR Evaluation

Four soil cleanup goals[3] for the Coal Storage Yard were identified in Table 5-2 of the ROD for OU-4 [U.S. Army 1996a]: diesel range organics (DROs), gasoline-range organics (GROs), benzene, and BTEX.

The soil remedy to prevent contaminated soil from acting as an ongoing source of contamination, is in place. Therefore, these soil cleanup goals have been achieved and only the groundwater remedy continues.

OU-4 CONCLUSIONS

There are no newly promulgated or modified requirements of federal and state environmental laws that would change the protectiveness of the groundwater and soil remedies implemented at the Landfill and Coal Storage Yard at Fort Wainwright.

OPERABLE UNIT 5 (OU-5)

*The Record of Decision for Operable Unit 5, Fort Wainwright, Fairbanks Alaska [*U.S. Army 1999] addressed potential risks to current and future hypothetical site users posed by soil and groundwater contamination and unexploded ordnance (UXO) at the following sites:

- West Section, Former Quartermaster's Fueling System (WQFS)
- East Section, Former Quartermaster's Fueling System (EQFS)
- Remedial Area 1A (RA1A)
- Open Burn/Open Detonation (OB/OD) Area

[3] These standards are now calculated under Method One and can be found in Table A1 in 18 AAC 75.

RAOs for the WQFS, EQFS, and Remedial Area 1A source areas, as defined in Section 5.2 of the ROD for OU-5 [U.S. Army 1999] are described below.

<u>Soil</u>

- Prevent the migration to groundwater of soil contaminants that could result in groundwater contamination and exceedances of federal MCLs and nonzero maximum contaminant level goals (MCLGs) and to groundwater that is closely hydrologically connected to surface water (such as the Chena River) that could result in exceedances of Alaska Water Quality Standards in surface water (EQFS and WQFS).
- Limit human health and terrestrial receptor exposure to lead-contaminated soil (RA1A).

<u>Groundwater (WQFS and EQFS)</u>

- Restore groundwater to its beneficial uses within a reasonable time frame. Reduce or prevent further migration of contaminated groundwater from the source areas to the down gradient aquifer or surface water bodies that are closely hydrologically connected by achieving MCLs (where there are no nonzero MCLGs) and Alaska Water Quality Standards. For groundwater that is hydrologically connected to surface water, Alaska Water Quality Standards will apply for the following Fresh Water Uses: (1)(A) Water Supply; (1)(B) Water Recreation; and (1)(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife.
- Ensure there is no risk to aquatic receptors through control of contaminant movement through the groundwater into the Chena River.
- Remove floating product to the extent practicable to eliminate film or sheen from groundwater.
- Prevent use of groundwater containing contaminants at levels above Safe Drinking Water Act MCLs, nonzero MCLGs, or the following Alaska Water Quality Standards for Fresh Water Uses: (1)(A) Water Supply; (1)(B) Water Recreation; and (1)(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife.

<u>Chena River Sediment and Surface Water</u>

- Reduce sources of contaminant releases to the Chena River.
- Meet the following Alaska Water Quality Standards for Fresh Water Uses: (1)(A) Water "J Supply; (*1*)(B) Water Recreation; and (1)(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife.
- Continue aquatic assessment.

The selected remedies for the three subareas of the WQFS consisted of:

WQFS1:

- Source area AS/SVE system, ICs, and natural attenuation of groundwater until federal and state MCLs were achieved.

WQFS2:

- Hot-spot AS/SVE system, down gradient sparge curtain and harbor boom to minimize impacts to the Chena River, ICs and monitored natural attenuation until MCLs are achieved.

WQFS3:

- Hot-spot AS/SVE system, ICs, and natural attenuation of groundwater until federal and state MCLs were achieved.

The selected remedy at the EQFS consisted of:

- Operate AS and SVE wells, ICs, and long-term monitoring and natural attenuation of groundwater COCs.

The selected remedy at Remedial Area 1A and the OB/OD Area consisted of ICs.

Section 5.3 of the ROD for OU-5 [U.S. Army 1999] identified the most significant ARARs for the remedy selections for the OU-5 source areas to be:

- Federal (40 Code of Federal Regulations [CFR] 141) and State of Alaska (18 Alaska Administrative Code [AAC] 80) Maximum Contaminant Levels (MCLs) – relevant and appropriate for groundwater that is a potential drinking water source and sets the active groundwater remediation goals. The Alaska Water Quality Standards (AWQS; 18 AAC 70) also apply to surface water, sediment, and groundwater that is closely hydrogeologically connected to surface water.
- Alaska oil pollution regulations (18 AAC 75) are applicable and require the cleanup of oil or hazardous material releases.

These significant ARARs applied to the WQFS, EQFS, and associated Chena River. In addition, a cleanup goal of eliminating sheen associated with floating-product petroleum hydrocarbons in groundwater at the WQFS and EQFS and in surface waters of the Chena River was identified in Table 12 of the ROD for OU-5 [U.S. Army 1999]. This cleanup goal was mainly based upon compliance with the AWQS (18 AAC 70). No ARARs were identified for Remedial Area 1a.

Groundwater/Surface Water ARAR Evaluation for the WQFS, EQFS, and Chena River

Table 12 of the ROD for OU-5 [U.S. Army 1999] identified:

- Six groundwater COCs for the WQFS: 1,2-dichloroethane, benzene, toluene, DRO, GRO, and residual range organics (RRO).
- Five groundwater COCs for the EQFS: 1,2-dichloroethane, toluene, trichloroethene, 1,2-dibromoethane, and bis(2-chloroethyl)ether, DRO, and RRO.
- Two surface water COCs for the Chena River: TAH and TAqH.

Federal and State of Alaska drinking water MCLs were adopted as groundwater and surface water cleanup goals for all of these COCs with the exception of bis(2-chloroethyl)ether for the EQFS, which was risk-based and is evaluated further in Attachment 8 of this Fourth-Five-Year Review Report.

As summarized in Table A.7-5, there have been no changes to these MCL-based groundwater and surface water cleanup goals since the ROD for OU-5 [U.S. Army 1999], with the exception of GRO for the WQFS. The groundwater MCL for GRO increased from 1,300 µg/L listed in the ROD for OU-5 [U.S. Army 1999] to 2,200 µg/L listed in Table C of 18 AAC 75. Groundwater monitoring in OU-5 [FES 2015b] indicates that annual groundwater monitoring should continue in the wells associated with elevated benzene, wells along the Chena River, and the WQFS DRO plume. Therefore continued groundwater monitoring and ICs are necessary for the remedy to remain protective.

A harbor and absorbent boom system was deployed each year since 1998 to contain any potential sheen in the Chena River during ice-free months (typically May-early October). The primary purpose for deploying the boom was to capture any observable sheen from residual contamination remaining along the shores of the Chena River, in accordance with the AWQS (18 AAC 70). According to the 2014 monitoring report for OU-5 [FES 2015b], the Chena River boom was deployed on May 22, 2014 with visible sheen being observed within the boom area on Nay 28, 2014. On June 20 2014, the water levels the water level in the Chena River rose so high that the boom floated off of the supports and up against the riverbank. The water levels remained high throughout the summer, and the boom could not be redeployed. Therefore, no other sheen observations could be made. The boom was removed from the riverbank on October 3, 2014. Figure 3-3 of the 2014 monitoring report [FES 2015b] indicates that although limited sheen observations could be made in 2014 due to high water levels, sheen was observed in one of four inspections between May 22, 2014 (when the boom was deployed) and June 20, 2014 (when water levels rose and displaced the boom). Additionally, Table 3-6 of the 2014 monitoring report shows that sheen observations have steadily decreased since 2012. The 2014 monitoring report indicated that the Chena River boom would be deployed in 2015 and visual observations would continue in compliance with ARARs. Continued sheen observations and deployment of the Chena River boom are necessary for the remedy to remain protective until MCLs are achieved.

Soil ARAR Evaluation

Table 12 of the ROD for OU-5 [U.S. Army 1999] identified:

- Six soil COCs for the WQFS: DRO, GRO, benzene, ethylbenzene, toluene, and xylene
- Three soil COCs for the EQFS: DRO, GRO, and xylene

No COC-specific soil cleanup goals were listed in Table 12 of the ROD for OU-5 [U.S. Army 1999], but 18 AAC 75 was listed as the basis for the cleanup goals. These soil cleanup goals applied to the active remediation of soils until contaminant levels in groundwater were consistently below state and federal MCLs. The current soil cleanup goals are listed in the Under 40 inch Zone of Table B.1 in 18 AAC 75. The soil remedy to prevent contaminated soil from acting as an ongoing source of contamination, is in place. Therefore, these soil cleanup goals have been achieved and only the groundwater remedy continues.

UXO ARAR Evaluation

The OB/OD area is a land-based unit subject to the requirements of the Resource Conservation and Recovery Act (RCRA) [i.e. 40 CFR 265, Subparts G and P]. ICs to restrict land use and access are required for the OB/OD Area as result of the regulated unit being located within an operational range, which is and will continue to be subject to the deposition of intended use munitions that may pose an explosive hazard.

Section 7.3 of the ROD required that the Army evaluate the OB/OD area no less often than during CERCLA FYRs. This evaluation was to include 1) review of the active range and any UXO within the range to determine whether ICs are sufficiently protective and 2) review of RCRA rules and regulations for military ranges and UXO to determine whether additional RCRA requirements must be met.

The Military Munitions Rule (MMR) was published in the Federal Register on 12 February 1997 as an amendment to the Resource Conservation and Recovery Act (RCRA). EPA promulgated the MMR, deciding not to impose the regulatory requirements of RCRA Subtitle C on operational military ranges. Specifically, military munitions as they relate to solid waste and their intended use, are not discarded, not solid wastes under RCRA's Subtitle C regulations, and consequently not regulated as hazardous waste[4].

The MMR states that military munitions are not a solid waste for regulatory purposes (1) when a munition is used for its intended purpose, which includes when a munition is used for the training of military personnel and of explosives and emergency response specialists: when a munition is used for research, development, testing and evaluation; and when a munition is destroyed during certain range clearance operations; and (2) when an unused munition, including components thereof, is repaired, reused recycled, reclaimed or disassembled reconfigured, or otherwise subjected to materials recovery activities.

The MMR was issued prior to the OU-5 ROD [U.S. Army 1999]. The range has not been closed and will continue to be used as operational range into the reasonably anticipated future. The OB/OD area continues to be subject to deposition of munitions and munitions constituents, and the delay of closure of the OU-5 OB/OD unit continues to be appropriate.

On September 30, 2013, EPA issued a RCRA B Permit that became effective on November 15, 2013 and will remain in effect until November 14, 2023. The permit contained requirements for closure of the OB/OD area, which would not go into effect until the small-arms impacted range closes, in accordance with the closure performance standard, and procedures for amendment of the closure plan and notification and completion of closure. Per Part II.B of the permit, the Army is required to submit to the EPA, for review and approval, a revised closure plan at least 90 days (1) prior to the date when the use of the Range will cease, or (2) after a request from the Administrator. The revised closure plan must meet the requirements of RCRA [40 CFR 264.111 through 116]. In accordance with the permit, EPA requested a revised closure plan for the OB/OD Area on December 18, 2014. Therefore, the Army was required to submit a revised closure plan to EPA for review and approval on March 18, 2015 [i.e. 90 days from the request on December 18, 2014]. To date, EPA has yet to receive a revised closure plan for the OB/OD area.

No new RCRA or munitions' rules have been promulgated that would change the unregulated status of intended use munitions or UXO on the operational range. Additionally, there are no additional RCRA or munitions' rules that must be met specific to post-closure procedures for former OB/OD areas.

OU-5 CONCLUSIONS

There are no newly promulgated or modified requirements of federal and state environmental laws that would change the protectiveness of the groundwater, soil, or UXO remedies implemented in the OU-5 source term areas.

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[4] Reference: RCRA [40 CFR 266.202] – Definition of Solid Waste

OPERABLE UNIT 6 (OU-6)

*The Record of Decision for Operable Unit 6, Former Communications Site, Fort Wainwright, Alaska [*U.S. Army 2014] addressed potential risks to current and future hypothetical site users posed by soil and groundwater contamination at Former Communications Site (FCS).

RAOs for the FCS, as defined in Section 1.4 of the ROD for OU-6 [U.S. Army 2014] are described below.

- Protect against human exposure to COCs in soil.
- Protect against human exposure to COCs in groundwater.
- Return groundwater to its beneficial use as a drinking water source.

The selected remedy for the FCS consisted of groundwater sampling to monitor the progress of natural attenuation and ensure that contamination is not migrating toward the Post drinking water supply wells, and ICs that prohibit:

- excavation and removal of soil from the FCS without permission of the U.S. Army Department of Public Works (DPW) and concurrence of USEPA and the Alaska Department of Environmental Conservation (ADEC); and
- on-site groundwater use to eliminate human exposure to COCs.

Table B-1 of the ROD for OU-6 [U.S. Army 2014] identified the following chemical-specific ARARs for OU-6.

- Federal (40 Code of Federal Regulations [CFR] 141) Maximum Contaminant Levels (MCLs) – applicable for groundwater that is a potential drinking water source and sets the MCL for TCE.
- Alaska oil pollution regulations (18 AAC 75) are relevant and appropriate for groundwater that is a potential drinking water source and establishes groundwater cleanup goals for DRO, RRO, and 1,2,3-TCP.

Soil cleanup goals for two of the COCs listed in Table 1 of the ROD for OU-6 [U.S. Army 2014] (i.e. aluminum and manganese) were risk-based. A review of toxicity and risk assessment methodology changes to these risk-based groundwater cleanup goals is included in Attachment 8 of this Five-Year Review Report.

Groundwater ARAR Evaluation for the FCS

Table 2 of the ROD for OU-6 [U.S. Army 2014] identified four groundwater COCs for the FCS; 1,2,3-trichloropropane (1,2,3-TCP), DRO, RRO, and TCE. Federal and State of Alaska drinking water MCLs were adopted as groundwater cleanup goals for all of these COCs.

As summarized in Table A.7-6, there have been no changes to these MCL-based groundwater cleanup goals since the ROD for OU-6 [U.S. Army 2014]. Groundwater monitoring in OU-6 [U.S. Army 2004] indicates that biannual groundwater monitoring should continue in FCS wells associated with elevated 1,2,3-TCP, DRO, and RRO. Therefore continued groundwater monitoring and ICs are necessary for the remedy to remain protective.

Soil ARAR Evaluation

Table 1 of the ROD for OU-6 [U.S. Army 2014] identified five soil COCs for the FCS; 1,2,3-TCP, DRO, aluminum, copper, and manganese. Risk-based concentrations were identified as soil cleanup goals for aluminum and manganese and are evaluated in Attachment 8 of this Five-Year Review Report.

Soil cleanup goals for 1,2,3-TCP, DRO, and copper were based upon ADEC direct contact or inhalation risk-based cleanup levels listed in the Under 40 inch Zone of Tables B1 and B2 of 18 AAC 75. The selected remedy for FCS soil consisted of institutional controls to address risks associated with subsurface soil (i.e. greater than 6 inches in depth) contamination remaining at the FCS. These soil cleanup goals act to define the boundary where ICs apply to restrict the digging and removal of soil in a defined area (highlighted in Figure A-25 of the ROD for OU-6).

As summarized in Table A.7-6, there have been no changes to ADEC-based soil cleanup goals since the ROD for OU-6 [U.S. Army 2014] for 1,2,3-TCP and DRO. The ADEC-based soil cleanup goal for copper slightly decreased from 4,160 mg/kg [ROD for OU-6] to 4,100 mg/kg [Table B1 of 18 AAC 75 - revised as of May 8, 2016]. Since COCs remain in subsurface soil above the soil cleanup goals listed in Table 1 of the ROD for OU-6, continued ICs to restrict digging and removal of soil in these areas are required for the remedy to remain protective.

OU-6 CONCLUSIONS

There are no newly promulgated or modified requirements of federal and state environmental laws that would change the protectiveness of the soil or groundwater remedy implemented in OU-6.

References

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FES 2015a. *Draft 2014 Monitoring Report, Operable Unit 3, Fort Wainwright*, Alaska, September.

FES 2015b. *Draft 2014 Monitoring Report. Operable Unit 5, Fort Wainwright*, Alaska, June.

FES 2015c. *Draft 2014 Annual Sampling Report. Operable Unit 4, Fort Wainwright*, Alaska, June.

FES 2015d. *Draft 2014 Monitoring Report, Operable Unit 2, U.S. Army Garrison Fort Wainwright*, Alaska, May.

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U.S. Army 1999. *The Record of Decision for Operable Unit 5, Fort Wainwright, Fairbanks Alaska*, May.

U.S. Army 1997c. *The Record of Decision for Operable Unit 1, Fort Wainwright, Fairbanks Alaska*, June.

U.S. Army 1997b. *The Feasibility Study, Operable Unit 1, Fort Wainwright, Alaska*, February.

U.S. Army 1997a. *The Record of Decision for Operable Unit 2, Fort Wainwright, Fairbanks Alaska*, January.

U.S. Army 1996a. *The Record of Decision for Operable Unit 4, Fort Wainwright, Fairbanks Alaska,* August.

U.S. Army 1996b. *The Record of Decision for Operable Unit 3, Fort Wainwright, Fairbanks Alaska*, June.

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Table A.7-1: Remediation Goals for Chemicals of Concern in Operable Unit 1								
Fort Wainwright, Fairbanks, Alaska								
OU	Site Description	Media of Concern	Contaminant of Concern	Remediation Goal[1]	Units	Basis[2,3]	Current Remediation Goal	Cleanup Goal Change?[4]
1	801 Drum Burial Site	Groundwater	Aldrin	0.004	µg/L	RBC	0.05	-
			Dieldrin	0.004	µg/L	RBC	0.05	-
			1,1-Dichloroethene	7	µg/L	MCL	7	No
			Benzene	5	µg/L	MCL	5	No
			Vinyl Chloride	2	µg/L	MCL	2	No
			DRO[5]	**15**	µg/L	**ARAR[6]**	**1500**	**Yes**
			cis-1,2-dichloroethene	not listed in ROD	µg/L	MCL	70	-
		Surface and Subsurface Soil	Aldrin	3.8	mg/kg	RBC	0.3	-
			Dieldrin	4	mg/kg	RBC	0.32	-
			DRO[5]	**200**	**mg/kg**	**ARAR[6]**	**250**	**Yes**

DRO - diesel range organics
MCL - maximum contaminant level
mg/kg – milligrams per kilogram
OU – operable unit
RBC – risk-based concentration
ROD – record of decision
µg/L – micrograms per liter

[1] Table 7-1 of the *Record of Decision for Operable Unit 1, Fort Wainwright, Fairbanks Alaska* (U.S. Army 1997)

[2] Maximum Contaminant Levels (MCLs) from the National Drinking Water Regulations (40 CFR 14.61) and 18 AAC 75 Table C for groundwater; cleanup levels for migration-to-groundwater in the under 40-inch zone from 18 AAC 75 Table B1 for soils.

[3] Risk for groundwater COCs is based upon Federal or State of Alaska drinking water MCLs or an excess lifetime cancer risk of $1x10^{-4}$ for residential exposure scenario. Risk for soil COCs is based upon an excess lifetime cancer risk of 1x10-6 for residential exposure scenario.

[4] A review of toxicity and risk assessment methodology changes to the listed RBCs is included in Attachment 8 of this Five-Year Review Report.

[5] Note in Table 7-1 of the OU-1 ROD stated that "Diesel-range organics will be cleaned up to levels consistent with proposed State of Alaska regulations (18 AAC 75). Preliminary remediation goals for DRO in soil and groundwater were listed in Table 2-1 of the Feasibility Study for OU-1 (USACE 1997).

[6] The current State of Alaska DRO soil cleanup level for migration-to-groundwater in the under 40-inch zone can be found in Table B2 of 18 AAC 75 (revised as of May 8, 2016) and DRO groundwater cleanup level can be found in Table C of 18 AAC 75.

Table A.7-2: Remediation Goals for Chemicals of Concern in Operable Unit 2 Fort Wainwright, Fairbanks, Alaska								
OU	Site Description	Media of Concern	Contaminant of Concern	Remediation Goal[1]	Units	Basis[2]	Current MCL	Cleanup Goal Change?
2	DRMO Yard	Groundwater	Benzene	5	µg/L	Primary MCL, 18 AAC 80	5	No
			Trichloroethene	5	µg/L	Primary MCL, 18 AAC 80	5	No
			Tetrachloroethene	5	µg/L	Primary MCL, 18 AAC 80	5	No
			Vinyl chloride	2	µg/L	Primary MCL, 18 AAC 80	2	No
			1,1-DCE	7	µg/L	Primary MCL, 18 AAC 80	7	No
			cis-1,2-DCE	70	µg/L	Primary MCL, 18 AAC 80	70	No
	Bldg 1168 Leach Well	Groundwater	Benzene	5	µg/L	Primary MCL, 18 AAC 80	5	No
			Trichloroethene	5	µg/L	Primary MCL, 18 AAC 80	5	No
			Tetrachloroethene	5	µg/L	Primary MCL, 18 AAC 80	5	No
			Vinyl chloride	2	µg/L	Primary MCL, 18 AAC 80	2	No
			1,1-DCE	7	µg/L	Primary MCL, 18 AAC 80	7	No
			cis-1,2-DCE	70	µg/L	Primary MCL, 18 AAC 80	70	No

MCL - maximum contaminant level

OU – operable unit

µg/L – micrograms per liter

[1] Sections 7.1.2.1 and 7.2.3 of the *Record of Decision for Operable Unit 2, Fort Wainwright, Fairbanks Alaska* (U.S. Army 1997)

[2] Maximum Contaminant Levels (MCLs) from the National Drinking Water Regulations (40 CFR 14.61) and Table C of 18 AAC 75 (revised as of May 8, 2016) for groundwater.

Table A.7-3: Remediation Goals for Chemicals of Concern in Operable Unit 3 Fort Wainwright, Fairbanks, Alaska								
OU	Site Description	Media of Concern	Contaminant of Concern	Remediation Goal[1]	Units	Basis[2]	Current MCL	Cleanup Goal Change?
3	All	Groundwater	Benzene	5	µg/L	Primary MCL, 18 AAC 80	5	No
			Toluene	1,000	µg/L	Primary MCL, 18 AAC 80	1,000	No
			Ethylbenzene	700	µg/L	Primary MCL, 18 AAC 80	700	No
			1,2-Dibromoethane (EDB)	0.05	µg/L	Primary MCL, 18 AAC 80	0.05	No
			1,2-Dichloroethane (DCA)	5	µg/L	Primary MCL, 18 AAC 80	5	No
			1,2,4-Trimethylbenzene[3]	1850	µg/L	RBC	-	-
			1,3,5-Trimethylbenzene[3]	1850	µg/L	RBC	-	-

MCL - maximum contaminant level
RBC - risk-based concentration
OU – operable unit
µg/L – micrograms per liter

[1] Section 7.3.1 of the *Record of Decision for Operable Unit 3, Fort Wainwright, Fairbanks Alaska* (U.S. Army 1996)

[2] Maximum Contaminant Levels (MCLs) from the National Drinking Water Regulations (40 CFR 14.61) and Table C of 18 AAC 75 (revised as of May 8, 2016) for groundwater.

[3] The remediation goals listed in Section 7.3.1 of the Record of Decision for OU-3 (U.S. 1996) were corrected to 1.85 mg/L in Section 2.3 of the Explanation of Significant Differences for OU-3 (U.S. Army 2002).

Table A.7-4: Remediation Goals for Chemicals of Concern in Operable Unit 4 Fort Wainwright, Fairbanks, Alaska								
OU	**Site Description**	**Media of Concern**	**Contaminant of Concern**	**Remediation Goal[1]**	**Units**	**Basis[2]**	**Current MCL**	**Cleanup Goal Change?**
4	Landfill	Groundwater	Benzene	5	µg/L	Primary MCL, 18 AAC 80	5	No
			cis-1,2-Dichloroethane	70	µg/L	Primary MCL, 18 AAC 80	70	No
			1,1,2-Trichloroethane	5	µg/L	Primary MCL	5	No
			1,1,2,2-Tetrachloroethane	5.2	µg/L	RBC	4.3	-
			Trichloroethene	5	µg/L	Primary MCL, 18 AAC 80	5	No
			Vinyl chloride	2	µg/L	Primary MCL, 18 AAC 80	2	No
			Bis(2-Ethylhexyl)phthalate	6	µg/L	Primary MCL, 18 AAC 80	6	No
	Coal Storage Yard	Groundwater	Benzene	5	µg/L	Primary MCL, 18 AAC 80	5	No
			Bis(2-Ethylhexyl)phthalate	6	µg/L	Primary MCL, 18 AAC 80	6	No
			Trichloroethene	5	µg/L	Primary MCL, 18 AAC 80	5	No
			Toluene	1,000	µg/L	Primary MCL, 18 AAC 80	1,000	No

MCL - maximum contaminant level
RBC - risk-based concentration
OU – operable unit
µg/L – micrograms per liter

[1] Tables 5-1 and 5-2 of the *Record of Decision for Operable Unit 4, Fort Wainwright, Fairbanks Alaska* (U.S. Army 1996)

[2] Maximum Contaminant Levels (MCLs) from the National Drinking Water Regulations (40 CFR 14.61) and Table C of 18 AAC 75 (revised as of May 8, 2016) for groundwater.

Table A.7-5: Remediation Goals for Chemicals of Concern in Operable Unit 5
Fort Wainwright, Fairbanks, Alaska

OU	Site Description	Media of Concern	Contaminant of Concern	Remediation Goal[1]	Units	Basis[2]	Current MCL	Cleanup Goal Change?
5	WQFS	Groundwater	1,2-Dichloroethane	5	µg/L	Primary MCL, 18 AAC 80	5	No
			Benzene	5	µg/L	Primary MCL, 18 AAC 80	5	No
			Toluene	1,000	µg/L	Primary MCL, 18 AAC 80	1,000	No
			Diesel Range Organics	1,500	µg/L	18 AAC 75, Table C	1,500	No
			Gasoline Range Organics	**1,300**	**µg/L**	**18 AAC 75, Table C**	**2,200**	**Yes**
			Residual Range Organics	1,100	µg/L	18 AAC 75, Table C	1,100	No
	EQFS	Groundwater	1,2-Dichloroethane	5	µg/L	Primary MCL, 18 AAC 80	5	No
			Toluene	1,000	µg/L	Primary MCL, 18 AAC 80	1,000	No
			Trichloroethene	5	µg/L	Primary MCL, 18 AAC 80	5	No
			1,2-Dibromoethane	0.05	µg/L	Primary MCL, 18 AAC 80	0.05	No
			bis(2-chloroethyl)ether	0.0092	µg/L	RBC	0.77	-
	Chena River	Surface Water	Total Aromatic Hydrocarbon	10	µg/L	Clean Water Act and 18 AAC 70	10	No
			Total Aqueous Hydrocarbon	15	µg/L	Clean Water Act and 18 AAC 70	15	No

MCL - maximum contaminant level

RBC - risk-based concentration

OU – operable unit

µg/L – micrograms per liter

[1] Table 12 of the *Record of Decision for Operable Unit 5, Fort Wainwright, Fairbanks Alaska* (U.S. Army 1999)

[2] Maximum Contaminant Levels (MCLs) from the National and State Drinking Water Regulations (40 CFR 14.61 and 18 AAC 80) and Table C of 18 AAC 75 (revised as of May 8, 2016) for groundwater.

Table A.7-6: Remediation Goals for Chemicals of Concern in Operable Unit 6 Fort Wainwright, Fairbanks, Alaska								
OU	**Site Description**	**Media of Concern**	**Contaminant of Concern**	**Remediation Goal (RD)[1]**	**Units**	**Basis[2]**	**Current RG**	**RG Change?**
6	FCS	Soil	1,2,3-Trichloropropane (1,2,3-TCP)	0.17	mg/kg	18 AAC 75, Table B1	0.17	No
			Diesel Range Organics (DRO)	10,250	mg/kg	18 AAC 75, Table B2	10,250	No
			Aluminum	77,000	mg/kg	RBC	-	-
			Copper	**4,160**	**mg/kg**	**18 AAC 75, Table B1**	**4,100**	**Yes**
			Manganese	1,800	mg/kg	RBC	-	-
		Groundwater	1,2,3-Trichloropropane (1,2,3-TCP)	0.12	µg/L	18 AAC 75, Table C	0.12	No
			Diesel Range Organics (DRO)	1,500	µg/L	18 AAC 75, Table C	1,500	No
			Residual Range Organics (RRO)	1,100	µg/L	18 AAC 75, Table C	1,100	No
			Trichloroethene (TCE)	5	µg/L	Primary MCL	5	No

FCS - Former Comminucations Site
OU – operable unit
MCL - maximum contaminant level
µg/L – micrograms per liter

[1] Table 1 (soil) and Table 2 (groundwater) of the *Record of Decision for Operable Unit 6, Former Communications Site, Fort Wainwright, Alaska* (U.S. Army 2014)

[2] Maximum Contaminant Levels (MCLs) from the National and State Drinking Water Regulations (40 CFR 14.61) and Tables B1 and B2 (soil) and Table C (groundwater) of 18 AAC 75 (revised as of May 8, 2016).

ATTACHMENT 8

Risk Assessment and Toxicology Evaluation

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Risk Assessment and Toxicology Evaluation

This evaluation was prepared to address Question B of the statement of service, *"Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of the remedy selection still valid?"*

This is the fourth five year review report for Operable Units (OU's) 1, 2, 3, 4, and 5 at Fort Wainwright Alaska (FWA). Previous five year reviews did not explicitly evaluate changes in the exposure assumptions, toxicity data, and associated risk-based cleanup levels; this is the first time this level of review is completed.

Note that for all of the OUs, older exposure factor values were utilized in assessing risk than what is currently recommended by the USEPA (USEPA 2014). However, the newly recommended exposure parameter values are generally less conservative than what was used in the past, and would not affect the protectiveness of the remedy. Therefore, this review will focus on aspects of updates to risk assessment methodology and toxicity criteria changes that may have occurred that could affect the protectiveness of the remedy.

Most of the cleanup goals for FWA are based on applicable or relevant and appropriate regulations (ARARs). The review of ARAR-based changes and related potential effects on cleanup goals is provided in Attachment 7. By definition, an ARAR-based cleanup goal is deemed protective. However, a review of changes to toxicity criteria is provided for all human health constituents of concern (COC). Table A.8-1 indicates whether or not there have been recent changes to toxicity criteria for each COC. For compounds that have risk-based cleanup goals, additional discussion of any toxicity criteria changes and effects on cleanup goals are discussed in conjunction with the OU-specific sections below.

For the eight compounds which have ARAR-based cleanup goals and recent toxicity changes, Table A.8-2 is presented which compares how those recent toxicity changes would translate into risk-based screening levels (use of the updated toxicity criteria by USEPA to develop risk-based concentrations for tapwater) vs. current ARAR-based cleanup levels. As indicated in Table A.8-2, the tapwater risk-based concentrations (developed within the acceptable cancer risk range and/or an acceptable hazard index of 1 for non-carcinogenic health effects) would be greater than the ARAR-based cleanup level (MCL) for six compounds. This indicates that the ARAR-based cleanup goal remains protective at those risk targets. For the other two compounds (trichloroethene and cis-1,2-dichloroethene), the non-cancer risk-based concentration for tapwater is slightly lower than the ARAR-based cleanup goal[1]. However, as the tapwater hazard index for each of these compounds would still approach 1 (e.g., be below 2) if the tapwater concentration equaled the MCL (5 ppb for TCE and 70 ppb for cis-1,2-DCE), the MCL remains protective, given the uncertainties surrounding both the toxicity assessments and the generic exposure assessments used in this risk characterization. A site-specific assessment for current exposures would indicate acceptable risk, as the on-site groundwater is not currently used for drinking water purposes. Regarding uncertainties in the toxicity assessments for these compounds, for TCE, the tapwater risk-based concentration is driven by the inhalation route for non-cancer health effects. Composite uncertainty factors of 10 and 100 were applied in developing the inhalation reference concentration for TCE (USEPA 2011). For cis-1,2-DCE, the tapwater risk-based concentration is driven by the ingestion route for non-cancer health effects.

[1] The TCE MCL became effective in 1989, and the MCL for cis-1,2-DCE became effective in 1992.

A composite uncertainty factor of 3,000 was applied to the oral reference dose for cis-1,2-DCE (USEPA 2010). Comparisons of current vs. previous toxicity criteria factors for TCE and cis-1,2-DCE are provided in Table A.8-3. A re-evaluation of the cleanup goals for TCE and DCE is not warranted until such a time that the ARAR itself may be revised.

One risk assessment methodology change that has occurred since the RODs were signed for OU's 1, 2, 3, 4, and 5 is an update to guidance concerning the vapor intrusion pathway (USEPA 2015b, 2016a; ADEC 2012). In the latest guidance, the U.S. Environmental Protection Agency (USEPA) recommends that all volatile constituents be evaluated for their potential to pose vapor intrusion risks when they are found in the subsurface below or near occupied buildings. In addition, conservative media-specific vapor intrusion screening levels (VISLs) have been developed by both the USEPA and the Alaska Department of Environmental Conservation (ADEC) to assist in identifying sites that warrant further evaluation of the vapor intrusion pathway. In some instances, the most conservative and generic VISLs for identifying volatile constituents in groundwater that may pose vapor intrusion risks that are lower than the USEPA's maximum contaminant level (MCL) for drinking water. In its latest guidance on the vapor intrusion pathway, the USEPA recommends that *"When groundwater is the subsurface vapor source, USEPA generally recommends comparing groundwater concentrations to the VISLs to estimate the boundaries of the plume, when contaminated groundwater is a subsurface vapor source, for purposes of establishing the boundaries of the vapor intrusion inclusion zone"* (USEPA 2015b). To clarify, the USEPA notes that, *"Among other possibilities, vapor intrusion impacts observed to occur at distances greater than 100 feet in the absence of a preferential migration route(s) may reflect imprecision in the interpolated edge of a plume, based upon sampling data from sparse monitoring wells, and/or use of screening levels for drinking water, rather than for vapor intrusion (i.e., vapor intrusion screening level, VISL), to delineate a plume's extent."* The USEPA developed a calculator that can be used to update the VISL using latest toxicity parameters for constituents; it can be modified to reflect site-specific groundwater temperature that will affect the volatilization rate of constituents from groundwater to air inside a building (USEPA 2016a). Table A.8-4 compares the USEPA's groundwater VISL (developed assuming a groundwater temperature of 5 degrees Celsius [ºC], which is an approximate average groundwater temperature at FWA) and the ADEC generic groundwater VISL. Groundwater MCLs, which were used as cleanup goals in the RODs, are provided for comparison in Table A.8-4.

The following sections review the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) at each OU. The USEPA's current VISLs are used to evaluate potential vapor intrusion risks because these potential exposures were not evaluated according to the USEPA's latest guidance on vapor intrusion at the time of remedy selection.

OU-1

Human Health

The OU-1 ROD was signed in 1997 and addressed soil and groundwater contamination. It contains a thorough summary of the earlier baseline risk assessment that was performed for the site. The RAOs from the ROD were designed to:

- Ensure that groundwater meets state and federal drinking water standards.
- Prevent buried drums and contaminated soil from continuing to act as a source of groundwater contamination.

- Reduce risks associated with exposure to contaminants in drums and soil.
- Minimize potential contaminant migration to the Chena River and downgradient drinking water wells.

The cleanup goals for soil and groundwater established in the ROD were reviewed to determine if there have been any changes in exposure assumptions, toxicity data, and/or risk-based cleanup levels that would affect the protectiveness of the remedy. Some of the cleanup goals were based on drinking water regulations (e.g., the cleanup goals for 1,1-dichloroethene, benzene, and vinyl chloride in groundwater), but others (aldrin and dieldrin in soil and groundwater) were based on the site-specific risk assessment, as no regulations were in place at the time of the ROD. Any changes in the regulations that would affect the cleanup goals are reviewed in Attachment 7.

Table A.8-5 presents the risk-based cleanup goals for aldrin and dieldrin that were established in the 1997 ROD, as well as the current USEPA risk based screening levels (USEPA 2015c). Table A.8-5 also indicates that the toxicity criteria used to develop risk-based cleanup goals for aldrin and dieldrin have not changed since the late 1980's. Any USEPA-recommended changes in the risk-based cleanup goals that are shown in Table A.8-5 for these two pesticides are therefore a result of evolving guidance regarding exposure assumptions (e.g., updates to recommended default exposure parameters, USEPA 2014a) as well as risk characterization for both the dermal and inhalation exposure pathways (USEPA 2004 and 2009a). The original exposure assumption used in the 1997 ROD assumed a residential soil exposure frequency of 200 days per year, instead of the USEPA default 350 days per year, because the ground would be frozen and/or snow covered for the remaining period. (This is approximately five months of snow covered/frozen ground per year.) This exposure assumption is still valid. The currently recommended USEPA generic risk-based screening levels for aldrin and dieldrin for both soil and groundwater were adjusted by a factor of 350/200 to make this Alaska-specific adjustment to the risk-based screening level. The current Alaska-adjusted USEPA risk based screening levels are comparable to, or slightly greater than, the soil and groundwater risk-based cleanup goals identified in the ROD. Therefore, the cleanup goals continue to be protective for direct exposure to aldrin and dieldrin in soil and groundwater.

The ROD stated that current and future land uses at the 801 Drum Burial Site are recreational due to the site's proximity to the Chena River (contamination is located on the flood plain). This still appears to be the case, as the land directly over the 801 Drum Burial Site remains vacant and the 801 Military Housing Area is directly across River Road from the site. Therefore, there is limited exposure to soil at this location. In addition, maximum detected concentrations of aldrin and dieldrin in surface soil samples taken in the 1996 RI and Supplemental Investigation Report (1997) are generally below the risk-based concentrations that were identified as cleanup goals protective of direct soil contact exposures in the ROD (Table A.8-5). Consequently, the remedy remains protective of direct contact soil exposures.

In 2004, a Cleanup Operations and Site Exist Strategy (CLOSES) evaluation for the 801 Drum Burial Site was prepared (CH2M HILL 2004b). The goal of CLOSES evaluation was a comprehensive assessment of monitoring data using diagnostic tools to develop cost-effective system operation and maintenance strategy. This report provided the following observations:

- The soil source was mostly removed and residual soil contamination is all that remains.
- All of the drums have been removed; this is supported by the results of multiple geophysical surveys and removal actions.

- Remaining contamination at the site is limited to residual soils left after the removal actions. Soil samples have not been collected since the excavation and drum removal activities in 1995 and 1996. Therefore, it is not possible to determine whether soil concentrations within the source area have decreased since these remedial activities. However, removal of the drums and contaminated soils suggest that the majority of the soil within the source was removed during these activities.
- Based on these determinations, the RAOs for the site have been met as best as practicable. Although there continue to be exceedances in groundwater, this is due to residual soils that were left after the removal actions.

Groundwater wells that supply drinking water for the Golden Heart Utilities water system (which supplies water to the 801 Military Housing Area – currently designated as the Birchwood Housing Area) and the City of Fairbanks are located downgradient of the site. Institutional controls are in place to ensure that groundwater wells are not installed on the site for drinking water purposes. Perimeter monitoring wells do not indicate that contaminants are migrating from the source area to the Chena River or to the 801 Military Housing Area.

Section 5.3 of the ROD indicates that the soil cleanup goals are considered to be protective of groundwater quality *"based on the fate and transport model conducted by the United States EPA"*. No further information regarding this fate and transport modeling is provided in the ROD.

One pathway that was not explicitly evaluated at the time of the ROD, nor during subsequent monitoring, is the vapor intrusion pathway. Groundwater beneath the 801 Drum Burial Site flows towards the housing area at least some times during the year (groundwater flow direction is affected seasonally by the river stage). The depth to groundwater is approximately 5 to 15 feet below ground surface. According to the USEPA's latest guidance for assessing the vapor intrusion pathway from subsurface vapor source to indoor air, all constituents that are volatile must be evaluated for the potential to cause a complete exposure the vapor intrusion pathway. All of the OU-1 COCs are considered volatile with the exception of dieldrin, although inhalation pathway toxicity criteria are not available for all of the volatile organic compounds (VOCs). The 801 Military Housing Area is the only potential receptor under the vapor intrusion pathway. Table A.8-6 compares the 2015 groundwater sampling results to VISLs developed by the USEPA and ADEC (USEPA 2016a, ADEC 2012, FES 2015c). It shows that only 1,2,4-trimethylbenzene (TMB) detected in wells AP-6327 and AP-1010 exceeds the USEPA VISL. Benzene concentrations in these wells exceed the ADEC VISL, but not the more recently developed USEPA VISL. Well AP-6326 is closer to the 801 housing development than well AP-6327, and at that well location, neither of those VOCs exceed either the USEPA or the ADEC VISLs. At well AP-6326, the reported concentration of cis-1,2-dichloroethylene (cis-1,2-DCE) exceeds the ADEC VISL. The USEPA does not have a corresponding VISL for cis-1,2-DCE due to the lack of a USEPA-approved inhalation toxicity criteria for this compound. This footnote appears to Appendix D, Target Levels for Indoor Air in the ADEC's VI Guidance 2012: *"DEC generally calculates indoor air target levels based on the methods, toxicity information, and exposure parameters provided in the USEPA Regional Screening Levels. However, DEC also calculated target levels for a few compounds not addressed by the USEPA. For chemical-specific information regarding calculation of the indoor air target levels, contact DEC"*. The USEPA's 2010 toxicological review of cis-1,2-DCE indicates that, *"There are no human, chronic, or subchronic inhalation studies for cis-1,2-DCE. The inhalation toxicity database for* *cis-1,2-DCE is limited to an acute study performed in 1999 in male and female rats... Therefore, in the absence of repeat-dose toxicity studies, the available inhalation data for cis-1,2-DCE do not support derivation of an RfC. An inhalation assessment for cis-1,2-DCE was not previously developed for the IRIS database"* (USEPA 2010). Furthermore, the USEPA 2015 RSL table does not provide an indoor air RSL for cis-1,2-DCE, as no toxicity criteria from any of the USEPA-approved three tiers of toxicity criteria are provided (USEPA 2015c, 2003b). Without further information from ADEC, the derivation of a VISL for 1,2-cis-DCE cannot be verified. The lack of verifiable toxicity criteria for the inhalation pathway for 1,2-cis-DCE indicates that risks cannot be quantified for this pathway for this compound. In addition, as stated above, no VOCs exceed USEPA VISL at well AP-6326, which is the closest well to the housing development.

Because the housing development is downgradient of groundwater that contains elevated VOCs in wells AP-6326 and AP-6327, and the full nature and extent of groundwater contamination in this area does not appear to be well defined from the groundwater results provided in the last five years (e.g., wells that surround wells AP-6326 and AP-6327 have not been sampled for VOCs in the past 10 years), there is uncertainty whether or not a vapor intrusion issue is present in the 801 Military Housing Area. The nearest building to well AP-6326 appears to be approximately 220 feet away. Since neither of the wells on the west side of River Road (i.e. closer to the housing units) were sampled for VOCs in 2015, it is recommended that future sampling events include analysis of samples obtained from AP10042-MW and AP-7162 for VOCs.

Significant Finding

For the two constituents that have risk-based cleanup goals, the exposure assumptions, toxicity criteria, and RAOs used at the time of the remedy are still valid.

Ecological

The main source area addressed under the 801 Drum Burial Site is within the 100-year floodplain of the Chena River. No threatened or endangered species reside in the area. The screening level ecological risk assessment concluded that surface soil exposure is not likely to pose a significant risk to small mammals at the site. It also concluded that burrowing animals are not exposed to risk at the site.

Results of the Chena River surface water and sediment screening suggest that these media do not pose an unacceptable risk to aquatic ecological receptors. This ecological issue will be further discussed in conjunction with OU-5.

OU-2

Human Health

The OU-2 ROD was signed in 1997. It addressed soil and groundwater contamination at two areas with OU-2, the Building 1168 Leach Well site and the Defense Reutilization Maintenance (DRMO) Yard. The ROD contains a thorough summary of the earlier baseline risk assessment that was performed for the site. The RAOs in the ROD were established to:

- Restore groundwater to drinking water quality.
- Prevent further leaching of contaminants into groundwater.
- Reduce of prevent further off-site migration of contaminated groundwater.

- Prevent use of groundwater above federal Safe Drinking Water Act and State of Alaska Drinking Water Standards MCLs.

A baseline risk assessment for the site evaluated potential residential and industrial exposures directly to contaminated soil and groundwater at OU-2. An evaluation of applicable or relevant and appropriate requirement (ARAR)-based cleanup goals for OU-2 is provided in Attachment 7; none of the cleanup goals are risk-based. Although the RAOs used at the time of the remedy selection remain valid, the exposure assumptions utilized at the time of the ROD did not consider the vapor intrusion pathway.

The Building 1168 leach well area is situated between two housing developments; the Birchwood Homes housing area is located directly south of Building 1168 and the Sitku Basin housing area is located directly to the north of Building 1168. Groundwater flow is generally to the northwest in this area, although flow direction fluctuations do occur. The latest groundwater monitoring data (FES 2014b) were compared to VISLs developed by the USEPA and ADEC (Table A.8-7). Although one of the groundwater samples collected from well PS-23 in 2010 had a benzene concentration that slightly exceeded the ADEC's VISL, the current USEPA VISL for $5^{o}C$ groundwater was not exceeded. None of the groundwater samples exceeded VISL for any other constituents of concern (COCs) in the area.

The DMRO Yard consists of some actively used commercial buildings (Building 5010). Groundwater monitoring results presented in the draft 2014 monitoring report (FES 2014b) were compared to VISL in Table A.8-8. None of the samples obtained in OU-2 since 2009 exceed any of the VISLs. Furthermore, there are no currently occupied buildings near well PO5 and the downgradient and upgradient wells (Probe B and AP-8916, respectively) do not contain trichloroethene (TCE) above its VISL. Therefore, vapor intrusion should not be a concern anywhere in OU-2.

Significant Finding

The RAOs and exposure assumptions used at the time of the remedy selection remain valid. The 1994 – 1997 soil sampling from the Building 1168 Leach Well indicated that the soil source term was decreasing as a result treatment by an air sparge/soil vapor extraction (AS/SVE) system (CH2M HILL 2003). Although the vapor intrusion pathway was not explicitly evaluated at this OU at the time of the ROD, the current concentrations of VOCs in groundwater do not exceed the VISLs and vapor intrusion should not be a concern at commercial buildings in DMRO Yard or at the neighboring residential housing units.

Ecological

A screening level ecological risk assessment was performed for OU-2. It indicated that no complete ecological exposure pathways existed at the Building 1168 Leach Well site. Although the DMRO Yard source area is an industrial area, potential ecological risks were evaluated. The ecological risk assessment concluded that overall, there do not appear to be unacceptable potential ecological risks associated with the DRMO Yard source area.

OU-3

Human Health

The OU-3 RAO's were established in a 1996 ROD and confirmed in a 2002 Explanation of Significant Differences (ESD).

Groundwater

- Restore to drinking water quality within a reasonable time.
- Reduce further migration of contaminated groundwater.
- Prevent use when concentrations exceed Safe Drinking Water Act levels.

Soil

- For petroleum-contaminated soil, prevent migration of contaminants from soil into groundwater that would result in groundwater contamination and exceedance of Safe Drinking Water Act standards.

Review of risk-based cleanup goals for TMBs: The cleanup goals for soil and groundwater established in the 1996 ROD and 2002 ESD were reviewed to determine if there have been any changes in exposure assumptions, toxicity data, and/or cleanup levels that would affect the protectiveness of the remedy. Some of the cleanup goals were based on regulations. Any changes in the regulations that would affect these cleanup goals are reviewed in Attachment 7. The cleanup goals for 1,2,4-TMB and 1,3,5-TMB were based on the site-specific risk assessment, as no regulations were in place at the time of the ROD.

Table A.8-9 presents the risk-based cleanup goals for 1,2,4-TMB and 1,3,5-TMB that were established in the 1996 ROD, the clarification to those cleanup goals presented in the 2002 ESD, as well as the current USEPA risk based screening levels available at the time this report was drafted (USEPA 2016). Table A.8-9 also presents the toxicity criteria used to develop these risk-based cleanup goals. Inhalation toxicity criteria for non-cancer health effects that pre-date the USEPA's Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment) (USEPA 2009a) are in the form of a inhalation reference dose (RfDi, mg/kg-day), while the newer inhalation toxicity criteria for non-cancer health effects are in the form of an inhalation reference concentration (RfCi, mg/m^3). In order to make a direct comparison among older and new inhalation toxicity criteria, the older RfDi were converted to RfCi by using a standard adult body weight (70 kg) and daily inhalation rate of 20 m^3/day in Table A.8-9.

As seen in Table A.8-9, the provisional RfCi's for both TMBs have slightly increased over time, indicating that the TMBs appear to be slightly less toxic now than when they were first evaluated in the 1994 Risk Assessment. Therefore, although the toxicity criteria have changed over time, this change in toxicity criteria alone does not affect protectiveness of the remedy. The current provisional inhalation reference concentration is a provisional peer-reviewed toxicity value (PPRTV)[2] for 1,2,4-TMB, which was developed in 2007. The final IRIS assessment includes a new oral toxicity criteria for 1,2,4-TMB.

For 1,3,5-TMB, no chronic pRfCi PPRTV could be derived, due to the lack of suitable peer-reviewed toxicity criteria. However, a subchronic pRfCi is presented in the PPRTV documentation. This subchronic pRfCi includes a composite uncertainty factor of 3,000. A subchronic RfCi may typically be extrapolated to a chronic RfCi, which would be appropriate to

[2] The USEPA's standard database for toxicity criteria, the Integrated Risk Information System (IRIS, USEPA 2015d) has not included toxicity criteria for TMBs. When toxicity criteria in IRIS is lacking, USEPA's Superfund Program will use provisional peer-reviewed toxicity values (PPRTV) which have been developed by USEPA but not yet undergone the multi-program consensus review provided for IRIS toxicity criteria.

use in a CERCLA risk assessment, by applying an additional uncertainty factor of 10. This would increase the total composite uncertainty factor to 30,000, which is greater than the limit of 10,000 that the USEPA generally considers to be appropriate in developing reference values. Therefore, no chronic RfCi is presented in the PPRTV. For oral exposures, screening level toxicity criteria for non-cancer health endpoints (an oral reference dose) are provided in an appendix to the PPRTV documentation. These screening level toxicity criteria are generally not suitable for use in quantifying risk, although the USEPA RSLs incorporate these appendix screening PPRTV values. Due to the uncertainty inherent in these PPRTV screening toxicity values, the U.S. Army's position is that they are unusable in quantitative risk assessment, as they do not fit into the hierarchy for toxicity values specified in DoD Instruction 4715.18 titled Emerging Contaminants (DOD 2009). Furthermore, the USEPA is in the process of developing new toxicity criteria for 1,3,5-TMB in its Integrated Risk Information System (IRIS). As part of their review of the toxicity for 1,3,5-TMB, it commissioned a peer-review of the oral toxicity studies that were utilized in the Appendix to the PPRTV. That review rejected used of the oral toxicity studies as being inadequate (USEPA 2013). Therefore, the screening level pRfDo presented in the PPRTV (Table A.8-9) should not be used for quantifying risk or developing a risk-based concentration at FWA. The final IRIS assessment includes a new oral toxicity criteria for 1,3,5-TMB.

Since the cleanup goals for 1,2,4-TMB and 1,3,5-TMB were developed as risk-based concentrations, the exposure assessment used as a basis of the risk assessment performed as part of the 1994 Remedial Investigation was also reviewed. In the 1994 Risk Assessment Report, it is explained that an assumed future resident would be exposed to contaminated groundwater at the site (while using groundwater as a drinking water source, i.e., tapwater) via three different exposure pathways: ingestion, dermal, and inhalation of volatiles during showering or washing dishes with tapwater (E&E 1994). The risk-based concentrations that were identified in the 1996 OU 3 ROD for 1,2,4-TMB and 1,3,5-TMB (14 and 12 parts per billion or µg/L, respectively) were described as assuming *"residential groundwater ingestion, inhalation, and dermal contact, and is based on a hazard quotient of 1."*

These risk-based concentrations were reviewed and revised as part of the 2002 ESD, which provided a clarification for the risk-based cleanup goals identified for these two TMBs. The ESD stated, *"The remedial goals for 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene are based on a risk-based concentration (RBC) equivalent to a noncancer hazard quotient of 1 using a residential groundwater exposure assumption. The values established in the ROD were erroneously selected from the wrong column in the Region 3, RBC tables. The values listed in the ROD for 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene, 0.014 mg/l and 0.012 mg/l, respectively, correspond to an inhalation pathway. The residential groundwater assumptions in the RI/FS correspond to a remedial goal of 1.85 mg/l for both compounds."*

While the statement in the 2002 ESD is true that the lower risk-based concentrations identified in the quote above do correspond to levels protective of inhalation exposures to residential tapwater use, from a risk technical perspective, this five-year review believes that elimination of the inhalation pathway in the ESD was an error. This is because the 1994 baseline risk assessment clearly considered residential inhalation of volatiles from tapwater to be a complete exposure pathway which was quantified in characterizing the baseline risk from exposure to site contaminants. Therefore, the change in risk-based cleanup goals for the TMBs in the ESD was not justified. If these changes were based upon risk management considerations, none were described in available documentation.

The cleanup goals for 1,2,4-TMB and 1,3,5-TMB should be reviewed. This re-evaluation may identify risk-based concentrations as the cleanup goals. Since the USEPA was revising its IRIS toxicity assessment for TMBs at the time this report was being drafted (USEPA 2015e), the re-evaluation of a risk-based concentration would benefit from waiting until the IRIS assessments are complete. Alternatively, this re-evaluation may consider adopting the groundwater cleanup goals for 1,2,4-TMB and 1,3,5-TMB identified in the Alaska regulations 18 AAC 75. They are identical to the groundwater cleanup goals identified in the 2002 ESD.

Note that as this report was being finalized, the IRIS assessments for these two compounds were released as final (USEPA 2016b). The finalized IRIS toxicity criteria are also presented in Table A.8-9. These are the toxicity criteria that should be used in developing new risk-based concentrations, unless a decision is made to adopt the ARAR based values as cleanup goals. The values of these final IRIS toxicity criteria do not change the interpretation of the risk-based cleanup goals provided above, and they support the recommendation to re-evaluate risk-based cleanup goal development for these compounds.

Vapor Intrusion Review

As for OU-1 and OU-2, the potential for vapor intrusion was evaluated at OU-3 using the latest USEPA and ADEC guidance on vapor intrusion. The only potential areas of the site that could have a potential vapor intrusion issue are those areas in which a currently occupied building exists, and in the case of OU-3, this is the area adjacent to Remedial Area 1B, just off the site. The results of sampling the off-site wells (FES 2015a) were reviewed and compared to USEPA and ADEC VISL. Only those wells screened in the alluvial aquifer in this region of the site would have the potential to pose vapor intrusion concerns; wells screened in the bedrock aquifer were assumed to not pose vapor intrusion risks, as any vapors emanating from this deeper zone would be attenuated by the presence of groundwater and/or permafrost in the subsurface above this area before reaching potential residential receptors. However, to be conservative, the sampling results from these bedrock well results were also screened against VISL. Table A.8-10 presents this evaluation. No off-site groundwater sampling results exceed any VISL and vapor intrusion is not a concern at OU-3.

Ecological

An ecological risk assessment was performed for OU-3 at the time of the 1996 ROD and concluded that lead concentrations in surface soil around the tank farm could pose a potential risk to wildlife. This will be mitigated by removal of lead contaminated soil, which is addressed in the OU-5 discussion.

Significant Finding

Not all of the exposure assumptions, toxicity data, cleanup levels, and RAOs established at the time of the remedy remain valid. The major exposure assumptions for current and future potential land use have not changed. In addition, although potential vapor intrusion risks to off-site residents were not evaluated at the time of the remedy, groundwater concentrations in that area of OU-3 remain below very conservative vapor intrusion levels and vapor intrusion is not a concern. The toxicity criteria used to develop risk-based concentrations for 1,2,4-TMB and

1,3,5-TMB have been updated since the cleanup goals were identified in the 1996 ROD and changed in the 2002 ESD. These toxicity changes do not indicate that the TMBs are more toxic now than previously assumed, so the toxicity changes do not affect the protectiveness of the remedy. However, from a technical perspective, the five-year review believes that elimination of the inhalation pathway from the development of TMB cleanup goals in the ESD was an error. This is because the 1994 baseline risk assessment clearly considered residential inhalation of volatiles from tapwater to be a complete exposure pathway, which was quantified in characterizing the baseline risk from exposure to site contaminants. Therefore, the change in TMB risk-based cleanup goals in the ESD was not justified; they should not have been increased by over a factor of 100. As land use controls are in place to prevent ingestion of groundwater, the remedy remains protective in the short term. If the groundwater would be used as a source of residential tapwater, the cleanup goals may not be fully protective. In order for the remedy to remain protective in the long-term, the cleanup goals for 1,2,4- TMB and 1,3,5- TMB should be re-evaluated. This re-evaluation may identify a risk-based concentration as the cleanup goal and should consider all relevant complete exposure pathways to residential exposure to tapwater, including ingestion, inhalation, and dermal exposure. Since the USEPA recently released as final an IRIS toxicity assessment for TMBs, the re-evaluation of a risk-based concentration should incorporate the final IRIS toxicity criteria for these compounds. Alternatively, this re-evaluation may include a consideration of the adoption of groundwater cleanup goals for 1,2,4-TMB and 1,3,5- TMB identified in 18 AAC 75. These groundwater standards are identical to the cleanup goals identified in the 2002 ESD.

OU-4

Human Health

The OU-4 ROD was signed in 1996 to address contamination at three source areas: the Landfill, the Coal Storage Yard, and the Fire Training Pits. Soil contamination at the Fire Training Pits was addressed via a removal action. The ROD established the following RAOs for the residual groundwater contamination remaining at the Landfill and Coal Storage Yard.

- Restore groundwater to drinking water quality.
- Prevent further leaching of contaminants into groundwater.
- Reduce or prevent further migration of contaminated groundwater.
- Prevent use of groundwater containing contaminants above Safe Drinking Water Act and State Water Quality Act Standards.

Most of the groundwater cleanup goals established in the 1996 ROD were based on Safe Drinking Water Act and State Water Quality Act Standards and are reviewed in Attachment 7. One compound, 1,1,2,2-tetrachloroethane, lacked Safe Drinking Water Act or State Water Quality Act standards and its cleanup goal was developed from the baseline risk assessment. Since this compound is considered a carcinogen, the risk-based cleanup goal was developed using an incremental lifetime cancer risk (ILCR) target of 1 in 10,000 (1×10^{-4}), which is the upper end of the range of what USEPA considers to be an acceptable cancer risk. The USEPA's current risk-based screening levels (RSLs) are developed using an ILCR of 1 in 1,000,000 (1×10^{-6}), which is the lower end of the acceptable cancer risk range. As presented in Table A.8-11a, the current USEPA RSL is 7.6×10^{-2} µg/L for an ILCR of 1×10^{-6}, which is equivalent to a risk-based concentration of 7.6 µg/L if the target ILCR were to be raised to 1×10^{-4}. The change in the RSL is mainly due to the updated toxicity criteria that was revised in IRIS in 2010 (Table

A.8-11b). However, as the updated toxicity criteria results in a higher risk-based target concentration, this change in toxicity does not affect the protectiveness of the remedy as it was identified in the ROD.

Land use at the Landfill and Coal Storage Yard is light industrial and access is restricted by fencing and signs. The fence surrounding both of these areas was intact and in good condition.

The Coal Storage Yard was recommended for no further action in the Second Five Year Review, with the stipulation that institutional controls needed to remain in place to prevent excavation or groundwater intrusion. The institutional controls appear to be in place, therefore, the exposure assumptions established at the time of the ROD appear to be still valid.

Groundwater monitoring is on-going at the Landfill. Since institutional controls prevent the use of groundwater in the vicinity of the landfill for drinking water purposes and there are no currently occupied buildings in the vicinity of the landfill that would warrant an evaluation for vapor intrusion concerns, the exposure assumptions established at the time of the ROD appear to still be valid.

Ecological

Because the Coal Storage Yard and Landfill are industrial use properties, little undisturbed high-quality ecological habitat exists on these sites. Therefore, complete ecological exposure pathways that would warrant evaluation of ecological risk are lacking.

Significant Finding

The RAOs, cleanup levels, and exposure assumptions used at the time of the remedy selection remain valid. The change in toxicity criteria for 1,1,2,2-tetrachloroethane that occurred in 2010 does not affect the protectiveness of the remedy. Although the vapor intrusion pathway was not explicitly evaluated at this OU at the time of the ROD, there are no currently occupied buildings in the vicinity of the landfill (or in the previously remediated areas of the coal storage yard) that would warrant an evaluation for vapor intrusion concerns, the exposure assumptions established at the time of the ROD appear to be still valid.

OU-5

Human Health

The OU-5 ROD was signed in 1999 that addressed soil and groundwater contamination at the West Quartermasters Fueling System (WQFS), the East Quartermasters Fueling System (EQFS), and lead contamination in soil at Remedial Area 1A at the BHTF. In addition, RAOs for protecting the nearby Chena River from contamination leaching from the WQFS were included in the ROD.

Soil Contamination

RAO's for soil source areas:

- Prevent the migration to groundwater of soil contaminants that could result in groundwater contamination and exceedances of federal MCLs and nonzero maximum contaminant level goals (MCLGs) and to groundwater that is closely hydrogeologically connected to surface water (such as the Chena River) that could result in exceedances of Alaska Water Quality Standards (AWQS) in surface water.

- Limit human health and terrestrial receptor exposure to lead-contaminated soil (Remedial Area 1A).

The first RAO was addressed by a soil removal action (1998) and operation of an AS/SVE system that was in place. Evaluation of the residual source term conducted in 2009 indicated that there may be a source remaining in soil that would continue to impact groundwater. The uncertainty surrounding the residual soil source term is unlikely to affect protection of human health, as there is very little direct soil contact since the area is only used for recreational use, and there is no ingestion of groundwater or intrusion of groundwater vapors into buildings as no occupied buildings exist in the area. However, the residual soil source term may be impacting ecological receptors if the soil source term continues to impact groundwater which discharges to the Chena River. This is evaluated below under ecological exposures.

The second RAO for projection of human health will be met when lead contaminated surface soil is removed from Remedial Area 1A (Marsh Creek and Weston 2015). The current plan is to remove all soils in excess of 400 mg/kg lead, which is the target level to protect human health in a residential setting (USEPA 2015c). This will result in a removal of an estimated 2,000 tons of contaminated soil. The remedial action identified in the 1999 OU 5 ROD to address lead contaminated soil in Remedial Area 1A referred to a To-Be-Considered criterion of the USEPA's Region 9 Industrial Preliminary Remediation Goal. This industrial risk-based concentration was 1,000 mg/kg lead at the time of the ROD. The USEPA's current industrial risk-based concentration for soil lead is 800 mg/kg (USEPA 2015c). The lowering of the risk-based concentration for lead in soil to protect industrial exposure does not affect the protectiveness of the remedy, since the decision was made to excavate all lead contaminated soil above 400 mg/kg, which is protective of residential use.

<u>Exposure to Groundwater Contamination</u>

The groundwater RAOs established in 1999 ROD included:

- Restore groundwater to its beneficial uses within a reasonable time frame.
- Reduce or prevent further migration of contaminated groundwater from the source areas to the downgradient aquifer or surface water bodies that are closely hydrologically connected by achieving MCLs (where there are no nonzero MCLGs) and AWQS. For groundwater that is hydrologically connected to surface water, AWQS will apply for the following Fresh Water Uses: (l)(A) Water Supply; (l)(B) Water Recreation; and (l)(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife.
- Ensure there is no risk to aquatic receptors through control of contaminant movement through the groundwater into the Chena River.
- Remove floating product to the extent practicable to eliminate film or sheen from groundwater.
- Prevent use of groundwater containing contaminants at levels above Safe Drinking Water Act MCLs, non-zero MCLGs, or the following AWQS for Fresh Water Uses: (l)(A) Water Supply; (l)(B) Water Recreation; and (l)(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife.

Most of the groundwater cleanup goals established in the 1999 ROD were based on Safe Drinking Water Act and State Water Quality Act Standards that are reviewed in Attachment 7. One compound, bis(2-chloroethyl)ether, lacked these standards and its cleanup goal was developed from the baseline risk assessment. Since this compound is considered a carcinogen, the risk-based cleanup goal was developed using an ILCR target of 1 in 1,000,000 (1 x 10^{-6}). As presented in Table A.8-12, the current USEPA RSL is 1.4 x 10^{-2} µg/L (also for an ILCR of 1 x 10^{-6}), slightly greater than the ROD risk-based cleanup goal of 9.2 x 10^{-3} µg/L. The slight change in the RSL is due to updated risk assessment methodology, as the IRIS cancer toxicity criteria for this compound has not been reviewed or revised since 1987. The updated risk assessment methods include guidance for characterizing risk for both the dermal and inhalation exposure pathways (USEPA 2004 and 2009a), as well as updates to recommended default exposure parameters (USEPA 2014a). Because the current USEPA RSL is greater than the original ROD risk-based target concentration, these risk assessment methodology updates do not affect the protectiveness of the remedy for this compound as identified in the ROD.

Ecological

Exposure to Surface Soil Contamination

Lead-contaminated surface soil in Remedial Area 1A (Birch Hill Tank Farm) was identified as the primary contributor to potential ecological risk for a red fox. The ROD indicates that existing fencing at Remedial Area 1A would help to mitigate these risks to terrestrial communities, presumably by limiting exposure. In addition, the areas of surface soil contamination do not provide a high quality suitable habitat for the red fox. However, as indicated above, remedial action is currently being planned to remove the surface soil lead contamination from Remedial Area 1A (Marsh Creek and Weston 2015). All soils containing lead greater than 400 mg/kg (the target level to protect human health in a residential setting) will be removed. This will result in the removal of approximately 2,000 tons of contaminated soil. Although a site-specific ecological cleanup goal was not developed for the site [which may be lower than 400 mg/kg (USEPA 2005)], removal of this much lead contaminated soil will also assist in mitigating potential ecological risks from exposure to contaminated soil at the site.

Exposure to Sediment and Surface Water Contamination in the Chena River

The 1999 ROD specified the following RAOs for Chena River Sediment and Surface Water:

- Reduce sources of contaminant releases to the Chena River.
- Meet the following AWQS for Fresh Water Uses: (1)(A) Water Supply; (1)(B) Water Recreation: and (1)(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife.
- Continue aquatic assessment.

The third RAO was determined to have been met in 2005. The potential for ecological risks to aquatic life in the Chena River were assessed as part of a Chena River Aquatic Assessment Program (CRAAP). This program was initiated in 1997 and continued in 2002. A 2002 Sediment Monitoring Report measured only very low concentrations of polycyclic aromatic hydrocarbons (PAHs) in Chena River sediments (and pore water) adjacent/downgradient of seep areas (CH2M HILL 2002). With two exceptions, the toxicity to test organisms (measured in terms of survival, growth, and reproduction) exposed to seep area sediments was comparable to toxicity to test organisms exposed to reference area sediments. The lack of gross contamination in the river sediments adjacent to seep areas may be explained by this observation in the report, *"Sediments in the Chena River are subject to significant scouring during high water events and during typical ice break-up events in the spring."* In the second Five Year Review report, it was stated that the CRAAP *"found evidence that contamination from the Fort Wainwright source areas was potentially adversely influencing biotic health in the Chena River ecosystem but did not prove that sediment toxicities caused changes in the benthic invertebrate communities of the Chena River"* (AEC 2006). In 2005 it was determined by the RPMs to be no longer necessary and was discontinued. However, groundwater discharges to the river have continued to be monitored.

Groundwater sampling of monitoring wells adjacent to the River

Groundwater monitoring wells along the Chena River were sampled in 2012, 2013, and 2014. Each year, results were well below ADEC surface water quality criteria for total aromatic hydrocarbons (TAH) and total aqueous hydrocarbons (TAqH). However, in 2014, levels of benzene and diesel range organics (DRO) in one of the wells along the Chena River (AP-10220MW) showed an increasing trend relative to previous years. Although these contaminant increases may be the result of the high groundwater level in 2014 (due to unusually high rain fall that year), there is also residual soil contamination in this area. The contaminant trends in this well should be closely monitored in the future to ensure continued protection of the Chena River.

Sediment sampling of the River

The 2012 OU 5 Monitoring Report included results of additional sampling of DRO-contaminated sediment from the river bank. The PAH levels measured in 2012 were within the range of PAHs detected during the CRAAP. The 2012 monitoring report thus concluded:

> *"The CRAAP used a comprehensive weight-of-evidence approach that included evaluating bulk sediment chemistry, bulk detritus chemistry, benthic macroinvertebrate community analysis, Chironomus tentans bioassays, and Chironomidae community analysis. The results were somewhat ambiguous with respect to contaminant impacts on the biotic integrity of the Chena River, but did not suggest adverse impacts on ecosystem structure and function (ABR, Inc., and CH2M HILL, 1999). As a result, the PAH detections in sediment identified during the 2012 sampling event do not appear to represent increased ecological risk at the site."*

Discrete surface water sampling of the River

Surface water samples in the River were obtained in 2012 as grab samples adjacent to well points installed in 2012 along the shore of the Chena River. The samples contained only trace levels of contaminants (DRO, benzene, toluene, ethylbenzene, xylenes, and naphthalene) at levels below ADEC surface water criteria. In addition, pore water samples were obtained from the well points, which showed some exceedances of surface water quality criteria (TAH and TAqH in well WP7). The elevated pore water contaminant concentrations were all located from samples obtained within the boom area.

Passive surface water sampling of the River

In 2012, GORETM module sampling was conducted which *"supported the conclusion that there is not significant contaminant migration into the Chena River occurring, either from the sediments directly adjacent to the river, or from contaminated groundwater migrating into the river."* The passive sampling was repeated in 2013, although the sampling methods were not the same so a direct comparison of results could not be made. The passive sampling was only used for screening purposes in 2013.

Chena River sheen observations and boom installation

In 2012, improvements in the visual observations for boom effectiveness were made to include greater detail so that effects from the Sparge Curtain treatment system shut down could be assessed. These included development of sheen observation stations at 10-feet intervals and recording of river stage heights at various points on the River. Sheen observations in the River continued in 2013, 2014, and 2015 and no increases in sheen occurrences (relative to 2012) were observed in more recent years. However, in 2015, the sheen was not observed until after walking along the shore, indicating that the sheen was released due to disturbance of shoreline sediments. In fact, in 2015, sheen was only observed during a single inspection, which represents the fewest number of sheen detections since the detailed observations were initiated in 2012. Sheen was not observed in any of the groundwater wells along the Chena River in 2013 or 2014 either. In the 2013 monitoring report, it was noted that the presence of sheen was correlated with shoreline width, which was inversely correlated with river stage. Sheen is likely produced when the river elevation is low, which allows the residual contamination in the sediments to seep into the river with groundwater discharge.

The draft 2014 OU-5 Monitoring Report indicates the harbor and absorbent boom system was deployed in 2014 and 2015 (May through October) to contain any potential sheen in the Chena River. Sheen was observed at one observation period in May 2014. In June 2014 the water level in the river rose so high that the boom floated off its supports and up against the river bank. This was due to unusually high rainfall that occurred in the summer of 2014. As noted in the monitoring report, the presence of sheen in the river is correlated with a lower River stage and it is likely that the high river stage in 2014 served to counter the migration of sediment and also groundwater contamination from discharging into the river. No other sheen observations were made that summer and the boom was removed in October 2014.

Significant Findings

The exposure assumptions, toxicity data, cleanup levels and RAOs used at the time of the remedy selection for protection of human health are still valid. Although the risk-based concentration for industrial exposure to lead in soil (identified as a to-be-considered criterion in the ROD) is now lower than it was at the time of the remedy, this does not affect protectiveness of the remedy at Remedial Area 1A, since the current target for excavation of lead contaminated soil is the USEPA's risk-based concentration for protection of residential exposure. In addition, there is one groundwater COC [bis(2-chloroethyl)ether] for which a risk-based concentration was established as the groundwater cleanup goal in the ROD. The toxicity criteria for this compound has not changed, although the USEPA's current risk-based concentration for this compound is slightly greater due to changes in risk assessment methods.

For protection of the environment (Chena River), the weight of evidence from the various sampling events performed in the past five years indicates that the cleanup goals and RAOs are still valid. The lines of evidence include collection of additional sediment and surface water samples from the Chena River (both discrete and passive surface water sampling), pore water samples from wells placed at the river shore, groundwater samples from monitoring wells adjacent to the river, sheen observations along the river, observations of river stage and shoreline width, and installation of a boom in the river. In 2014, levels of benzene and DRO in one monitoring well (AP-10220MW) along the river showed an increasing trend relative to previous years, although surface water quality criteria have not been exceeded in this well. The contaminant increases may be the result of the high groundwater level in 2014 (due to unusually high rain fall that year), which caused desorption of contaminants on vadose zone soils. Lower concentrations of benzene, DRO, and GRO were measured in this well (AP-10220MW) in 2015. Since the Sparge Curtain treatment system was approved for decommissioning in 2013, the contaminant trends in this well should be closely monitored to ensure continued protection of the Chena River.

OU-6

Human Health

The ROD was signed in 2014; OU-6 is only being reviewed at this time in order to keep all the CERCLA operable units on the same Five Year Review schedule.

Table 1 of the 2014 ROD lists soil and groundwater cleanup goals for OU-6. Most of these cleanup goals are ARAR based and are reviewed in Attachment 7. Table A.8-13 reviews those cleanup goals that were based on risk to determine whether changes in toxicity criteria or exposure assumptions may have occurred since the cleanup goals were established. For aluminum and manganese, no changes have occurred which would affect the risk-based cleanup goals for soil in OU-6. These cleanup goals are based on protection of residential exposure, using USEPA default exposure assumptions. Those exposure assumptions are protective of someone living in the continental United States, and assume more exposure than would occur in Alaska, where snow cover and frozen ground would limit the amount of soil someone may be exposed to over the course of a year.

Since the signing of the ROD, occupancy of the housing unit at OU-6 is now allowed. Since VOCs (including TCE) are COCs in groundwater in OU-6, the housing units are being monitored for potential vapor intrusion impacts on a quarterly basis for a period of 5 years. This is currently being accomplished by sampling and analyzing the sub-slab below 12 representative housing units for VOCs, and applying a site-specific attenuation factor to estimate the amount of VOCs in indoor air from sub-slab sources. The site-specific attenuation factor was developed using paired sub-slab and indoor air samples analyzed for radon, first during the 2010 RI and then during the initiation of the 5 year quarterly sampling effort in spring of 2014. The use of radon as a surrogate for developing site-specific attenuation factors for vapor intrusion is discussed in USEPA 2015a. This site-specific attenuation factor is used to develop site-specific VISL, which are derived from the ADEC VISL for indoor air. As discussed on the first page of this attachment, the USEPA has also developed VISL, which use the USEPA RSL (for indoor air) as their basis. Since the USEPA has updated their VISL calculator in January 2016 using the most recent toxicity criteria available, the USEPA VISL for indoor air were compared to the ADEC indoor air VISL to ensure that the ADEC indoor air VISL remain protective. As explained in ADEC 2012, the ADEC indoor air VISL are based on a cancer risk of 1E-05 and a hazard quotient of 1. Therefore, USEPA VISL were set to the same risk limits. The comparison of ADEC 2012 VISL and current USEPA VISL for indoor air are presented in Table A.8-14. (ADEC uses an attenuation factor of 0.1 for sub-slab samples, while the USEPA VISL calculator uses an attenuation factor of 0.03. Therefore, the indoor air VISL are used for a direct comparison.) As seen in Table A.8-14, the current USEPA VISL for indoor air are all comparable to the ADEC 2012 VISL for indoor air. The single exception is the absence of an ADEC VISL for hexachlorobutadiene, a compound which was not detected in 2014 or 2015 in

OU-6 sub-slab samples. Therefore, the ADEC and project-specific and site-specific VISL for OU-6 remain protective.

In addition to using the site-specific VISL, the sub-slab sampling results are first being compared to Alaska "generic" VISL for sub-slab samples developed by ADEC (ADEC 2012), which are much more conservative than the site-specific VISL. There have only been sporadic low level exceedances of the Alaska sub-slab VISL in OU-6 sub-slab samples, and no exceedances of the site-specific screening levels. Therefore, this VI monitoring indicates that the remedy remains protective of residents inhabiting the housing unit at OU-6.

Ecological

As OU-6 is a residential housing development, little high quality ecological habitat exists at this operable unit. The conclusions from the phased ecological risk assessment that no constituents of potential ecological concern or areas that would require additional sampling to protect ecological resources at the site exist in OU-6 remains valid.

Significant Finding

The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection at OU-6 remain valid. The site is now being used for residential use, and that potential exposure was assessed during the RI and identified as an anticipated land use at the time of the ROD. No changes to toxicity criteria for risk-based cleanup goals identified in the ROD for soil and groundwater, or vapor intrusion screening levels used in the VI monitoring reports have occurred. The remedy remains protective of human health and the environment.

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Table A.8-1 Summary of Toxicity Criteria Changes for Ft. Wainwright Human Health Constituents of Concern

Constituent of Concern	Operable Units	Media	Cleanup Goal Basis	Date of RODs	Toxicity Criteria Last Reviewed in IRIS	Current Toxicity Criteria Source	Change in Toxicity Criteria since ROD?
Aluminum	6	Soil	Risk	2014	NA	PPRTV (2006)	No change in toxicity criteria
Copper	6	Soil	ARAR	2014	1988	HEAST (1987)	No change in toxicity criteria
Manganese	6	Soil	Risk	2014	1993 (inhalation reference concentration), 1995 (oral reference dose)	IRIS	No change in toxicity criteria
Aldrin	1	Soil, Groundwater	Risk	1997	1987	IRIS	No change in toxicity criteria
Dieldrin	1	Soil, Groundwater	Risk	1997	1988	IRIS	No change in toxicity criteria
Benzene	1, 2, 3, 4, 5	Groundwater	ARAR	1996, 1997, 1999	2003 (non-cancer), 2000 (cancer)	IRIS	Yes, change in toxicity criteria will be reviewed vs. ARAR-based cleanup goal
Toluene	2, 3, 4, 5,	Groundwater	ARAR	1996, 1997, 1999	2005	IRIS	Yes, change in toxicity criteria will be reviewed vs. ARAR-based cleanup goal
Ethylbenzene	2, 3, 4, 5,	Groundwater	ARAR	1996, 1997, 1999	1987 (inhalation reference concentration), 1991 (oral reference dose), 1988 (cancer)	CalEPA (cancer), IRIS (non-cancer)	No change in toxicity criteria
Xylene	2, 4, 5	Groundwater	ARAR	1996, 1997, 1999	2003	IRIS	Yes, change in toxicity criteria will be reviewed vs. ARAR-based cleanup goal
1,1-Dichloroethene	1, 2	Groundwater	ARAR	1997	2002	IRIS	Yes, change in toxicity criteria will be reviewed vs. ARAR-based cleanup goal
Tetrachloroethene	2	Groundwater	ARAR	1997	2012	IRIS	Yes, change in toxicity criteria will be reviewed vs. ARAR-based cleanup goal
Trichloroethene	2, 4, 5, 6,	Groundwater	ARAR	1996, 1997, 1999, 2014	2011	IRIS	Yes, change in toxicity criteria will be reviewed vs. ARAR-based cleanup goal
cis-1,2-Dichloroethene	1, 2, 4	Groundwater	ARAR	1996, 1997	2010	IRIS	Yes, change in toxicity criteria will be reviewed vs. ARAR-based cleanup goal
Vinyl chloride	1, 2, 4	Groundwater	ARAR	1996, 1997	2000	IRIS	Yes, change in toxicity criteria will be reviewed vs. ARAR-based cleanup goal
1,2-Dibromoethane	3, 5	Groundwater	ARAR	1996, 1999	2004	IRIS	Yes, change in toxicity criteria will be reviewed vs. ARAR-based cleanup goal
1,1,2,2-Tetrachloroethane	4	Groundwater	Risk	1996	2010	IRIS (oral cancer slope factor and oral reference dose), CalEPA (inhalation unit risk)	Yes, change in toxicity criteria indicates less toxic compound
1,1,2-Trichloroethane	4	Groundwater	ARAR	1996	1988 (non-cancer), 1987(cancer)	IRIS	No change in toxicity criteria
1,2-Dichloroethane	3, 5	Groundwater	ARAR	1996, 1999	1987	IRIS (cancer), PPRTV (non-cancer)	No change in toxicity criteria
1,2,4-Trimethylbenzene	3	Groundwater	Risk	1996, 2002 (ESD)	2016 (9 September)	IRIS	Yes, change in toxicity. Recommendation to review the risk-based cleanup goal
1,3,5-Trimethylbenzene	3	Groundwater	Risk	1996, 2002 (ESD)	2016 (9 September)	IRIS	Yes, change in toxicity. Recommendation to review the risk-based cleanup goal
1,2,3-Trichloropropane	6	Soil, Groundwater	ARAR	2014	2009	IRIS	No change in toxicity criteria
Bis(2-chlorethyl)ether	5	Groundwater	Risk	1999	1991 (non-cancer), 1987 (cancer)	IRIS	No change in toxicity criteria
bis(2-Ethylhexyl) phthalate	4, 5	Groundwater	ARAR	1996, 1999	1987 (non-cancer), 1988 (cancer)	IRIS (oral cancer slope factor and oral reference dose), CalEPA (inhalation unit risk)	No change in toxicity criteria

IRIS is the USEPA Integrated Risk Information System, the primary source of toxicity criteria for CERCLA risk assessments.
PPRTV are the USEPA's provisional peer reviewed toxicity criteria, the secondary source of toxicity criteria for CERCLA, when IRIS toxicity criteria are absent.
CalEPA is the California Environmental Protection Agency, a tertiary source of toxicity criteria for CERCLA, when IRIS toxicity criteria are absent.
HEAST is the USEPA's health effects summary assessment table, a tertiary source of toxicity criteria for CERCLA, when IRIS toxicity criteria are absent.
The hierarchy of toxicity sources for CERCLA risk assessments was established in 2003 in the USESPA OSWER directive, 9285.7-53

Table A.8-2 Toxicity Criteria Updates Impact on Risk-Based Cleanup Goal vs. Current ARAR-based Cleanup Goal (MCL) for Groundwater

COC with toxicity criteria change	Current EPA Risk Based Concentration at ILCR of 1E-06 (ug/L)	Current EPA Risk Based Concentration at HI of 1 (ug/L)	ARAR based cleanup goal (ug/L)	Level of protection afforded by current MCL (ARAR based cleanup goal)
Benzene	0.46	33	5	MCL still protective at ILCR ~ 1E-05 and HI of <1
Toluene	NA	1,100	1,000	MCL still protective at HI of <1
1,2-Dibromoethane	0.0075	17	0.05	MCL still protective at ILCR < 1E-05 and HI of <1
Tetrachloroethene	11	41	5	MCL still protective at ILCR < 1E-06 and HI of <1
Trichloroethene	0.49	2.8	5	MCL still protective at ILCR ~ 1E-05 and HI of ~ 1 within range of uncertainties
1,1-Dichloroethene	NA	280	7	MCL still protective at HI of <1
cis-1,2-Dichloroethene	NA	36	70	MCL still protective at HI of ~ 1 within range of uncertainties
Vinyl chloride	0.019	44	2	MCL still protective at ILCR < 1E-04 and HI of <1

Current EPA Risk Based Concentration was obtained from the May 2016 version of the EPA Regional Risk Based Screening Level Table, Tapwater values

MCL is EPA's Maximum Contaminant Level for drinking water.

ILCR is incremental lifetime cancer risk. The EPA's acceptable range of cancer risks are 1E-06 up to 1E-04.

HI is hazard index (non-cancer health effects). A hazard index of 1 or below indicates that adverse non-cancer health effects are unlikely to occur.

NA indicates screening level not available for that target risk or hazard; not toxic via that endpoint.

Table A.8-3 Comparison of Toxicity Criteria for Trichloroethene and cis-1,2-Dichloroethene

	SF_O $(mg/kg\text{-}day)^{-1}$	Source of SFo	Inhalation Cancer Risk Factor (IUR or CSFi)	Units	Source of Inhalation Cancer Risk Factor	RfD_o (mg/kg-day)	Source of RfDo	Inhalation Reference Dose or Reference Concentration	Units	Source of Inhalation Reference Dose
trichloroethene										
2016 Toxicity Criteria	4.60E-02	IRIS	4.1E-06 (IUR)	$(ug/m^3)^{-1}$	IRIS	5.00E-04	IRIS	0.002 (RfCi)	mg/m^3	IRIS
Previous Toxicity Criteria (OU-1 1996)	1.10E-02	NCEA provisional value 1993	6.0E-03 (CSFi)	$(mg/kg\text{-}day)^{-1}$	NCEA provisional value 1993	6.00E-03	NCEA provisional value 1993	NA		
cis-1,2-dichloroethene										
2016 Toxicity Criteria	NA		NA			2.00E-03	IRIS	NA		
Previous Toxicity Criteria (OU-1 1996)	NA		NA			1.00E-02	HEAST 1995	NA		

The source of the previous toxicity criteria is Table 6.1-11 from the OU-1 Remedial Investigation Report, 1996.
SF_O is oral cancer slope factor
RfDo is oral reference dose (non-cancer)
IRIS is the EPA's Integrated Risk Information System
NCEA is the EPA's National Center for Exposure Assessment, Cincinnati, Ohio
HEAST is the Health Effects Assessment Summary Table
NA not available/ not provided

Table A.8-4 Comparison of Vapor Intrusion Screening Levels and Cleanup Goals for Groundwater COCs at Ft. Wainwright

Constituent of Concern	Units	ROD Cleanup Goal Concentration (MCL)	USEPA 2016 Residential VISL at 5°C (ICLR 1E-04 and HQ of 1)	ADEC Residential VISL (2012)
benzene	µg/L	5	370	14
toluene	µg/L	1,000	59,000	19,200
ethylbenzene	µg/L	700	1,200	30
1,2,4-Trimethyl benzene	µg/L	1850	120	29
1,3,5- Trimethyl benzene	µg/L	1850	NIT	20
1,2-dichloroethane	µg/L	5	430	19
1,2-dibromoethane	µg/L	0.05	61	1.5
1,1-dichloroethene	µg/L	7	430	200
vinyl chloride	µg/L	2	27	1.4
tetrachloroethene	µg/L	5	190	58
trichloroethene	µg/L	5	15	5.2
cis-1,2-dichloroethene	µg/L	70	NIT	44
1,1,2,2-tetrachloroethane	µg/L	5.2	1,200	28

<u>Notes</u>:

1 The USEPA VISLs were developed using VISL calculator version 3.4.6, downloaded February 2016. http://www.epa.gov/vaporintrusion

2 The USEPA VISLs were developed to protect residential exposure, using a groundwater temperate of 5 degrees celsius, a target cancer risk of 1E-04, and hazard quotient of 1.

ADEC Alaska Department of Environmental Conservation
COC constituent of concern
HQ hazard quotent
ICLR incremental lifetime cancer risk
MCL Maximum Contaminant Level
NIT No inhalation toxicity information
ROD Record of Decision
VISL vapor intrusion screening level
µg/L micrograms per liter

Table A.8-5 Summary of Risk-Based Cleanup Goals for Operable Unit 1

ROD Date Cleanup Goal Identification	Source Area	Medium	Constituent of Concern	ROD Residential ILCR Limit (unitless)	1997 ROD Cleanup Goal	Units	Date toxicity criteria last reviewed in IRIS	Current 2015 EPA generic RBC for Cancer Risk Limit (mg/kg or ug/L)	Current EPA Residential ILCR Limit (unitless)	Current EPA (ILCR) RBC adjusted for Alaska*	Current Residential USEPA Generic RBC for non-cancer health effects (child HI = 1) (mg/kg or ug/L)	Current USEPA non-cancer RBC adjusted for Alaska*
June 1997	Drum Burial Site	Soils	Aldrin	1.E-04	**3.8E+00**	mg/kg	1987	3.90E+00	1.E-04	6.8E+00	2.3E+00	**4.0E+00**
June 1997			Dieldrin	1.E-04	**4.0E+00**	mg/kg	1988	3.40E+00	1.E-04	6.0E+00	3.2E+00	**5.6E+00**
June 1997	Drum Burial Site	Groundwater	Aldrin	1.E-06	**4.0E-03**	µg/L	1987	9.20E-04	1.E-06	**1.6E-03**	6.0E-01	1.1E+00
June 1997			Dieldrin	1.E-06	**4.0E-03**	µg/L	1988	1.70E-03	1.E-06	**3.0E-03**	3.8E-01	6.7E-01

Notes:

* Original exposure assumption that soil exposure frequency for resident limited to only 200 days/year due to snow cover/frozen ground is still valid. This allowed the USEPA's generic RBC to be adjusted by a factor of 350/200.

Current RBCs in blue bold should be compared to the 1997 ROD Cleanup Goal for evaluation of protectiveness

HI	Hazard index; an indication of potential for non-cancer health effects
ILCR	Incremental Lifetime Cancer Risk
IRIS	Integrated Risk Information System
RBC	risk-based concentration
ROD	Record of Decision
mg/kg	milligrams per kilogram
µg/L	micrograms per liter

Table A.8-6 Comparison of OU 1 2015 Groundwater Monitoring Results to Vapor Intrusion Screening Levels [1]

						1	3	4	6	8	9	10	11	12	13	14	15
Sample ID						15FWOU101WG	15FWOU102WG	15FWOU103WG	15FWOU104WG	15FWOU105WG	15FWOU106WG	15FWOU107WG	15FWOU108WG	15FWOU109WG	15FWOU110WG	15FWOU111WG	15FWOU112WQ
Location ID						AP-6326	AP-6331	AP-6327	AP-1010	AP-7279	AP-7282	AP-6630	AP-7284	AP-10042MW	AP-2020	AP-6001	Trip Blank
Sample Data Group						K1504900	K1504900	K1504900	K1504900	K1504900	K1504900	K1504900	K1504900	K1504900	K1504900	K1504900	K1504900
Laboratory ID						150490001F	K150490002	150490003F	150490004F	K150490005	K150490006	K150490007	K150490008	K150490009	K150490010	K150490011	K150490012
Collection Date						5/5/2015	5/5/2015	5/6/2015	5/6/2015	5/6/2015	5/7/2015	5/7/2015	5/7/2015	5/7/2015	5/7/2015	5/7/2015	5/5/2015
Matirx						WG	WG	WG	WG	WG	WG	WG	WG	WG	WG	WG	WG
Sample Type						Primary	Primary	Primary	Field Duplicate	Primary	Primary	Primary	Primary	Primary	Field Duplicate	PE Sample	Trip Blank
Analyte	Method	Units	Cleanup Level[2]	USEPA VISL 2016 5° C (ILCR 1E-04, HQ 1)	ADEC VISL, residential 2012	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result[[LOD] Qualifier	Result[[LOD] Qualifier
Gasoline Range Organics (C6-C10)	AK101	µg/L	2,200			-	-	2100 [25]	2000 [25]	-	-	-	-	-	-	-	ND [25]
Diesel Range Organics (C10-C25)	AK102	µg/L	1,500			-	-	**5400 [20] J-**	**5600 [20]**	-	-	-	-	-	-	-	-
Sulfate	E300.0	mg/L	NE			13.5 [0.2]	-	0.17 [0.04] J	0.24 [0.04] J	-	-	-	-	-	-	-	-
Iron	SW6010C	µg/L	NE			30.6 [10]	-	69500 [10]	68100 [10]	-	-	-	-	-	-	-	-
Manganese	SW6010C	µg/L	NE			22.1 [1]	-	6260 [1]	6080 [1]	-	-	-	-	-	-	-	-
4,4'-DDD	SW8081B	µg/L	3.5			ND [0.0046]	ND [0.0045]	ND [0.0046]	-	ND [0.0045]	ND [0.0045]	ND [0.0045]	ND [0.0045]	ND [0.0045]	ND [0.0045]	ND [0.0046]	-
4,4'-DDE	SW8081B	µg/L	2.5			ND [0.0021]	ND [0.002]	ND [0.0069]	-	ND [0.002]	ND [0.002]	0.0005 [0.002] J	ND [0.002]	ND [0.002]	ND [0.002]	0.0022 [0.0021] J	-
4,4'-DDT	SW8081B	µg/L	2.5			ND [0.024]	ND [0.0072]	ND [0.015]	-	ND [0.001]	ND [0.001]	ND [0.001]	ND [0.0022]	ND [0.0017]	ND [0.0015]	0.0013 [0.0011] J	-
Aldrin	SW8081B	µg/L	0.05 (0.004)			ND [0.0021]	ND [0.002]	ND [0.0041]	-	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	0.55 [0.021]	-
alpha-BHC	SW8081B	µg/L	0.14			ND [0.0021]	ND [0.002]	ND [0.0044] J-	-	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.0021]	-
alpha-Chlordane	SW8081B	µg/L	2			ND [0.0021]	ND [0.002]	ND [0.021] J-	-	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.0021]	-
beta-BHC	SW8081B	µg/L	0.47			ND [0.0046]	ND [0.0045]	ND [0.0046] J-	-	ND [0.0045]	ND [0.0045]	ND [0.0045]	ND [0.0045]	ND [0.0045]	ND [0.0045]	ND [0.0046]	-
Chlordane	SW8081B	µg/L	2			ND [0.21]	ND [0.2]	ND [0.21]	-	ND [0.2]	ND [0.2]	ND [0.2]	ND [0.2]	ND [0.2]	ND [0.2]	ND [0.21]	-
Chlorpyrifos	SW8081B	µg/L	NE			ND [0.0021]	ND [0.002]	ND [0.015]	-	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.0021]	-
cis-Nonachlor	SW8081B	µg/L	NE			ND [0.0021]	ND [0.002]	ND [0.0021]	-	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.0021]	-
delta-BHC	SW8081B	µg/L	NE			ND [0.0046]	ND [0.0045]	ND [0.0046] J-	-	ND [0.0045]	ND [0.0045]	ND [0.0045]	ND [0.0045]	ND [0.0045]	ND [0.0045]	ND [0.0046]	-
Dieldrin	SW8081B	µg/L	0.053 (0.004)			0.65 [0.023]	0.24 [0.0045]	ND [0.0056] J-	-	ND [0.0045]	0.0029 [0.0045] J	ND [0.0045]	0.0043 [0.0045] J	0.021 [0.0045]	0.022 [0.0045]	1.5 [0.046]	-
Endosulfan I	SW8081B	µg/L	220			ND [0.0021]	ND [0.002]	ND [0.0021] J-	-	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.0021]	-
Endosulfan II	SW8081B	µg/L	220			0.001 [0.0021] J	0.0021 [0.002] J	ND [0.025] J-	-	0.0023 [0.002] J	0.0024 [0.002] J	0.0024 [0.002] J	0.0047 [0.002] J	0.0083 [0.002] J	0.0094 [0.002] J	ND [0.0021]	-
Endosulfan sulfate	SW8081B	µg/L	NE			ND [0.0021]	ND [0.002]	ND [0.014] J-	-	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.0023]	ND [0.0021]	-
Endrin	SW8081B	µg/L	2			0.0074 [0.0021] J	0.0071 [0.002] J	ND [0.0027] J-	-	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	1.5 [0.021]	-
Endrin aldehyde	SW8081B	µg/L	NE			ND [0.0046]	ND [0.0045]	0.0079 [0.0046] J-	-	ND [0.0045]	ND [0.0045]	ND [0.0045]	ND [0.0045]	ND [0.0045]	ND [0.0045]	0.0016 [0.0046] J	-
Endrin ketone	SW8081B	µg/L	NE			0.0059 [0.0021] J-	0.0073 [0.002] J-	ND [0.0021] J-	-	ND [0.002] J-	ND [0.002] J-	ND [0.002] J-	ND [0.002] J-	ND [0.002] J-	ND [0.002] J-	0.01 [0.0021] J-	-
gamma-BHC (Lindane)	SW8081B	µg/L	0.2			ND [0.0021]	ND [0.002]	ND [0.0043]	-	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	2.4 [0.021]	-
gamma-Chlordane	SW8081B	µg/L	2			ND [0.0046]	ND [0.0045]	ND [0.0063] J-	-	ND [0.0045]	ND [0.0045]	ND [0.0045]	ND [0.0045]	ND [0.0045]	ND [0.0045]	0.0019 [0.0046] J	-
Heptachlor	SW8081B	µg/L	0.4			ND [0.0011]	ND [0.001]	ND [0.0073]	-	ND [0.001]	ND [0.001]	ND [0.001]	ND [0.001]	ND [0.001]	ND [0.001]	0.79 [0.011]	-
Heptachlor epoxide	SW8081B	µg/L	0.2			ND [0.0021]	ND [0.002]	ND [0.0025] J-	-	0.0005 [0.002] J	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	1.2 [0.021]	-
Hexachlorobenzene	SW8081B	µg/L	1			ND [0.0021]	ND [0.002]	ND [0.0021]	-	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	3.1 [0.021]	-
Hexachlorobutadiene	SW8081B	µg/L	7.3			ND [0.013]	ND [0.013]	ND [0.013]	-	ND [0.013]	ND [0.013]	ND [0.013]	ND [0.013]	ND [0.013]	ND [0.013]	0.008 [0.013] J	-
Hexachloroethane	SW8081B	µg/L	40			ND [0.013]	ND [0.013]	ND [0.013]	-	ND [0.013]	ND [0.013]	ND [0.013]	ND [0.013]	ND [0.013]	ND [0.013]	ND [0.013]	-
Isodrin	SW8081B	µg/L	NE			ND [0.0021]	ND [0.002]	ND [0.0021]	-	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	0.0075 [0.0021] J	-
Methoxychlor	SW8081B	µg/L	40			ND [0.0021]	ND [0.002]	ND [0.0021] J-	-	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	2.8 [0.021]	-
Mirex	SW8081B	µg/L	NE			ND [0.0021]	ND [0.002]	ND [0.005]	-	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.0021]	-
Oxychlordane	SW8081B	µg/L	NE			ND [0.0021]	ND [0.002]	ND [0.0048]	-	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.0036]	-
Toxaphene	SW8081B	µg/L	3			ND [0.41]	ND [0.4]	ND [0.83] J	-	ND [0.4]	ND [0.4]	ND [0.4]	ND [0.4]	ND [0.4]	ND [0.4]	ND [0.41]	-
trans-Nonachlor	SW8081B	µg/L	NE			ND [0.0021]	ND [0.002]	ND [0.0021] J-	-	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.002]	ND [0.0021]	-
1,1,1,2-Tetrachloroethane	SW8260C	µg/L	NE			ND [0.2]	-	ND [2] J-	ND [2]	-	-	-	-	-	-	-	ND [0.2]
1,1,1-Trichloroethane	SW8260C	µg/L	200			ND [0.2]	-	ND [0.2]	ND [0.2]	-	-	-	-	-	-	-	ND [0.2]
1,1,2,2-Tetrachloroethane	SW8260C	µg/L	4.3			ND [0.2]	-	ND [0.2]	ND [0.2]	-	-	-	-	-	-	-	ND [0.2]
1,1,2-Trichloroethane	SW8260C	µg/L	5			ND [0.4]	-	ND [4] J-	ND [4]	-	-	-	-	-	-	-	ND [0.4]
1,1-Dichloroethane	SW8260C	µg/L	7,300			ND [0.2]	-	ND [0.2]	ND [0.2]	-	-	-	-	-	-	-	ND [0.2]
1,1-Dichloroethene	SW8260C	µg/L	7 (7)		200.0	0.34 [0.2] J	-	ND [0.2]	ND [0.2]	-	-	-	-	-	-	-	ND [0.2]
1,1-Dichloropropene	SW8260C	µg/L	NE			ND [0.2]	-	ND [0.2]	ND [0.2]	-	-	-	-	-	-	-	ND [0.2]
1,2,3-Trichlorobenzene	SW8260C	µg/L	NE			ND [0.4]	-	ND [0.4]	ND [0.4]	-	-	-	-	-	-	-	ND [0.4]
1,2,3-Trichloropropane	SW8260C	µg/L	0.12			ND [0.5]	-	ND [0.5]	ND [0.5]	-	-	-	-	-	-	-	ND [0.5]
1,2,4-Trichlorobenzene	SW8260C	µg/L	70			ND [0.3]	-	ND [0.3]	ND [0.3]	-	-	-	-	-	-	-	ND [0.3]
1,2,4-Trimethylbenzene	SW8260C	µg/L	1,850	120.0	29.0	ND [0.2]	-	180 [2]	170 [2]	-	-	-	-	-	-	-	0.09 [0.2] J
1,2-Dibromo-3-chloropropane	SW8260C	µg/L	NE			ND [0.8]	-	ND [0.8]	ND [0.8]	-	-	-	-	-	-	-	ND [0.8]
1,2-Dibromoethane	SW8260C	µg/L	0.05			ND [0.2]	-	ND [2] J-	ND [2]	-	-	-	-	-	-	-	ND [0.2]
1,2-Dichlorobenzene	SW8260C	µg/L	600			ND [0.2]	-	ND [0.2]	ND [0.2]	-	-	-	-	-	-	-	ND [0.2]
1,2-Dichloroethane	SW8260C	µg/L	5			ND [0.15]	-	ND [0.15]	ND [0.15]	-	-	-	-	-	-	-	ND [0.15]
1,2-Dichloropropane	SW8260C	µg/L	5			ND [0.2]	-	ND [0.2]	ND [0.2]	-	-	-	-	-	-	-	ND [0.2]
1,3,5-Trimethylbenzene	SW8260C	µg/L	1,800	NIT	20.0	ND [0.2]	-	62 [0.2]	62 [0.2]	-	-	-	-	-	-	-	ND [0.2]
1,3-Dichlorobenzene	SW8260C	µg/L	3,300			ND [0.2]	-	ND [0.2]	ND [0.2]	-	-	-	-	-	-	-	ND [0.2]
1,3-Dichloropropane	SW8260C	µg/L	8.5			ND [0.3]	-	ND [3] J-	ND [3]	-	-	-	-	-	-	-	ND [0.3]
1,4-Dichlorobenzene	SW8260C	µg/L	75			ND [0.2]	-	ND [0.2]	ND [0.2]	-	-	-	-	-	-	-	ND [0.2]
2,2-Dichloropropane	SW8260C	µg/L	NE			ND [0.2]	-	ND [0.2]	ND [0.2]	-	-	-	-	-	-	-	ND [0.2]
2-Butanone	SW8260C	µg/L	22,000			ND [4]	-	ND [4]	ND [4]	-	-	-	-	-	-	-	ND [4]
2-Chlorotoluene	SW8260C	µg/L	NE			ND [0.2]	-	ND [0.2]	ND [0.2]	-	-	-	-	-	-	-	ND [0.2]
2-Hexanone	SW8260C	µg/L	NE			ND [10]	-	ND [100]	ND [100]	-	-	-	-	-	-	-	ND [10]
4-Chlorotoluene	SW8260C	µg/L	NE			ND [0.2]	-	ND [0.2]	ND [0.2]	-	-	-	-	-	-	-	ND [0.2]
4-Isopropyltoluene	SW8260C	µg/L	NE			ND [0.2]	-	9.7 [0.2]	9.6 [0.2]	-	-	-	-	-	-	-	ND [0.2]
4-Methyl-2-pentanone	SW8260C	µg/L	2,900			ND [10]	-	ND [10]	ND [10]	-	-	-	-	-	-	-	ND [10]
Acetone	SW8260C	µg/L	33,000			ND [10]	-	ND [10]	ND [10]	-	-	-	-	-	-	-	ND [10]
Benzene	SW8260C	µg/L	5 (5)	370.0	14.0	0.44 [0.1] J	-	30 [0.1]	31 [0.1]	-	-	-	-	-	-	-	ND [0.1]
Bromobenzene	SW8260C	µg/L	NE			ND [0.2]	-	ND [0.2]	ND [0.2]	-	-	-	-	-	-	-	ND [0.2]
Bromochloromethane	SW8260C	µg/L	NE			ND [0.2]	-	ND [0.2]	ND [0.2]	-	-	-	-	-	-	-	ND [0.2]
Bromodichloromethane	SW8260C	µg/L	14			ND [0.3]	-	ND [0.3]	ND [0.3]	-	-	-	-	-	-	-	ND [0.3]
Bromoform	SW8260C	µg/L	110			ND [0.5]	-	ND [5] J-	ND [5]	-	-	-	-	-	-	-	ND [0.5]
Bromomethane	SW8260C	µg/L	51			ND [0.3]	-	ND [0.3]	ND [0.3]	-	-	-	-	-	-	-	ND [0.3]
Carbon disulfide	SW8260C	µg/L	3,700	2800.0	1240.0	ND [0.2]	-	0.08 [0.2] J	0.09 [0.2] J	-	-	-	-	-	-	-	ND [0.2]
Carbon tetrachloride	SW8260C	µg/L	5			ND [0.2]	-	ND [0.2]	ND [0.2]	-	-	-	-	-	-	-	ND [0.2]
Chlorobenzene	SW8260C	µg/L	100			ND [0.2]	-	ND [2] J-	ND [2]	-	-	-	-	-	-	-	ND [0.2]
Chloroethane	SW8260C	µg/L	290			ND [0.2]	-	ND [0.2]	ND [0.2]	-	-	-	-	-	-	-	ND [0.2]
Chloroform	SW8260C	µg/L	140			ND [0.2]	-	ND [0.2]	ND [0.2]	-	-	-	-	-	-	-	ND [0.2]
Chloromethane	SW8260C	µg/L	66			ND [0.2]	-	ND [0.2]	ND [0.2]	-	-	-	-	-	-	-	ND [0.2]
cis-1,2-Dichloroethene	SW8260C	µg/L	70	NIT	44.0	**100 [1]**	-	4.9 [0.2]	5.1 [0.2]	-	-	-	-	-	-	-	ND [0.2]
cis-1,3-Dichloropropene	SW8260C	µg/L	8.50			ND [0.2]	-	ND [0.2]	ND [0.2]	-	-	-	-	-	-	-	ND [0.2]
Dibromochloromethane	SW8260C	µg/L	10			ND [0.5]	-	ND [5] J-	ND [5]	-	-	-	-	-	-	-	ND [0.5]
Dibromomethane	SW8260C	µg/L	370			ND [0.5]	-	ND [0.5]	ND [0.5]	-	-	-	-	-	-	-	ND [0.5]
Dichlorodifluoromethane	SW8260C	µg/L	7,300			ND [0.2]	-	ND [0.2]	ND [0.2]	-	-	-	-	-	-	-	ND [0.2]
Ethylbenzene	SW8260C	µg/L	700	1200.0	30.0	ND [0.1]	-	12 [1]	12 [1]	-	-	-	-	-	-	-	ND [0.1]
Hexachlorobutadiene	SW8260C	µg/L	7.3			ND [0.3]	-	ND [0.3]	ND [0.3]	-	-	-	-	-	-	-	ND [0.3]

Table A.8-6 Comparison of OU 1 2015 Groundwater Monitoring Results to Vapor Intrusion Screening Levels [1]

						1	3	4	6	8	9	10	11	12	13	14	15
Sample ID						15FWOU101WG	15FWOU102WG	15FWOU103WG	15FWOU104WG	15FWOU105WG	15FWOU106WG	15FWOU107WG	15FWOU108WG	15FWOU109WG	15FWOU110WG	15FWOU111WG	15FWOU112WQ
Location ID						AP-6326	AP-6331	AP-6327	AP-1010	AP-7279	AP-7282	AP-6630	AP-7284	AP-10042MW	AP-2020	AP-6001	Trip Blank
Sample Data Group						K1504900	K1504900	K1504900	K1504900	K1504900	K1504900	K1504900	K1504900	K1504900	K1504900	K1504900	K1504900
Laboratory ID						150490001F	K150490002	150490003F	150490004F	K150490005	K150490006	K150490007	K150490008	K150490009	K150490010	K150490011	K150490012
Collection Date						5/5/2015	5/5/2015	5/6/2015	5/6/2015	5/6/2015	5/7/2015	5/7/2015	5/7/2015	5/7/2015	5/7/2015	5/7/2015	5/5/2015
Matirx						WG	WG	WG	WG	WG	WG	WG	WG	WG	WG	WG	WG
Sample Type						Primary	Primary	Primary	Field Duplicate	Primary	Primary	Primary	Primary	Primary	Field Duplicate	PE Sample	Trip Blank
Analyte	Method	Units	Cleanup Level[2]	USEPA VISL 2016 5° C (ILCR 1E-04, HQ 1)	ADEC VISL, residential 2012	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result [LOD] Qualifier	Result[[LOD] Qualifier	Result[[LOD] Qualifier
Isopropylbenzene	SW8260C	µg/L	3,700			ND [0.2]	-	6.6 [2] J-	6.4 [2]	-	-	-	-	-	-	-	ND [0.2]
Methylene chloride	SW8260C	µg/L	5			ND [0.2]	-	ND [0.2]	ND [0.73]	-	-	-	-	-	-	-	ND [0.2]
Methyl-tert-butyl ether (MTBE)	SW8260C	µg/L	470			ND [0.3]	-	ND [0.3]	ND [0.3]	-	-	-	-	-	-	-	ND [0.3]
Naphthalene	SW8260C	µg/L	730	840.0	40.0	ND [0.3]	-	17 [0.3]	16 [0.3]	-	-	-	-	-	-	-	0.09 [0.3] J
n-Butylbenzene	SW8260C	µg/L	370			ND [0.1]	-	ND [5.8]	ND [5.8]	-	-	-	-	-	-	-	ND [0.1]
n-Propylbenzene	SW8260C	µg/L	370		2420.0	ND [0.2]	-	8.9 [0.2]	8.9 [0.2]	-	-	-	-	-	-	-	ND [0.2]
o-Xylene	SW8260C	µg/L	10,000		490.0	ND [0.2]	-	17 [2]	17 [2]	-	-	-	-	-	-	-	ND [0.2]
sec-Butylbenzene	SW8260C	µg/L	370		250.0	ND [0.1]	-	3.9 [0.1]	3.9 [0.1]	-	-	-	-	-	-	-	ND [0.1]
Styrene	SW8260C	µg/L	100			ND [0.2]	-	ND [2] J-	ND [2]	-	-	-	-	-	-	-	ND [0.2]
tert-Butylbenzene	SW8260C	µg/L	370		340.0	ND [0.2]	-	0.61 [0.2] J	0.58 [0.2] J	-	-	-	-	-	-	-	ND [0.2]
Tetrachloroethene (PCE)	SW8260C	µg/L	5		58.0	ND [0.2]	-	ND [2]	ND [2]	-	-	-	-	-	-	-	ND [0.2]
Toluene	SW8260C	µg/L	1,000	59000.0	19200.0	0.14 [0.1] J	-	3.9 [0.1]	4.1 [0.1]	-	-	-	-	-	-	-	ND [0.1]
trans-1,2-Dichloroethene	SW8260C	µg/L	100	NIT	380.0	1.8 [0.2]	-	0.15 [0.2] J	0.14 [0.2] J	-	-	-	-	-	-	-	ND [0.2]
trans-1,3-Dichloropropene	SW8260C	µg/L	8.50			ND [0.2]	-	ND [2] J-	ND [2]	-	-	-	-	-	-	-	ND [0.2]
Trichloroethene (TCE)	SW8260C	µg/L	5	15.0	5.2	0.23 [0.1] J	-	ND [0.1]	ND [0.1]	-	-	-	-	-	-	-	ND [0.1]
Trichlorofluoromethane	SW8260C	µg/L	11,000			ND [0.2]	-	ND [0.2]	ND [0.2]	-	-	-	-	-	-	-	ND [0.2]
Vinyl chloride	SW8260C	µg/L	2 (2)	27.00	1.40	ND [0.1]	-	0.32 [0.1] J	0.34 [0.1] J	-	-	-	-	-	-	-	ND [0.1]
Xylene, Isomers m & p	SW8260C	µg/L	10,000		490.0	ND [0.2]	-	54 [2]	53 [2]	-	-	-	-	-	-	-	ND [0.2]

Notes:

1	Taken from Draft 2015 Groundwater Sample Results (FES Table A-2, Operable Unit 1, 801 Drum Burial Site Fort Wainwright, Alaska)
2	The ADEC cleanup level is the most stringent soil cleanup level from 18 AAC 75.341 (below 40 inches). The ROD Cleanup levels for the five OU1 contaminants of concern are shown in parentheses.
J	Estimated value
ND	Not detected [detection limit in btackets]
NIT	"No inhalation toxicity criteria" (e.g.,not a vapor intrusion inhalation risk)
WG	Groundwater
µg/L	micrograms per liter
	VISL is exceeded

Table A.8-7. OU-2 Groundwater Sample Results Former Building 1168 Compared to VISL. (From FES Draft 2014 OU 2 Monitoring Report, May 2015, Table 5-1).

Well Number	Relative Location	Sample Number	Date	Water Elevation (feet NGVD29)	ORP (mV)	Dissolved Oxygen (mg/L)	pH	Conductivity (mS/cm)	Dissolved Iron (mg/L)	Sulfate (mg/L)	Gasoline Range Organics (µg/L)	Diesel Range Organics (µg/L)	Residual Range Organics (µg/L)	ROD Chemicals of Concern (µg/L)						
														Benzene	TCE	PCE	Vinyl Chloride	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE
ROD CLEANUP LEVELS (3-Party Site)											2200	1500	1100	**5**	**5**	**5**	**2**	**7**	**70**	**70**
USEPA VISL 5° C													EPA VISL 5° C	**370**	**15**	**190**	**27**	**430**	**NIT**	**NIT**
ADEC VISL													ADEC VISL	**14**	**5.2**	**58**	**1.4**	**200**	**44**	**380**
AP-5751	Upgradient	11FW2H05WG	1/27/2011	426.19	-42.6	0.5	6.20	0.622	NA	NA	410	**7,400**	640	0.4 J	0.49 J	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
		11FW2H09WG-A	6/1/2011	427.78	66.3	0.7	6.07	0.347	5.79	7.49	370	**3,300 ML**	810	0.28 J	0.49 J	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
		11FW2H09WG-B[3]							0.03	22.4	120	**3,000**	560 J	0.07 J	ND(0.5)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
		11FW2H08WG-B	8/12/2011	428.03	50.6	2.5	6.22	0.59	0.04	22.3	120	**2,900**	520 J	0.08 J	0.11 J	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
		11FW2H14WG	9/21/2011	428.71	6.9	2.5	6.16	0.576	0.70 J	27.1	130	**2,600**	660 QH	0.07 J	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
		12FW2H02WG	8/22/2012	427.13	101.9	3.6	6.34	0.481	0.51	11.7	110	1,300	270 J,Q	0.09 J	ND(0.10)	ND(0.20)	ND(0.10)	ND(0.20)	ND(0.20)	ND(0.20)
		13FW2H01WG	5/2/2013	426.06	-24.2	0.3	6.07	0.502	5.95	13.5	350 B	**4,520**	850	0.41	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)
		14FWOU204WG	10/9/2014	429.12	169	0.6	6.25	0.913	ND(0.25)	33.8	ND(50)	1,210	786	ND(0.2)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)
PS-23	Source Area	10FW2H02WG	6/2/2010	NA	-87.2	0.8	6.55	0.802	30.70	22.7	430	1,300 QL	180 J	**15**	0.86	ND(0.5)	ND(0.5)	ND(0.5)	0.27 J	ND(0.5)
		10FW2H03WG[3]							NA	NA	420	1,300 QL	190 J	**15**	0.85	ND(0.5)	ND(0.5)	ND(0.5)	0.26 J	ND(0.5)
AP-10037MW		10FW2H05WG	7/28/2010	NM	NM	NM	NM	NM	12.40	24.9	260	1,200	140 J,B	1.4	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	0.080 J	ND(0.5)
		10FW2H07WG	9/28/2010	427.05	24.4	0.8	6.43	0.933	NA	NA	160	**1,600**	320 J,B	0.9	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)
		10FW2H09WG	11/15/2010	NM	178.6	12.9[2]	8.07	2.590	0.62	295	55 J	810 J,QL	190 J,Q	0.5 J	0.13 J	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)
		11FW2H01WG	1/24/2011	426.23	-100.0	1.0	6.88	3.275	3.90	366	61 J	640 J	210 J	0.3 J	0.15 J	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
		11FW2H06WG-A	6/1/2011	427.80	-62.3	0.7	6.97	2.178	5.63	128	73 J	**1,500**	380 J	0.4 J	0.33 J	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
		11FW2H07WG-A[3]								128	77 J	**1,500**	420 J	0.4 J	0.34 J	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
		11FW2H07WG-B	8/12/2011	428.08	5.5	1.0	7.03	1.981	6.18	122	67 J	1,100	250 J	0.6	0.30 J	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
		11FW2H12WG	9/21/2011	428.75	-93.3	2.3	7.06	2.12	7.09 J	144	75 J	1,300	440 J,QH	0.5	0.21 J	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
		11FW2H13WG[3]							6.86 J,QL	143	75 J	1,100	380 J,QH	0.5	0.23 J	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
		12FW2H03WG	8/22/2012	427.15	-40.6	4.0	7.17	2.179	8.21 QL	63.0	110	860	73 J,Q	1.3	ND(0.10)	ND(0.20)	ND(0.10)	ND(0.20)	ND(0.20)	ND(0.20)
		12FW2H04WG[3]							8.27 QL	63.1	110	1,110	120 J,Q	1.3	ND(0.10)	ND(0.20)	ND(0.10)	ND(0.20)	ND(0.20)	ND(0.20)
		13FW2H02WG	5/2/2013	426.08	-107.6	0.3	6.85	1.686	8 QL	38.9	126 B	**1,760**	774 Q	1.6	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)
		13FW2H03WG[3]							7.77	48.7	129 B	**1,550**	527 Q	1.8	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)
		14FWOU201WG	10/9/2014	429.13	209.5	0.7	7.2	3.758	ND(0.25) J-,J	185.0	32.5 J,B	773	490 J	ND(0.2)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(500)
		14FWOU202WG							0.15 J-, J	188.0	33.7 J	990	637	ND(0.2)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)
AP-6809	Downgradient	10FW2H04WG	6/2/2010	426.51	-10.3	1.3	6.34	0.970	NA	NA	66 J	1,000 QL	340 J	1.3	0.54	ND(0.5)	ND(0.5)	ND(0.5)	0.18 J	ND(0.5)
		10FW2H06WG	9/28/2010	426.88	144.8	0.8	6.08	1.017	NA	NA	34 J	1,300	280 J,B	0.7	0.28 J	ND(0.5)	ND(0.5)	ND(0.5)	0.08 J	ND(0.5)
		10FW2H10WG	11/15/2010	NM	170.6	0.7	6.50	1.172	NA	NA	21 J	870 ML,QL	150 J,B,Q	0.5 J	0.25 J	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)
		11FW2H02WG	1/24/2011	426.06	77.8	0.4	6.32	1.004	NA	NA	39 J	1,400	200 J	1.0	0.32 J	ND(0.50)	ND(0.50)	ND(0.50)	0.11 J	ND(0.50)
		11FW2H03WG[3]							NA	NA	39 J	1,400	190 J	0.9	0.31 J	ND(0.50)	ND(0.50)	ND(0.50)	0.09 J	ND(0.50)
		11FW2H08WG-A	6/1/2011	427.61	143.2	0.8	6.24	0.756	5.54	35.3	72 J	**2,100**	290 J	0.7	0.29 J	ND(0.50)	ND(0.50)	ND(0.50)	0.11 J	ND(0.50)
		11FW2H06WG-B	8/12/2011	427.82	61.1	1.3	6.17	0.766	1.68	40.5	53 J	1,300	170 J,B	0.7	0.24 J	ND(0.50)	ND(0.50)	ND(0.50)	0.11 J	ND(0.50)
		11FW2H11WG	9/21/2011	428.56	8.3	2.3	6.26	0.774	1.39 J	53.6	41 J,B	**1,600 ML**	260 J,B,QH	0.8	0.22 J	ND(0.50)	ND(0.50)	ND(0.50)	0.08 J	ND(0.50)
		12FW2H01WG	8/22/2012	427.00	80.2	1.4	6.45	1.017	3.19	61.4	36 J	1,200 ML	110 J,Q	0.6	0.12J	ND(0.20)	ND(0.10)	ND(0.20)	ND(0.20)	ND(0.20)
		13FW2H04WG	5/2/2013	425.92	41.3	0.3	6.33	1.005	0.96 J	80.3	56 J,B	**1,630**	479 J	0.6	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)
		14FWOU203WG	10/9/2014	428.98	181.4	1.0	6.36	1.254	ND(0.25)	102	ND(50)	ND(318)	0.232 J	ND(0.2)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)

Notes:

ADCE	Alaska Department of Environmental Conservation
DCE	dichloroethene
PCE	tetrachlorowthene
ROD	Record of Decision
TCE	trichloroethene
VISL	vapor intrusion screening level
mg/L	millirgams per liter
mS/cm	microSiemens per centimeter
mV	millivolts
µg/L	micrograms per liter
[red box]	VISL is exceeded

Table A.8-8 OU-2 Groundwater Results from DMRO Yard, Compared to VISL (From Draft 2014 OU 2 Monitoring Report, May 2015, Tables 3-3 and 4-1)

DRMO-4 (3-Party) Sub-Area

Well Number	Relative Location	Sample Number	Date	Water Elevation (ft NGVD29)	ORP (mV)	Dissolved Oxygen (mg/L)	pH	Conductivity (mS/cm)	Dissolved Iron (mg/L)	Sulfate (mg/L)	Alkalinity (mg/L)	Total Organic Carbon (mg/L)	Diesel Range Organics (µg/L)	ROD Contaminantss of Concern (µg/L)						
														Benzene	TCE	PCE	Vinyl Chloride	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE
ROD CLEANUP LEVELS													**1,500**	**5**	**5**	**5**	**2**	**7**	**70**	
USEPA Vapor Intrusion Screening Levels														**370**	**15**	**190**	**27**	**430**	**NIT**	**NIT**
ADEC Vapor Intrusion Screening Levels														**14**	**5.2**	**58**	**1.4**	**200**	**44**	**380**
AP-8916	Upgradient	10FW2C02WG	2/11/10	441.76	1.7	1.21	7.4	0.414	8.4	6.9	194	4.2	NA	ND(0.5)	ND(0.5)	2.0	ND(0.5)	ND(0.5)	0.25 J	ND(0.5)
		10FW2C04WG	6/2/10	442.25	-97.5	0.59	6.9	0.474	8.4	6.9	238	4.5	NA	0.34 J,QL	0.52 QL	1.9 QL	ND(0.5)	ND(0.5)	0.28 J,QL	ND(0.5)
		10FW2C08WG	10/12/10	442.64	-63.9	0.64	6.6	0.380	NA	NA	224	7.6	1,000 Q	0.59	1.50	4.0	ND(0.5)	ND(0.5)	0.23 J	ND(0.5)
		11FW2C02WG	6/3/2011	443.22	61.0	1.02	6.4	0.538	6.0	17.3	243	4.3	NA	ND(0.5)	1.2 QH	**9.2 QH**	ND(0.5)	ND(0.5)	0.2 J,QH	ND(0.5)
		11FW2C04WG	9/20/2011	443.73	28.7	2.37	5.6	0.453	1.92 J	22.2	206	3.9	170 J	0.09 J	0.65	**6.1**	ND(0.5)	ND(0.5)	0.23 J	ND(0.5)
		11FW2C05WG2							1.76 J	22.5	217	3.5	200 J	0.08 J	0.68	**6.2**	ND(0.5)	ND(0.5)	0.24 J	ND(0.5)
		11FW2C08WG	10/27/2011	442.89	-94.5	0.59	5.8	1.233	80.6	8.9	493	720	NA	0.46 J,QH	0.77 QH	4.7 QH	ND(0.5)	ND(0.5)	ND(0.50)	ND(0.5)
		11FW2C09WG2							73.2 QL	8.6	466	619	NA	0.43 J,QH	0.67 QH	4.4 QH	ND(0.5)	ND(0.5)	ND(0.50)	ND(0.5)
		12FW2C03WG	5/31/2012	443.34	-55.3	0.26	6.1	1.056	108	0.38 J	293	261	NA	ND(0.7)	0.75 Q	2.7 J,ML,Q	ND(0.1)	ND(0.2)	0.26 J,Q	ND(0.2)
		12FW2C04WG2							110	0.5	304	264	NA	ND(0.49)	0.81 Q	2.3 J,Q	ND(0.1)	ND(0.2)	0.26 J,Q	ND(0.2)
		12FW2C07WG	8/22/2012	443.34	-98.7	0.13	6.1	1.010	125	0.6	307	207	**10,000**	0.26 J,QH	ND(0.1)	**5.1 QH**	ND(0.1)	ND(0.2)	0.26 J,QH	ND(0.2)
		12FW2C08WG2							126	0.5	307	198	**9,600**	0.28 J,QH	ND(0.1)	**5.7 QH**	ND(0.1)	ND(0.2)	0.27 J,QH	ND(0.2)
		13FW2C03WG	8/27/2013	443.45	-102.9	0.19	6.6	0.560	42.5	0.4	170	29.2	1,360	ND(0.24)	ND(0.62)	ND(0.62) Q	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)
		13FW2C04WG2							39.3	0.4	169	27.9	**1,530**	ND(0.24)	ND(0.62)	2.18 Q	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)
		14FWOU215WG	10/9/2014	442.10	21.9	0.74	6.6	0.761	20.1	5.8	206	8.05	630	ND(0.200)	ND(0.500)	**6.7**	ND(0.500)	ND(0.500)	ND(0.500)	ND(0.500)
PO5	Source Area	10FW2C01WG	2/11/10	NM	-12.9	10.59	6.9	0.407	NA	NA	189	3.6	NA	0.29 J	1.2	1.6	ND(0.5)	ND(0.5)	0.27 J	ND(0.5)
		10FW2C03WG	6/2/10	NM	-58.3	2.10	6.5	0.419	NA	NA	201	3.7	NA	0.39 J	0.7	1.0	ND(0.5)	ND(0.5)	0.26 J	ND(0.5)
		10FW2C05WG	10/11/10	NM	-25.3	2.25	6.6	0.350	5.4	24	201	4.8	140 J,Q	0.28 J	3.1	4.0	ND(0.5)	ND(0.5)	0.29 J	ND(0.5)
		10FW2C05WG2							NA	NA	NA	NA	150 J,Q	0.28 J	3.2	4.0	ND(0.5)	ND(0.5)	0.31 J	ND(0.5)
		11FW2C03WG	6/6/2011	NM	5.0	5.73	6.3	0.422	5.0	24.6	165	3.1	NA	0.09 J	0.97	1.7	ND(0.5)	ND(0.5)	0.28 J	ND(0.5)
		11FW2C06WG	9/20/2011	NM	-56.9	1.55	6.6	0.434	5.1	30.3	181	3.8	120 J	0.11 J	3.8	**6.6**	ND(0.5)	ND(0.5)	0.49 J	0.07 J
		11FW2C10WG	10/27/2011	NM	-76.1	0.19	6.8	0.433	5.1	37.4	205	3.8	NA	0.11J	3.6	**7.9**	ND(0.5)	ND(0.5)	0.40 J	ND(0.5)
		12FW2C02WG	5/31/2012	NM	-63.9	0.21	6.8	0.432	4.5	23.4	158	2.3	NA	0.28 J	1.3	1.1	ND(0.1)	ND(0.2)	0.38 J	0.13 J
		12FW2C06WG	8/22/2012	NM	-74.5	0.15	6.8	0.468	4.9	26.4	227	2.6	83 J	0.10 J	4.2	3.8	ND(0.1)	ND(0.2)	0.51	0.26 J
		13FW2C02WG	8/27/2013	NM	-76.4	0.74	6.8	0.421	4.7	25.1	156	2.8	ND(0.39)	ND(0.24)	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)
		14FWOU211WG	10/9/2014	NM	16.5	4.7	6.5	0.501	5.1	28.4	213	4.7	228 J	ND(0.200)	4.63	**7.28**	ND(0.500)	ND(0.500)	ND(0.500)	ND(0.500)
Probe B	Downgradient	10FW2C07WG	10/11/10	442.36	26.2	1.10	6.6	0.438	NA	NA	273	22.7	**2,600 Q**	0.12 J	0.16 J	0.10 J	ND(0.5)	ND(0.5)	0.23 J	0.29 J
		11FW2C01WG	6/3/2011	442.78	111.8	1.02	6.3	0.569	4.6	29.2	267	3.6	NA	0.09 J	0.11 J	ND(0.5)	ND(0.5)	ND(0.5)	0.19 J	0.08 J
		11FW2C07WG	9/20/2011	443.46	-15.0	2.29	6.4	0.609	1.8 J	36.5	312	16.5	**4500**	0.07 J	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	0.13 J	ND(0.5)
		11FW2C11WG	10/27/2011	442.53	19.5	0.47	6.6	0.534	2.9	34.0	264	7.4	NA	0.090 J	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	0.21 J	0.070 J
		12FW2C01WG	5/31/2012	443.01	-13.6	0.33	6.4	0.716	4.6	40.2	330	3.8	NA	0.22 J	0.13 J	ND(0.2)	ND(0.1)	ND(0.2)	0.14 J	ND(0.2)
		12FW2C05WG	8/22/2012	442.98	-7.0	0.26	6.5	0.733	2.5	40.0	387	11.0	**2,200**	0.08 J	ND(0.1)	ND(0.2)	ND(0.1)	ND(0.2)	0.17 J	ND(0.2)
		13FW2C01WG	8/26/2013	443.13	-34.6	0.26	6.3	0.545	3.2	30.0	213	3.3	299 J	ND(0.24)	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)
		14FWOU210WG	10/9/2014	443.87	30.3	0.5	6.5	0.903	5.5	67.6	442	19.3	**2,320**	ND(0.200)	ND(0.500)	ND(0.500)	ND(0.500)	ND(0.500)	ND(0.500)	ND(0.500)
DRMO1, DRMO5, and Building 5010 Two-Party Sub-Areas																				
DRMO1 Two-Party Treatment System Area Wells																				
AP-5826		09FW2D02WG	5/20/2009	443.47	-15.6	0.7			NA	NA			1,000	NA	NA	NA	NA	NA	NA	NA
		10FW2D03WG	6/2/2010	442.50	-74.8	0.3			NA	NA			**3,900 QL**	NA	NA	NA	NA	NA	NA	NA
		11FW2D02WG	6/3/2011	443.40	84.6	0.8			2.2	20.7			**1,600**	NA	NA	NA	NA	NA	NA	NA
MP-4		09FW2D01WG	5/19/2009	443.26	-41.4	1.4			NA	NA			**5,300**	NA	NA	NA	NA	NA	NA	NA
		10FW2D01WG	6/1/2010	442.34	-80.4	0.4			NA	NA			**2,400 QL**	NA	NA	NA	NA	NA	NA	NA
		10FW2D01WG2							NA	NA			**2,400 QL**	NA	NA	NA	NA	NA	NA	NA
		11FW2D01WG	6/2/2011	443.29	50.4	0.9			10.9	4.1			**8,000**	NA	NA	NA	NA	NA	NA	NA
DRMO5 Two-Party Treatment System Area Wells																				
PI-3		09FW2E01WG	5/19/2009	442.55	35.2	1.5			NA	NA			**2,700**	NA	NA	NA	NA	NA	NA	NA
		10FW2E02WG	6/1/2010	441.90	-87.6	0.5			NA	NA			690 QL	NA	NA	NA	NA	NA	NA	NA
		11FW2E01WG	6/2/2011	442.83	46.7	1.3			9.0	28.7			**2,700**	NA	NA	NA	NA	NA	NA	NA
AP-6806		09FW2E02WG	5/19/2009	442.57	2.1	1.0			NA	NA			**8,200**	NA	NA	NA	NA	NA	NA	NA
		10FW2E01WG	6/1/2010	441.59	-109.5	0.5			NA	NA			**2,000 QL**	NA	NA	NA	NA	NA	NA	NA
		11FW2E02WG	6/3/2011	442.51	45.6	0.9			15.7	26.2			**9,300**	NA	NA	NA	NA	NA	NA	NA
Building 5010 Wells																				
AP-7346		09FW2F02WG	5/20/2009	444.01	-22.5	1.36			NA	NA			100 J	ND(1)	ND(1)	ND(1) QL	ND(1)	ND(1)	ND(1)	ND(1)
		10FW2F01WG	6/2/2010	442.83	-60.1	0.4			NA	NA			89 J,QL	0.080 J	0.48 J	ND(0.5)	ND(0.5)	ND(0.5)	0.40 J	0.16 J
		11FW2F02WG	6/6/2011	443.56	30.3	0.9			0.5	21.3			66 J	0.07 J	0.39 J	ND(0.50)	ND(0.50)	ND(0.50)	0.35 J	0.17 J
		12FW2F01WG	8/23/2012	443.92	19.7	0.2			0.2	30.9			62 J,B	ND(0.10)	0.7	ND(0.20)	ND(0.10)	ND(0.20)	0.64	0.4 J
		13FW2F01WG	5/6/2013	442.50	-14.2	0.4			NA	NA			ND(376)	ND(0.24)	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)
		13FW2F02WG2							NA	NA			ND(410)	ND(0.24)	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)
		14FWOU216WG	10/10/2014	444.78	136	1.7			NA	NA			ND(300)	ND(0.2)	0.41 J	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)

Table A.8-8 OU-2 Groundwater Results from DMRO Yard, Compared to VISL (From Draft 2014 OU 2 Monitoring Report, May 2015, Tables 3-3 and 4-1)

DRMO-4 (3-Party) Sub-Area

Well Number	Relative Location	Sample Number	Date	Water Elevation (ft NGVD29)	ORP (mV)	Dissolved Oxygen (mg/L)	pH	Conductivity (mS/cm)	Dissolved Iron (mg/L)	Sulfate (mg/L)	Alkalinity (mg/L)	Total Organic Carbon (mg/L)	Diesel Range Organics (µg/L)	ROD Contaminantss of Concern (µg/L)						
														Benzene	TCE	PCE	Vinyl Chloride	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE
ROD CLEANUP LEVELS													**1,500**	**5**	**5**	**5**	**2**	**7**	**70**	
USEPA Vapor Intrusion Screening Levels														**370**	**15**	**190**	**27**	**430**	**NIT**	**NIT**
ADEC Vapor Intrusion Screening Levels														**14**	**5.2**	**58**	**1.4**	**200**	**44**	**380**
AP-7348		09FW2F01WG	5/20/2009	443.82	-54.1	0.62			NA	NA			10,000	ND(1)	ND(1)	ND(1) QL	ND(1)	ND(1)	ND(1)	ND(1)
		10FW2F02WG	6/2/2010	442.86	-99.7	0.4			NA	NA			**11,000 QL**	1.2	0.19 J	ND(0.5)	ND(0.5)	ND(0.5)	0.40 J	ND(0.5)
		11FW2F01WG	6/3/2011	443.76	-10.5	0.7			30.7	8.9			**7,000**	0.6	0.16 J	ND(0.50)	ND(0.50)	ND(0.50)	0.56	0.09 J
		12FW2F02WG	8/23/2012	443.87	-86.3	0.1			56.1	0.8			**29,000**	2.2	0.15 J	ND(0.20)	ND(0.10)	ND(0.20)	0.42 J	0.12 J
		12FW2F03WG[2]							56.2	0.9			**31,000**	2.2	0.16 J	ND(0.20)	ND(0.10)	ND(0.20)	0.39 J	0.10 J
		13FW2F03WG	5/6/2013	442.44	-93.1	0.2			NA	NA			**14,500**	0.6	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)	ND(0.62)
		14FWOU218WG	10/10/2014	444.74	-0.2	0.4			NA	NA			**4,810**	ND(0.2)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)

Notes:

VISL is exceeded

Analytes exceeding remedial action goals (RAGs) established in the Record of Decision (ROD) or ADEC groundwater cleanup levels (from Table C of 18 AAC 75) are in bold type and gray shading. ROD chemicals of concern analyzed by EPA Method 8260C.

[1] Cleanup goal listed is an ADEC cleanup level and is not listed in the OU2 ROD.

[2] Sample is a Field Duplicate of the sample immediately above.

B - analytical result is qualified as a potential high estimate due to contamination present in a blank sample

btoc - below top of casing

DCE - dichloroethene

J - analyte is reported between the detection limit and LOQ indicated with a "L" (low) or "H" (high).

LOD - limit of detection

LOQ - limit of quantitation

NA - not analyzed or not applicable

ND - not detected at the detection limit (LOD in parentheses. LOQ in parentheses for data prior to 2012.)

msl - mean seal level

mS/cm - milliSiemens per cemtimeter

mg/L - milligrams per liter

mV - millivolts

PCE - tetrachloroethene

TCE - trichloroethene

Q - result considered an estimate due to a quality control failure. If direction of bias is known, it is further

µg/L - micrograms per liter

Table A.8-9 Summary of Risk-Based Cleanup Goals and Toxicity Criteria for Trimethylbenzenes in Operable Unit 3

Constituent of Concern	1996 ROD Cleanup Goal Concentration µg/L	1996 ROD toxicity criteria, source and date[1]	2002 ESD Concentration µg/L	2002 ESD toxicity criteria, source and date[2]	EPA Current 2015 tapwater RSL (HQ=1) µg/L	Provisional toxicity criteria, source and date (values available during drafting of report, December 2015)
1,2,4-Trimethyl benzene	14	pRfDo: 5E-04 mg/kg-day (EPA ECA 1994) pRfDi: 5E-04 mg/kg-day (EPA ECA 1994) *pRfCi equivalent: 1.75E-03 mg/m ^{3}*	1,850	RfDo: 5.0E-02 mg/kg-day (NCEA 2002) RfDi: 1.7E-03 mg/kg-day (NCEA 2002) *RfCi equivalent: 5.95E-03 mg/m ^{3}*	15	RfDo or pRfDo: Not available (none derived) pRfCi: 7.0E-03 mg/m ^{3} (PPRTV 2007)
1,3,5- Trimethyl benzene	12	pRfDo: 4E-04 mg/kg-day (EPA ECA 1994) pRfDi: 4E-04 mg/kg-day (EPA ECA 1994) *pRfCi equivalent: 1.40E-03 mg/m ^{3}*	1,850	RfDo: 5.0E-02 mg/kg-day (NCEA 2002) RfDi: 1.7E-03 mg/kg-day (NCEA 2002) *RfCi equivalent: 5.95E-03 mg/m ^{3}*	120	pRfDo: 1.0E-02 mg/kd-day (PPRTV Appendix 2009) subchronic pRfCi = 1E-02 mg/m ^{3} (PPRTV 2009)

Notes:

1	The ROD toxicity criteria is assumed to be equal to that used in the 1994 OU-3 Risk Assessment
2	The toxicity criteria used as the basis of the 2002 ESD risk-based concentrations were not presented in the ESD. These toxicity criteria are inferred from a 2002 EPA Region 9 Preliminary Remediation Goals table.
EPA ECA	USEPA's Environmental Criteria and Assessment Office
ESD	Explanation of Significant Differences
HQ	Hazard Quotent
NCEA	USEPA's National Center for Exposure Assessment
PPRTV	USEPA's Provisional Peer Reviewed Toxicity Value
ROD	Record of Decision
RfDi	Non-cancer inhalation reference dose (mg/kg-day), now superceded by inhalation reference concentration. "p" indicates a provisional value.
RfCi	Non-cancer inhalation reference concentration (mg/m3), which is equivalent to the RfDi x (70 kg / 20 m3/day). "p" indicates a provisional value.
RfDo	Non-cancer ingestion reference dose (mg/kg-day). "p" indicates a provisional value.
RSL	USEPA's Regional (risk-based) Screening Level

Table A.8-10 Comparison of Off-Site Groundwater Sample Results in Alluvial and Bedrock Monitoring Wells with Vapor Intrusion Screening Levels from 2014 Monitoring Report, FES 2015a (Tables 2-5 and 2-7)

Birch Hill Tank Farm

Probe/Well Number	Sample Number	Date	Water Elevation (ft msl)	Dissolved Oxygen (mg/L)	ROD Contaminants of Concern (µg/L)						
					Benzene	Toluene	Ethylbenzene	1,2,4-TMB	1,3,5-TMB	1,2-DCE	1,2-EDB
ROD CLEANUP LEVELS (MCLs)					**5**	**1,000**	**700**	**1,850**	**1,850**	**5**	**0.05**
USEPA VISL (at 5 degrees C)					**370.0**	**59,000**	**1200.0**	**120**	**NIT**	**430.0**	**61.00**
ADEC VISL					**14**	**19,200**	**12**	**29**	**20**	**19**	**1.50**
ALLUVIAL WELL AP-9958	10FWTH01WG	2/10/2010	424.57	1.08	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	0.35 J	ND(0.02)
	10FWTH06WG	6/22/2010	424.82	0.68	ND(1)	0.12 J	ND(1)	ND(1)	ND(1)	ND(1)	ND(0.01) QL
	10FWTH26WG	8/17/2010	425.53	0.43	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	0.37 J	ND(0.01)
	10FWTH31WG	11/9/2010	424.95	0.45	ND(1)	0.27 J ,B,QH	ND(1)	ND(1)	ND(1)	0.41 J, QH	ND(0.019)
	10FWTH32WG[2]	11/9/2010	424.95		ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	0.4 J	ND(0.020)
	11FW3BH03WG	6/30/2011	425.79	0.72							
	11FW3BH71WG	10/6/2011	426.84	1.85	ND(1) NA NA	ND(1) NA NA	ND(1) NA NA	ND(1) NA NA	ND(1) NA NA	ND(1) NA NA	ND(1) NA NA
	11FW3BH72WG[2]	10/6/2011	426.84								
	12FW3BHA01WG	9/25/2012	425.95	0.16	ND(0.2)	ND(0.4)	ND(0.2)	ND(0.2)	ND(0.4)	0.34 J	ND(0.2)
	13FW3BHA08WG	6/11/2013	425.73	1.79	ND(0.2)	ND(0.4)	ND(0.2)	0.48 J	0.19 J	0.41 J	ND(0.2)
	14FWOU343WG	10/15/2014	429.51	0.56	ND(0.1)	0.07 J	ND(0.1)	ND(0.2)	ND(0.2)	0.26 J	ND(0.2)
	14FWOU344WG	10/15/2014	429.51	0.56	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.2)	ND(0.2)	0.25 J	ND(0.2)
ALLUVIAL WELL AP-9956	10FWTH05WG	2/10/2010	424.51	1.33	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	1.4	ND(0.02)
	10FWTH09WG	6/22/2010	424.77	0.40	ND(1)	0.12 J	ND(1)	ND(1)	ND(1)	1.5	ND(0.01) QL
	10FWTH29WG	8/17/2010	425.42	0.14	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	1.3	ND(0.010)
	10FWTH34WG	11/9/2010	424.87	0.44	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	1.4	ND(0.020)
	11FW3BH05WG	6/30/2011	425.80	0.79	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	1.1	ND(1)
	11FW3BH73WG	10/6/2011	426.78	2.04	NA	NA	NA	NA	NA	NA	NA
	12FW3BHA02WG	9/25/2012	425.89	0.19	ND(0.2)	ND(0.4)	ND(0.2)	ND(0.2)	ND(0.4)	1.1	ND(0.2)
	13FW3BHA07WG	6/11/2013	425.72	2.01	ND(0.2)	0.18 J	ND(0.2)	ND(0.2)	ND(0.4)	1.2	ND(0.2)
	14FWOU345WG	10/15/2014	429.36	0.41	ND(0.1)	0.06 J	ND(0.1)	ND(0.2)	ND(0.2)	1.3	ND(0.2)
BEDROCK well AP-9957	10FWTH04WG	2/10/2010	424.48	1.41	ND(1)	ND(1)	0.15 J	ND(1)	ND(1)	0.62 J	ND(0.02)
	10FWTH08WG	6/22/2010	424.77	0.18	ND(1)	0.12 J, Q	ND(1)	0.060 J	ND(1)	ND(1) Q	ND(0.01) QL
	10FWTH13WG[2]	6/22/2010	424.77	0.18	ND(1)	0.19 J	ND(1)	ND(1)	ND(1)	0.71 J	ND(0.01) QL
	10FWTH30WG	8/17/2010	425.28	0.11	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	0.61 J	ND(0.10)
	10FWTH35WG	11/9/2010	424.89	0.65	ND(1)	ND(1)	0.11 J,QH	ND(1)	ND(1)	0.76 J, QH	ND(0.021)
	11FW3BH06WG	6/30/2011	425.68	0.86	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(0.02)
	11FW3BH08WG[2]	6/30/2011	425.68	0.86	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(0.02)
	12FW3BHB06WG	9/25/2012	425.87	0.19	ND(0.2)	ND(0.4)	ND(0.2)	ND(0.2)	ND(0.4)	0.84 J	ND(0.2)
	12FW3BHB07WG[2]	9/25/2012	425.87	0.19	ND(0.2)	ND(0.4)	ND(0.2)	ND(0.2)	ND(0.4)	0.83 J	ND(0.2)
	13FW3BHB42WG	6/11/2013	425.68	1.70	ND(0.2)	0.21 J	ND(0.2)	ND(0.2)	ND(0.4)	0.63 J	ND(0.2)
	14FWOU346WG	10/15/2014	429.80	0.44	ND(0.1)	0.11 J	ND(0.1)	ND(0.2)	ND(0.2)	0.73 J	ND(0.2)
BEDROCK WELL AP-9959	10FWTH02WG	2/10/2010	425.31	0.88	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	0.75 J	ND(0.02)
	10FWTH03WG[2]	2/10/2010	425.31	0.88	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	0.72 J	ND(0.02)
	10FWTH07WG	6/22/2010	425.52	0.28	ND(1)	0.18 J	ND(1)	ND(1)	ND(1)	0.78 J	ND(0.01) QL
	10FWTH27WG	8/17/2010	426.25	0.11	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	0.81 J	ND(0.02)
	10FWTH28WG[2]	8/17/2010	426.25	0.11	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	0.75 J	ND(0.019)
	10FWTH33WG	11/9/2010	425.69	0.61	ND(1)	ND(1) B,QH ND(1)	ND(1)	ND(1)	ND(1)	0.61 J,QH	ND(0.20)
	11FW3BH04WG	6/30/2011	426.55	1.26	ND(1)		ND(1)	ND(1)	ND(1)	0.72 J	ND(0.02)
	12FW3BHB05WG	9/25/2012	426.64	0.29	ND(0.2)	ND(0.4)	ND(0.2)	ND(0.2)	ND(0.4)	0.91 J	ND(0.2)
	13FW3BHB43WG	6/11/2013	426.48	1.51	ND(0.2)	ND(0.4)	ND(0.2)	ND(0.2)	ND(0.4)	0.72 J	ND(0.2)
	13FW3BHB44WG[2]	6/11/2013	426.48	1.51	ND(0.2)	ND(0.4)	ND(0.2)	ND(0.2)	ND(0.4)	0.69 J	ND(0.2)
	14FWOU341WG	10/15/2014	430.25	0.33	ND(0.1)	0.06 J	ND(0.1)	ND(0.2)	ND(0.2)	0.62	ND(0.2)
	14FWOU342WG[2]	10/15/2014	430.25	0.33	ND(0.1)	0.07 J	ND(0.1)	ND(0.2)	ND(0.2)	0.60	ND(0.2)

Bold results represent concentrations in excess of remedial action goals

1 Replacement wells installed in November 2011. Wells that were replaced are shown in parentheses.

2 Denotes sample is a field duplicate of preceding row.

3 1,2-Dibromoethane results were generated from either Method 8260 or Method 504.1. Results from Method 504.1 were used when available. ND - not detected at the detection limit (LOQ in parentheses for data prior to 2012. LOD in parentheses for data staring in 2012.)

DCE - dichloroethene

DRO - Diesel Range organics

EDB - ethylene dibromide

ft - feet

LOD - Limit of Detection

LOQ - Limit of Quantitation

NA - not analyzed

NM - not measured

MCL - Maximum Contaminant Level

mg/L - milligrams per liter

msl - mean sea level

ROD - Record of Decision

TMB - trimethylbenzene

µg/L - micrograms per liter

Table A.8-11a Summary of Risk-Based Cleanup Goals for Operable Unit 4

ROD Date Cleanup Goal Identification	Constituent of Concern	Concentration	Units	Target ILCR for 1996 RBC	Current 2015 tapwater RSL (ILCR of 1E-06)	Current toxicity criteria source and date
Aug 1996	1,1,2,2-Tetrachloroethane	5.2	µg/L	1.00E-04	7.60E-02	IRIS 2010

Table A.8-11b Comparison of Toxicity Criteria for 1,1,2,2,-Tetrachloroethane

1,1,2,2-Tetrachloroethane	SF_O $(mg/kg\text{-}day)^{-1}$	Source of SFo	Inhalation Cancer Risk Factor (IUR or CSFi)	Units	Source of Inhalation Cancer Risk Factor	RfD_o (mg/kg-day)	Source of RfDo
2016 Toxicity Criteria	2.00E-01	IRIS	5.8E-05 (IUR)	$(ug/m^3)^{-1}$	California EPA	2.00E-02	IRIS
Previous Toxicity Criteria (circa 2003)	2.00E-01	IRIS	2.00E-01 (CSFi)	$(mg/kg\text{-}day)^{-1}$	IRIS	6.00E-02	EPA provisional value; National Center Exposure Assessment

Notes:

ILCR incremental lifetime cancer risk
IRIS Integrated Risk Information System
RBC risk-based concentration
ROD Record of Decision
RSL Regional Screening Level
µg/L micrograms per liter

The previous toxicity criteria were surmised from a 2003 edition of the EPA Region 3 Risk Based Concentration screening table, for which the tapwater RBC was 5.3 ug/L at a cancer risk limit of 1E-04

Table A.8-12 Summary of Risk-Based Cleanup Goals for Operable Unit 5

ROD Date Cleanup Goal Identification	Constituent of Concern	Concentration	Units	Target ILCR for 1996 RBC	Current 2016 tapwater RSL (ILCR of 1E-06)	Current toxicity criteria source and date
May 1999	bis(2-chloroethyl) ether	9.20E-03	µg/L	1.00E-06	1.40E-02	IRIS 1987

Notes:

ILCR	incremental lifetime cancer risk
RBC	risk-based concentration
ROD	Record of Decision
RSL	Regional Screening Level
µg/L	micrograms per liter

Table A.8-13 Summary of Risk-Based Cleanup Goals for Operable Unit 6

ROD Date Cleanup Goal Identification	Constituent of Concern	ROD Risk-Based Concentration	Units	Current 2016 EPA RSL	Current toxicity criteria source and date
Jan 2014	aluminum	7.70E+04	mg/kg	7.70E+04	PPRTV 2006
Jan 2014	manganese	1.80E+03	mg/kg	1.80E+03	IRIS 1993 (inhalation), IRIS 1995 (oral)

Notes:

RSL EPA regional risk-based screening level
ROD Record of Decision
mg/kg milligrams per kilogram

Table A.8-14 Comparison of Indoor Air Vapor Intrusion Screening Levels (ug/m3)

Compound	ADEC 2012	USEPA 2016
Xylene, Isomers m & p	100	100
1,1,1-Trichloroethane	5210	5200
1,1,2,2-Tetrachloroethane	0.42	0.48
1,1,2-Trichloroethane	0.21	0.21
1,1-Dichloroethane	15	18
1,1-Dichloroethene	210	210
1,2,3-Trichloropropane	0.31	0.31
1,2,4-Trichlorobenzene	2.1	2.1
1,2,4-Trimethylbenzene	7.3	7.3
1,2-Dibromoethane	0.041	0.047
1,2-Dichlorobenzene	210	210
1,2-Dichloroethane	0.94	1.1
1,2-Dichloropropane	2.4	2.8
1,3,5-Trimethylbenzene	7.3	NA
1,3-Dichlorobenzene	210	NA
1,4-Dichlorobenzene	2.2	2.6
2-Butanone	5210	5200
2-Hexanone	31	31
4-Methyl-2-pentanone	3130	3100
Acetone	32200	32000
Benzene	3.1	3.6
Bromodichloromethane	0.66	0.76
Bromoform	22	26
Bromomethane	5.2	5.2
Carbon disulfide	730	730
Carbon tetrachloride	4.1	4.7
Chlorobenzene	52	52
Chloroethane	10400	10000
Chloroform	1.1	1.2
cis-1,2-Dichloroethene	7.3	NA
cis-1,3-Dichloropropene	6.1	7
Dibromochloromethane	0.9	NA
Ethylbenzene	9.7	11
Hexachlorobutadiene	NA	1.3
Isopropylbenzene	420	420
Methylene chloride	52	630
Methyl-tert-butyl ether (MTBE)	94	110
Naphthalene	0.72	0.83
n-Butylbenzene	180	NA
n-Propylbenzene	1040	1000
o-Xylene	100	100
sec-Butylbenzene	180	NA
Styrene	1040	1000
tert-Butylbenzene	180	NA

Table A.8-14 Comparison of Indoor Air Vapor Intrusion Screening Levels (ug/m3)

Compound	ADEC 2012	USEPA 2016
Tetrachloroethene (PCE)	42	42
Toluene	5210	5200
trans-1,2-Dichloroethene	63	NA
trans-1,3-Dichloropropene	6.1	7
Trichloroethene (TCE)	2.1	2.1
Trichlorofluoromethane	730	NA
Vinyl chloride	1.6	1.7
Xylenes	100	100

Notes:
ADEC VISL are from ADEC 2012 Appendix D, for protection of residential exposure
The USEPA VISLs were developed using VISL calculator version 3.4.6, downloaded February 2016. http://www.epa.gov/vaporintrusion
Both VISL use a target cancer risk of 1E-05 and a hazard index of 1.

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ATTACHMENT 9

Public Notice

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The U.S. Army announces the 4th Five-Year Review for soil and groundwater remedies implemented at Operable Units (OUs) 1 through 6 on Fort Wainwright, Alaska (FWA).

Section 121 (c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP) state "a remedial action that resulted in hazardous substances, pollutants, or contaminants remaining at the site shall be reviewed no less frequently than every five years." Thus CERCLA requires a statutory Five-Year Review of the selected remedial actions on FWA. The last Five-Year Review of OUs I through 6 was completed in September 2011.

The U.S. Army Corps of Engineers, Buffalo District (USACE) is conducting the 4th Five-Year Review for OUs 1 through 6 on FWA. The five-year review includes review of new data and information, inspection of the OUs, and interviews of stakeholders and interested community members. The objective of the review is to ensure that the completed or on-going remedies are protective of human health and the environment.

USACE initiated the Five-Year Review process in July 2015 and it will be completed by September 2016. The findings of the Five-Year Review will be available for public review after September 2016 at the three document repositories listed below. These three libraries contain detailed information concerning the selected remedies for OUs 1 through 6 and the contamination addressed by the remedies.

Contact Information: If you have any questions, comments, and/or concerns above the five-year review you may contact the following:

Sandra Halstead
USEPA, Federal Facilities
Alaska Operations Office
222 W. 7th Avenue, Box 19
Anchorage, AK 99513-7588
(907) 271-1218
halstead.sandra@epa.gov

Guy Warner
Alaska Department of Environmental Conservation

Joe Malen
U.S. Army Alaska, Directorate of Public Works
ATTN: IMPA-FWA-PWE (J. Malen)
1060 Gaffney Road #4500
Fort Wainwright, AK 99703-4500
(907) 353-4512
Joseph.malen@us.army.mil

Document Repositories:

Noel Wien Public Library
1215 Cowles Street
Fairbanks, Alaska 99701
(907) 459-1020

Fort Wainwright CERCLA Library
Building 3023
Fort Wainwright, AK 99703
(907) 353-4512

Fort Wainwright Post Library
3700 Santiago Avenue
Fort Wainwright, AK 99703
(907) 353-2642

Soldier readiness starts at home, on top-quality Army installations

Chief of Staff of the U.S. Army Gen. Mark A. Milley, left, recognized U.S. Army Garrison, Fort Wainwright, Alaska, as a bronze winner for installation excellence, during the 2016 Army Communities of Excellence Awards ceremony, May 24, in the Pentagon. Col. Sean C. Williams, garrison commander accepted the award. (Photo by Sgt. Ricky Bowden, U.S. Army)

C. Todd Lopez
Army Service News

A good foundation for Soldier and Army readiness, said the Army's chief of staff, is home base -- where Soldiers live, where their kids go to school, and where their spouses shop for groceries.

Thirteen Army installations were cited, May 24, for providing to Soldiers just that type of home base: one where they can leave home to conduct the nation's business, without being distracted by concerns for the well-being of the families they left behind.

During the 2016 Army Communities of Excellence Awards at the Pentagon, Gen. Mark A. Milley explained how installation excellence directly supports Soldier and Army readiness.

About 2.7 million Soldiers, he said, have deployed to Iraq and Afghanistan over the last 15 years. And for each one of those Soldiers, he said, "their first concern, actually, was not the Taliban or al Qaeda ... their first concern was always, in every case, their family."

The general said that today, some 60 percent of the force is married, and has, on average, between one and two children. Those Solders, he said, could not have performed their duties abroad if they were distracted with concerns for the well-being of their families back home.

"A Soldier who is deployed and who thinks his family doesn't have adequate housing, has mold in the showers, the roof is leaking, the heat or air conditioning doesn't work, who doesn't have adequate medical care for his family or children ... or a community that doesn't feel safe, or doesn't have adequate police protection ... is not going to focus on their job in training, and certainly not going to focus on their job in wartime."

It's the role of installation commanders, Milley said, to ensure that there are adequate medical facilities, schools in place that are well-equipped, well-stocked commissaries and post exchanges, family support programs, recreational centers, youth centers, child care facilities and fi-ness centers, for instance.

"The list goes on and on," he said. "These are huge responsibilities for these communities. It's incumbent upon all of us as part of the institution ... to really take care of that Soldier and importantly, their family. By doing so, we are contributing to the readiness of the force."

Readiness, Milley said, is today the Army's No. 1 priority.

"Those 2.7 million could not have performed their task in combat without knowing there was a rear detachment, without knowing there was a garrison commander, or hospital commander, or a school district their child was going to," he said.

Well-run installations, Milley said, provide for families. And that, he said, provides Soldiers with the confidence to do their combat mission. "It's really a direct and causal contributor to the readiness of our force."

For 2016, the Army recognized the following installations for providing Soldier families with the support needed so that Soldiers could confidently deploy in support of the nation:

PUBLIC NOTICE

U.S. Army Garrison Fort Wainwright, Alaska announces the Five-Year Review process of evaluating soil and groundwater remedies implemented at Operable Units 1 through 6 on Fort Wainwright, Alaska.

Section 121 (C) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan state "a remedial action that resulted in hazardous substances, pollutants, or contaminants remaining at the site shall be reviewed no less frequently than every five years." Thus, CERCLA requires a statutory Five-Year Review of the selected remedial actions at FWA.

USAG FWA initiated the Five-Year Review process in August 2015 and it will be completed by September 2016. The findings of the Five-Year Review will be available for public review after September 2016 at: Noel Wien Library in Fairbanks; Fort Wainwright Post Library; and Directorate of Public Works CERCLA Library, Building 3023, on Fort Wainwright. These three libraries contain detailed information concerning the selected remedies at Fort Wainwright and the soil and ground water contamination addressed by the remedies.

If you are interested in reviewing the document or if you have any questions regarding the Five-Year Review process, questions may be directed to:

Directorate of Public Works
ATTN: IMFW-PWE (J. Malen)
1046 Marks Rd
Fort Wainwright, AK 99703
(907) 361-4512 – *joseph.s.malen.civ@mail.mil*

ATTACHMENT 10

Groundwater Monitoring Data

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OU-1 801 Drum Burial Site

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OU-1 801 Drum Site Trend Analysis

Dieldrin groundwater concentrations (µg/L) were subjected to the Mann-Kendall test to determine if any surveillance well shows a statistically significant upward trend in concentration.

The Mann-Kendall test, described in the EPA document: Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance (USEPA, March 2009) and USACE Engineer Manual: Environmental Quality – Environmental Statistics (USACE, May 2013), is an accepted method for identifying the presence of a significant upward trend at surveillance wells. Under this method it is assumed that no discernible linear trend exists in concentration data over time (null hypothesis). To test this hypothesis the Mann-Kendall statistic (test statistic) is determined. The test statistic is a function of the sample data which quantifies the probability associated with the relative magnitudes of the sample data for a given sample size (n). The significance of this probability is determined by comparison to the critical value, a threshold value of statistical significance. Under the normal approximation to the Mann-Kendall test, the critical value is determined based on a 95% level of confidence associated with the standard normal distribution. If the test statistic exceeds the critical value, the null hypothesis is rejected and the alternative hypothesis (concentrations are trending) accepted. For small sample sizes ($n \leq 10$) a slightly different procedure is utilized, in which the probability is calculated directly and compared to the selected level of significance (0.05 for a 95% level of confidence); in this case, the null hypothesis is rejected if the probability is less than the level of significance. Rejection of the null hypothesis is considered to be strong evidence of an upward trend; if the null hypothesis is not rejected there is insufficient evidence for identifying a significant, non-zero trend.

The results of the dieldrin groundwater concentration trend evaluation are presented in the following table. No trend was identified in wells 6327, 6326, 6331 and 7282.

WELL	SAMPLE SIZE (N)	TEST STATISTIC	CRITICAL VALUE
6327	12	0.07	1.64
6326	12	0.07	1.64
6331	12	-1.37	-1.64
7282	14	0.22	1.64

NOTE: If Test Statistic exceeds the Critical Value, there is evidence of trending.

Wells 6630, 7284 and 7279 were not evaluated as most of the data are censored (concentrations are predominantly non-detectable). The test loses significant statistical power if most of the data are censored.

Benzene groundwater concentrations were evaluated in wells 6327 and 6326, the results of which are presented in the table below. A downward trend was identified for well 6327, however concentrations remained constant between 2010 and 2015; a trend was not identified for well 6326, however the time series plot suggests a downward trend.

WELL	SAMPLE SIZE (N)	TEST PROBABILITY	LEVEL OF SIGNIFICANCE
6327	7	<0.0002	0.05
6326	6	0.068	0.05

NOTE: If the Test Probability is less than the Level of Significance, there is evidence of trending.

DRO groundwater concentrations were evaluated in well 6327, the results of which are presented in the table below. No trend was identified.

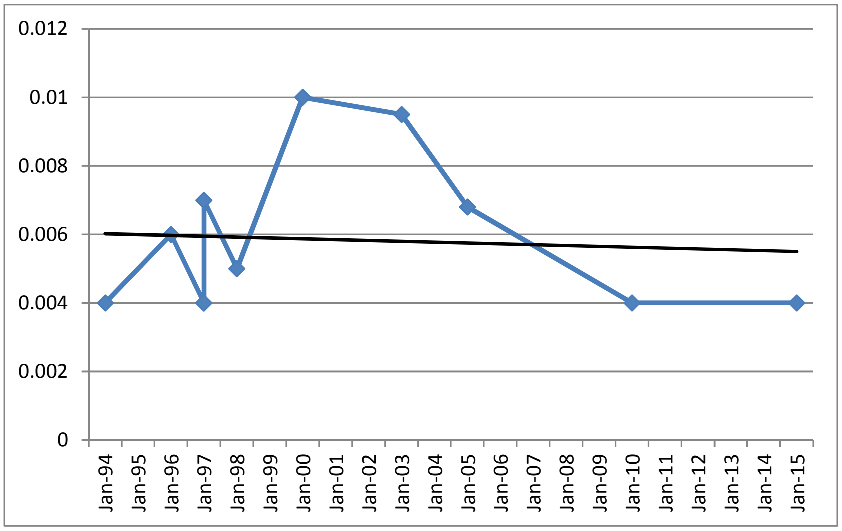
WELL	SAMPLE SIZE (N)	TEST PROBABILITY	LEVEL OF SIGNIFICANCE
6327	4	0.375	0.05

Cis-1,2-dichloroethene groundwater concentrations were evaluated in well 6326, the results of which are presented in the table below. A downward trend was identified.

WELL	SAMPLE SIZE (N)	TEST PROBABILITY	LEVEL OF SIGNIFICANCE
6326	6	0.028	0.05

Well AP-6327

Dieldrin	**µg/L**
Aug-93	0.66
Dec-94	0.004
Aug-96	0.006
Mar-97	0.004
Jun-97	0.004
Sep-97	0.007
Mar-98	0.005
Mar-00	0.01
Apr-03	0.0095
Apr-05	0.0068
Jul-10	0.004
May-15	0.004



Mann-Kendall Test Using Normal Approximation for Larger Samples

S	2					
V(S)	196.00	n	12	ties		
z	**0.07**			w_1 (0.004)	5	300
Z(0.9)	**1.28**	Z(0.95)	1.64			

Ho: No trend

Ha: upward Trend

Reject Ho if z> Z(0.9)

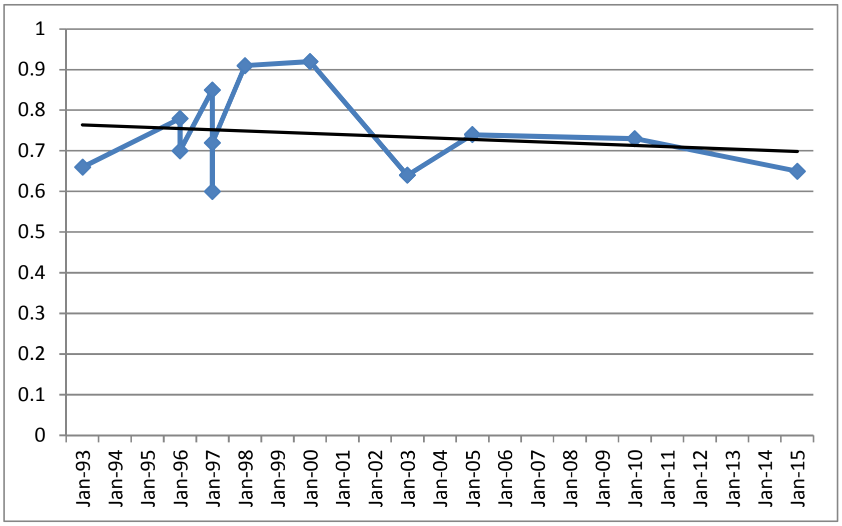
Ho is not rejected, there is no evidence of an upward trend at the 90% level of confidence

Reject Ho if z> Z(0.95)

Ho is not rejected, there is no evidence of an upward trend at the 95% level of confidence

Well AP-6326

Dieldrin	µg/L
Aug-93	0.66
Aug-96	0.78
Dec-96	0.7
Mar-97	0.85
Jun-97	0.6
Sep-97	0.72
Mar-98	0.91
Mar-00	0.92
Apr-03	0.64
Apr-05	0.74
Jul-10	0.73
May-15	0.65



Mann-Kendall Test Using Normal Approximation for Larger Samples

S	2		
V(S)	212.67	n	12
z	**0.07**		
Z(0.9)	**1.28**	Z(0.95)	1.64

Ho: No trend

Ha: upward Trend

Reject Ho if z> Z(0.9)

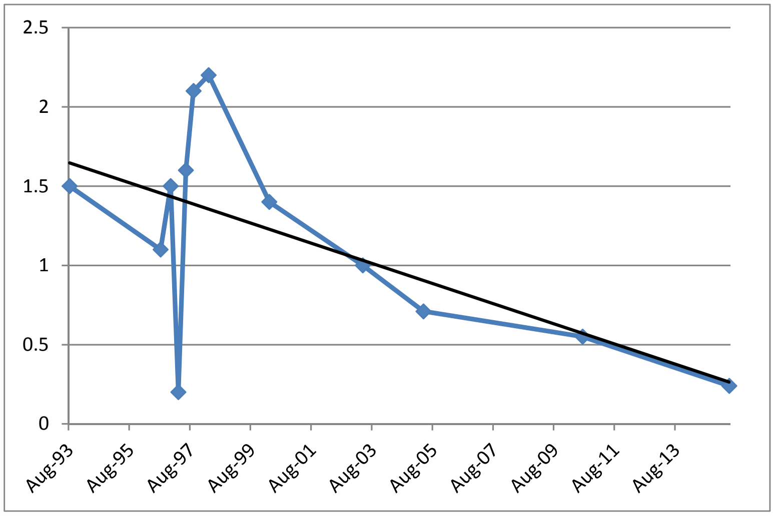
Ho is not rejected, there is no evidence of an upward trend at the 90% level of confidence

Reject Ho if z> Z(0.95)

Ho is not rejected, there is no evidence of an upward trend at the 95% level of confidence

Well AP-6331

Dieldrin	µg/L
Aug-93	1.5
Aug-96	1.1
Dec-96	1.5
Mar-97	0.2
Jun-97	1.6
Sep-97	2.1
Mar-98	2.2
Mar-00	1.4
Apr-03	1
Apr-05	0.71
Jul-10	0.55
May-15	0.24



Mann-Kendall Test Using Normal Approximation for Larger Samples

S	-21					
V(S)	211.67	n	12	ties		
z	**-1.37**			w_1 (1.5)	2	18
Z(0.9)	**-1.28**	Z(0.95)	**-1.64**			

Ho: No trend

Ha: downward Trend

Reject Ho if z< Z(0.9)

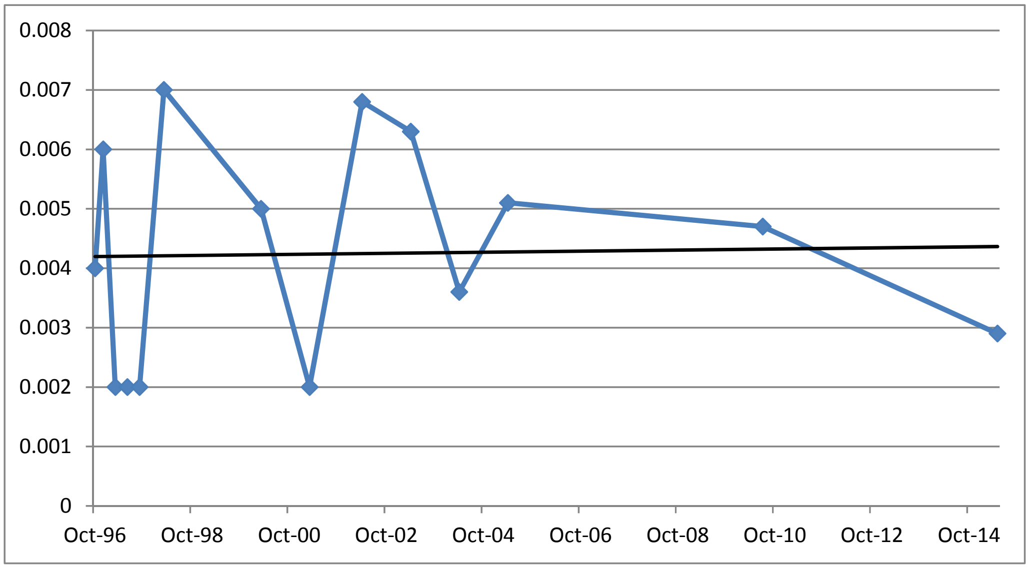
Ho is rejected, there is evidence of a downward trend at the 90% level of confidence

Reject Ho if z< Z(0.95)

Ho is not rejected, there is no evidence of a downward trend at the 95% level of confidence

Dieldrin	µg/L
Oct-96	0.004
Dec-96	0.006
Mar-97	0.002
Jun-97	0.002
Sep-97	0.002
Mar-98	0.007
Mar-00	0.005
Mar-01	0.002
Apr-02	0.0068
Apr-03	0.0063
Apr-04	0.0036
Apr-05	0.0051
Jul-10	0.0047
May-15	0.0029

Well AP-7282



Mann-Kendall Test Using Normal Approximation for Larger Samples

S	5					
V(S)	325.00	n	14	ties		
z	**0.22**			w_1 (0.002)	4	156
Z(0.9)	**1.28**	Z(0.95)	**1.64**			

Ho: No trend

Ha: Upward Trend

Reject Ho if z > Z(0.9)

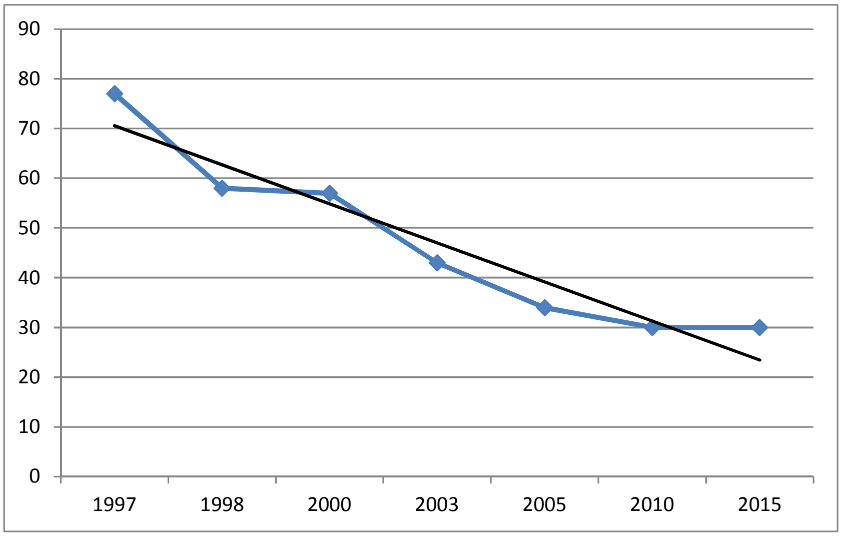
Ho is not rejected, there is no evidence of an upward trend at the 90% level of confidence

Reject Ho if z > Z(0.95)

Ho is not rejected, there is no evidence of an upward trend at the 95% level of confidence

Well AP-6327

Benzene	µg/L
1997	**77**
1998	**58**
2000	**57**
2003	**43**
2005	**34**
2010	**30**
2015	**30**



Mann-Kendall Trend Test for Small Sample Sizes (n≤10)

S	-20	
p	**<0.0002**	From Table B-10
n	7	

Ho: No trend

Ha: Downward Trend

Reject Ho if $p < 0.1$

Ho is rejected, there is evidence of a downward trend at the 90% level of confidence

Reject Ho if $p < 0.05$

Ho is rejected, there is evidence of a downward trend at the 95% level of confidence