RELATIVE RISK SITE EVALUATION

Kingsley Field Air National Guard Base, Oregon

Introduction

The Department of Defense (DoD) identified certain per- and polyfluoroalkyl substances (PFAS) as emerging contaminants of concern which affected installations across the Air Force. When the term "Air Force" is used in this fact sheet, it includes Air National Guard. Specifically, perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), and perfluorobutanesulfonic acid (PFBS) are components of legacy Aqueous Film Forming Foam (AFFF) that the Air Force began using in the 1970s as a firefighting agent to extinguish petroleum fires. The U.S. Environmental Protection Agency (EPA) issued lifetime drinking water Health Advisories (HA) for PFOS and PFOA, and health-based regional screening levels for PFBS.

The Air Force has systematically evaluated potential AFFF releases on all Installations and former Installations. It began with the Preliminary Assessments, or PAs, that identified potential release areas. First responders, fire chiefs, and hangar staff were interviewed to determine where a release or a spill may have occurred on an Installation (for example, aircraft crash site or an accidental hangar AFFF release). Once the information in the PA was collected, Site Inspections, or SIs, were initiated to take soil and water samples and analyzed the media for PFAS compounds at the potential release areas. The intention of the SI was to determine if a release had occurred and to determine the impacts to soil and/or groundwater. The next step in the process is called the Relative Risk Site Evaluation, or RRSE, which is a tool used to sequence Sites/Installations to begin a Remedial Investigation, or RI. Air Force Installations are at the beginning of the more detailed investigative stage, the RI, to determine, where action is needed and to identify remedial technologies.

The Kingsley Field Air National Guard Base (ANGB) PFAS PA and SI can be found at the Air Force Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Administrative Record (AR): https://ar.afcec-cloud.af.mil/ Scroll to the bottom of the page and click on “Continue to site”, then select Air National Guard (e.g., Active, ANG, BRAC), scroll down the Installation List and click on Klamath Falls Int APT, OR, then enter the AR Number 469950 in the “AR #” field for the PA. For the SI, enter the AR Number 580134 (1 of 5). Then click “Search” at the bottom of the page. Click on the spy glass to view the document.

More information on the Air Force response to PFOS and PFOA can be found at: https://www.afcec.af.mil/WhatWeDo/Environment/Perfluorinated-Compounds/

Acronyms

AFFF - Aqueous Film Forming Foam

ANGB - Air National Guard Base

AST – Aboveground Storage Tank

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act

CHF – Contaminant Hazard Factor

DoD - Department of Defense

EPA – US Environmental Protection Agency

HA – Health Advisory

MPF – Migration Pathway Factor

PA – Preliminary Assessment

PFAS - Per-and polyfluoroalkyl substances

PFBS – Perfluorobutanesulfonic acid

PFOS - Perfluorooctane sulfonate

PFOA - Perfluorooctanoic acid

RF – Receptor Factor

RI – Remedial Investigation

ROD - Record of Decision

RRSE – Relative Risk Site Evaluation

PRL - Potential Release Location

SI – Site Inspection

RELATIVE RISK SITE EVALUATION, cont.

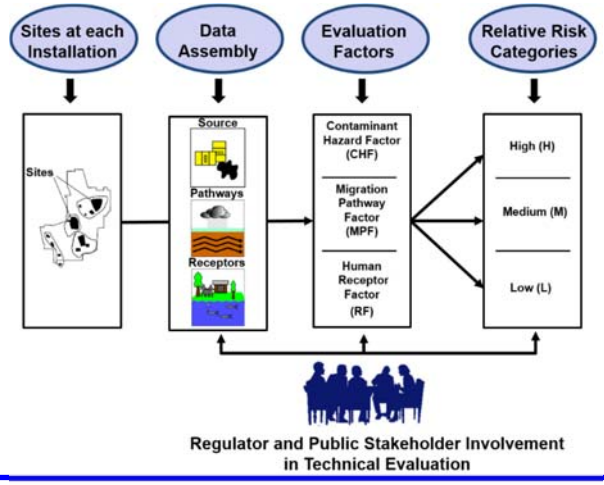
Q. What is the Relative Risk Site Evaluation (RRSE)?

A. RRSE is a methodology to sequence environmental restoration work used by the DoD. The RRSE process is used to evaluate the relative risk posed by an environmental restoration site in relation to other sites. The DoD fundamental premise in site prioritization is "worst first," meaning the DoD Component shall address sites that pose a relatively greater potential risk to public safety, human health, or the environment before sites posing a lesser risk. Relative risk is not the sole factor in determining the sequence of environmental restoration work, but it is an important consideration in the priority setting process. The methodology is described in the DoD, Relative Risk Site Evaluation Primer, Summer 1997 Revised Edition: https://denix.osd.mil/references/dod/policy-guidance/relative-risk-site-evaluation-primer/

Q. What is the RRSE framework?

A. The RRSE framework provides a DoD-wide approach for evaluating the relative risk to human health and the environment posed by contamination present at sites. The **Relative Risk Site Evaluation Concept Summary** (shown in the figure) illustrates the selection of sites, evaluation of the site data using three evaluation factors, and placement into high, medium, and low categories. The relative risk site evaluation framework is based on information fundamental to risk assessment: sources, pathways, and receptors to sequence restoration work. The RRSE is not a baseline risk assessment or health assessment in the CERCLA process. Regulators and public stakeholders in the environmental restoration process are provided the opportunity to participate in the process in accordance with the DoD Defense Environmental Restoration Program.

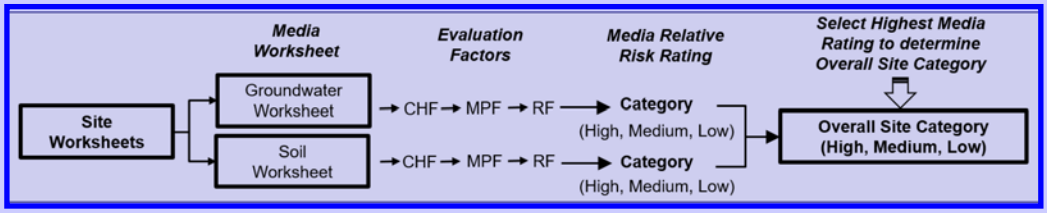
Relative Risk Site Evaluation Concept Summary



Sites at Each Installation

Q. What restoration sites are required to be evaluated in the RRSE process?

A. Restoration sites in CERCLA phases prior to remedy-in-place are evaluated in the process. Worksheets are developed for environmental media at each site. For consistency across all the Installations, only surface soil (0-1 foot deep) and groundwater media were evaluated in the RRSE.



The figure shows the process for a media to be evaluated using the contaminant hazard factor (CHF), the migration pathway factor (MPF), and the receptor factor (RF). Each media is scored to obtain a relative risk rating of High, Medium, or Low. The highest media rating determines the Overall Site Category.

Q. How is the Contaminant Hazard Factor (CHF) determined?

A. The Contaminant Hazard Factor (CHF) is determined by dividing the maximum level for a contaminant at each site by the approved screening values (i.e., comparison values). Contaminant concentration ratios are totaled to arrive at a **Contaminant Hazard Factor (CHF).** A CHF sum of greater than 100 earns a **Significant (High)** ranking. **Moderate (Medium)** is when the total is 2 to 100. **Minimal (Low)** is when a CHF is less than two.

FOR MORE INFORMATION

Air Force Civil Engineer Center
Environmental Restoration Program
www.afcec.af.mil

AFCEC CERCLA
Administrative Record (AR)
https://ar.afcec-cloud.af.mil/

POINT OF CONTACT
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240-612-8573
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Q. How is the Migration Pathway Factor (MPF) determined?

A. The movement of contamination at a site is evaluated and assigned a **Migration Pathway Factor (MPF)** rating.

Ratings for MPFs are designated as: **evident**, **potential**, or **confined** (for **High, Medium, and Low**). **Evident** exposure means the contamination is at a point where exposure to humans or the environment can occur, such as at a drinking water well. **Potential** ratings are given to sites where exposure may happen. A **confined** rating is given to sites where a low possibility for exposure may occur.

Q. How is the Receptor Factor (RF) determined?

A. The **Receptor Factor (RF)** is determined by a receptor's, such as humans, potential to come into contact with contaminated media. **RFs** are designated as: identified, potential, or limited **(High, Medium, and Low). Identified** rating is given when receptors are in contact or threat of contact with contaminated media. **Potential** is given when receptor may contact contaminated media. **Limited** is given when there is little or no contact with contaminated media.

RELATIVE RISK SITE EVALUTION, cont.

Media Relative Risk Rating

Q. How is the media relative risk rating determined?
A. Use the chart to determine the relative risk rating for each media evaluated. Start by choosing the **CHF** result of the evaluation. If the **CHF** is **Significant**, use **box 1.**; if **Moderate**, use **box 2.**; if **Minimal**, use **box 3.** Then find the **MPF** and **RF** results and move to the square where the results meet. That square indicates the media relative risk rating. For example, if the **CHF** is **Significant (go to box 1.)**, the **MPF** is **Potential** and the **RF** is **Identified**, then the rating is High (**H**).

Relative Risk Site Evaluation Matrix

1. CHF = Significant

MPF \ RF	Identified	Potential	Limited
Evident	H	H	M
Potential	H	H	M
Confined	M	M	L

2. CHF = Moderate

MPF \ RF	Identified	Potential	Limited
Evident	H	H	M
Potential	H	M	L
Confined	L	L	L

3. CHF = Minimal

MPF \ RF	Identified	Potential	Limited
Evident	H	M	L
Potential	M	L	L
Confined	L	L	L

CHF (Contaminant Hazard Factor) **MPF** (Migration Pathway Factor) **RF** (Receptor Factor) **H** (High) **M** (Medium) **L** (Low)

Overall Site Category

Q. How do I determine the Overall Site Category?
A. The highest relative risk media rating becomes the **Overall Site Category** for the site. For example, if a site has a groundwater relative risk rating of **High**, and soil relative risk rating of **Low**, then the Overall Site Category rating for the site is **High**.

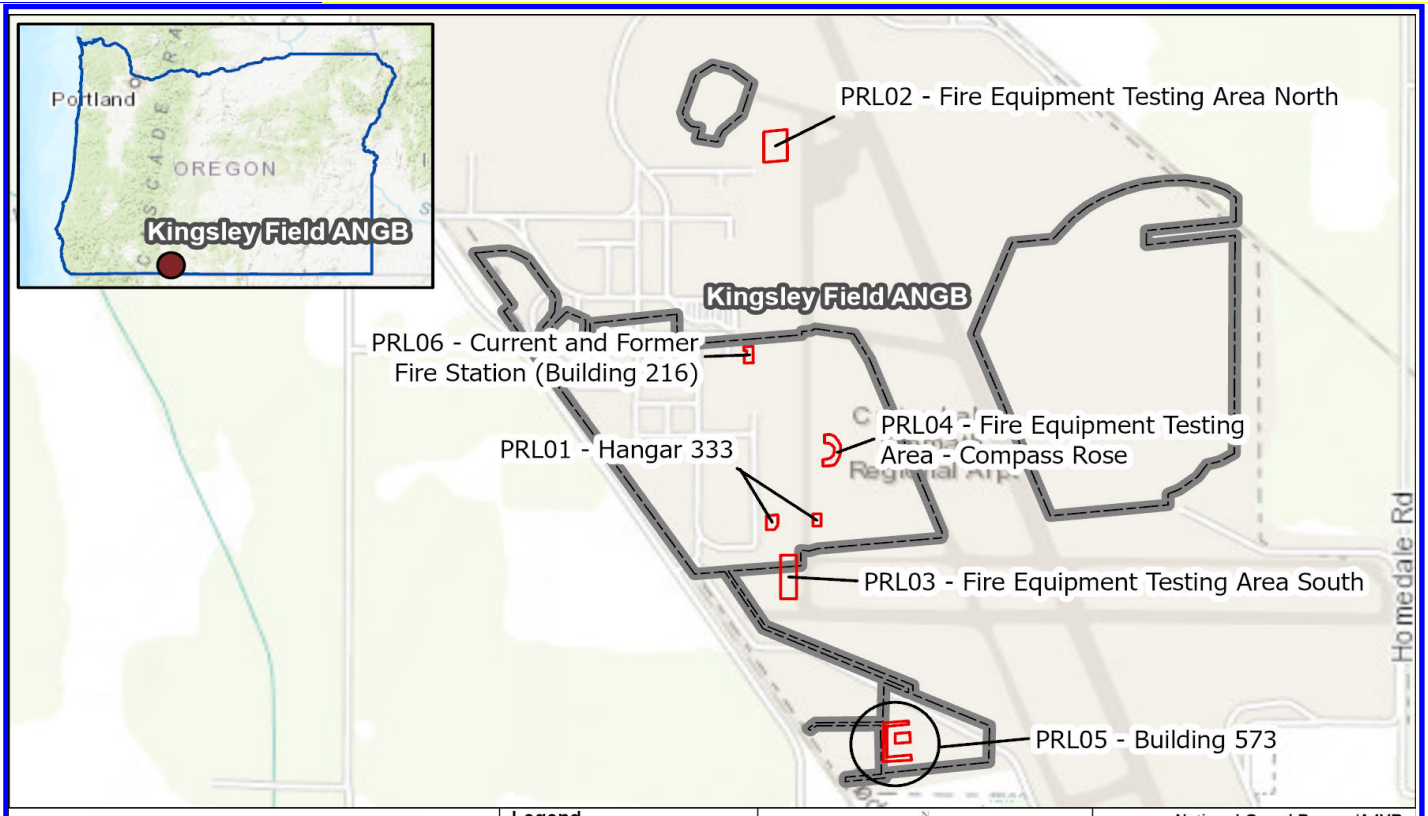
Regulatory and Stakeholder Involvement

Q. **How do I participate as Stakeholder?**

A. To offer opportunity to participate in RRSE, the Air Force announces a public comment period in your local newspaper. There is also opportunity to participate during installation Restoration Advisory Committees where active. Installation Restoration Advisory Committee meetings are also announced in your local newspaper.

Relative Risk Site Evaluation Summary Klamath Falls ANGB, OR

Overall Site Category	Site Name (Sites are shown on the map below and RRSE Worksheets are attached)
HIGH	PRL 1, PRL 2, PRL 3, PRL 4, PRL 5, PRL 6
MEDIUM	
LOW	



Kingsley Field ANGB Relative Risk Site Evaluation (RRSE) Figure
National Guard Bureau
Kingsley Field Air National Guard Base, Oregon

Legend
AFFF Release Areas
Kingsley Field ANGB Installation Boundary

0 500 1,000 2,000
Feet

National Guard Bureau/A4VR Environmental Restoration
3500 Fetchet Ave
Joint Base Andrews, MD 20762

AFFF Area is another term for Potential Release Location (PRL)

Site Background Information			
Installation:	Kingsley Field ANGB	**Date:**	9/23/2021
Location (State):	Oregon	**Media Evaluated:**	Groundwater, Soil
Site Name and ID:	Hangar 333 - PRL 1	**Phase of Execution (e.g., RI, Record of Decision (ROD)):**	N/A
RPM's Name:	Lt Col. Lydia Stefanik	**Agreement Status (e.g., Federal Facility Agreement date signed):**	N/A
OVERALL SITE CATEGORY: HIGH			

Site Summary	
Brief Site Description:	Hangar 333's fire suppression system (FSS) with aqueous film forming foam (AFFF) was installed in 1987. In 2007, approximately 200 gal of AFFF plus associated water were released at Hangar 333 (total volume unknown). Most of the AFFF and water mixture was contained inside the building where floor drains are connected to the sanitary sewer. The floor drains were reportedly plugged at the time of the release. This mixture of AFFF and water was removed by hand (e.g., temporary trash pumps) and discharged east of the hangar, across the taxiway, and into the grassy area next to the taxiway. The FSS was converted from AFFF to high expansion foam (HEF) in 2012 to 2013.
Brief Description of Pathways:	Klamath Falls is situated in an area that was covered by ancestral Lake Klamath during the Pleistocene Era. The facility is underlain by thick Quaternary alluvial sediments. The actual thickness is unknown, however, geothermal test wells have been drilled to depths greater than 1500 feet (ft), without encountering bedrock. The sediments underling the facility are composed of sand, silt, and clay that are laterally discontinuous. The widespread occurrence of clay and silt layers with low hydraulic conductivity restricts the vertical movement of potentially contaminated shallow groundwater to deeper aquifers. Where these shallow clay and silt strata are not present, however, there is a greater potential for downward movement of contaminants. The discontinuous nature of the clay and silt layers make the likelihood this pathway is complete is medium to high. Groundwater movement is to the southeast towards the Lost River and the Lost River diversion channel. PRL-1 is covered in grass and is located near a taxiway and an access road.
Brief Description of Receptors:	There are no federal or public water wells within a 1-mile radius of the Base. Two water wells are within one mile that are likely observational or test wells. No drinking water wells are located at the Base, with water supplied from the city of Klamath Falls. City water wells are obtained from deep groundwater wells ranging in depth from 300 to more than 1000 ft below ground surface (bgs). Multiple domestic (drinking water) water wells were identified within one mile and hydraulically downgradient of the base. State requested sampling of private drinking water wells. PRL-1 is within the base boundaries in the active airfield. PRL-1 would be only accessible by base personnel.

Groundwater Worksheet

Installation: Klamath Falls ANGB

Site ID: PRL 1 **AFFF Release Area #:** AFFF 1

Contaminant	Maximum Concentration (ug/L)	Comparison Value (ug/L)	Ratios
PFOS	0.5	0.04	12.5
PFOA	0.02	0.04	0.5
PFBS	0.039	0.602	0.1

CHF Scale	CHF Value	Contamination Hazard Factor (CHF)	13.1
CHF > 100	H (High)	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		
CHF Value		CHF VALUE	M

Migratory Pathway Factor		
Evident	Analytical data or direct observation indicates that contamination in the groundwater has moved to a point of exposure (e.g., well)	
Potential	Contamination in the groundwater has moved beyond the source or insufficient information available to make a determination of Evident or Confined	M
Confined	Analytical data or direct observation indicates that the potential for contaminant migration from the source via groundwater is limited (possibly due to geological structures or physical controls)	
Migratory Pathway Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	M

Receptor Factor		
Identified	Impacted drinking water well with detected contaminants or existing downgradient water supply well within 4 miles and groundwater is current source of drinking water (EPA Class I or IIA groundwater)	H
Potential	Existing downgradient drinking water well beyond 4 miles with no contaminant detection(s) or no known drinking water wells downgradient and groundwater is currently or potentially usable for drinking water (i.e., EPA Class I or II groundwater) or other beneficial use (e.g., agricultural)	
Limited	No known water supply wells downgradient and groundwater is not considered potential drinking water source and is of limited beneficial use (Class III)	
Receptor Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	H
	Groundwater Category	**HIGH**

Soil Worksheet

Installation: Klamath Falls ANGB

Site ID: PRL 1 **AFFF Release Area #:** AFFF 1

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
PFOS	0.43	0.126	3.4
PFOA	0.0039	0.126	0.0
PFBS	0.00031	1.9	0.0
CHF Scale	**CHF Value**	**Contamination Hazard Factor (CHF)**	**3.4**
CHF > 100	**H (High)**	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CHF Value		**CHF VALUE**	**M**

Migratory Pathway Factor		
Evident	Analytical data or observable evidence that contamination is present at a point of exposure	H
Potential	Contamination has moved beyond the source, could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined	
Confined	Low possibility for contamination to be present at or migrate to a point of exposure	
Migratory Pathway Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	H

Receptor Factor		
Identified	Receptors identified that have access to contaminated soil	
Potential	Potential for receptors to have access to contaminated soil	
Limited	No potential for receptors to have access to contaminated soil	L
Receptor Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	L
	Soil Category	**MEDIUM**

Site Background Information			
Installation:	Kingsley Field ANGB	**Date:**	9/23/2021
Location (State):	Oregon	**Media Evaluated:**	Groundwater, Soil
Site Name and ID:	Fire Equip Testing Area - North - PRL 2	**Phase of Execution (e.g., RI, Record of Decision (ROD)):**	N/A
RPM's Name:	Lt Col. Lydia Stefanik	**Agreement Status (e.g., Federal Facility Agreement date signed):**	N/A
OVERALL SITE CATEGORY: HIGH			

Site Summary	
Brief Site Description:	From approximately 1995 to 2005, AFFF testing from fire trucks would occur every Monday at one of three different locations: The North Fire Equipment Testing Area (FETA), the South FETA, or the Compass Rose FETA. Typically, the fire department (FD) utilized 3% AFFF. The estimated amount of AFFF released weekly was 3-4 gal per event. The North FETA is a flat grass and dirt covered area with an estimated area of 1-2 acres located southeast of the alert apron adjacent to the Pelican Aviation ramp (Building 8). Fire trucks would conduct foam testing near the edge of the paved road east of Building 8, spraying in a northerly direction - to the north of Building 8, south of Taxiway A, and west of the north/south access road located immediately east of Building 8. AFFF would have infiltrated the permeable surface soils in this area.
Brief Description of Pathways:	Klamath Falls is situated in an area that was covered by ancestral Lake Klamath during the Pleistocene Era. The facility is underlain by thick Quaternary alluvial sediments. The actual thickness is unknown, however, geothermal test wells have been drilled to depths greater than 1500 ft, without encountering bedrock. The sediments underling the facility are composed of sand, silt, and clay that are laterally discontinuous. The widespread occurrence of clay and silt layers with low hydraulic conductivity restricts the vertical movement of potentially contaminated shallow groundwater to deeper aquifers. Where these shallow clay and silt strata are not present, however, there is a greater potential for downward movement of contaminants. The discontinuous nature of the clay and silt layers make the likelihood this pathway is complete is medium to high. Groundwater movement is to the southeast towards the Lost River and the Lost River diversion channel. PRL 2 is covered in grass adjacent to paved taxiways.
Brief Description of Receptors:	There are no federal or public water wells within a 1-mile radius of the Base. Two water wells are within one mile that are likely observational or test wells. No drinking water wells are located at the Base, with water supplied from the city of Klamath Falls. City water wells are obtained from deep groundwater wells ranging in depth from 300 to more than 1000 ft bgs. Multiple domestic (drinking water) water wells were identified within one mile and hydraulically downgradient of the base. State requested sampling of private drinking water wells. PRL 2 is located outside of the base boundary and an active small aircraft parking and taxiway. The area would be accessible to non-base workers.

Groundwater Worksheet

Installation: Klamath Falls ANGB

Site ID: PRL 2 **AFFF Release Area #:** AFFF 2

Contaminant	Maximum Concentration (ug/L)	Comparison Value (ug/L)	Ratios
PFOS	380	0.04	9500.0
PFOA	21	0.04	525.0
PFBS	9.7	0.602	16.1

CHF Scale	CHF Value	Contamination Hazard Factor (CHF)	10041.1
CHF > 100	H (High)	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		
CHF Value		CHF VALUE	H

Migratory Pathway Factor

Evident	Analytical data or direct observation indicates that contamination in the groundwater has moved to a point of exposure (e.g., well)	
Potential	Contamination in the groundwater has moved beyond the source or insufficient information available to make a determination of Evident or Confined	M
Confined	Analytical data or direct observation indicates that the potential for contaminant migration from the source via groundwater is limited (possibly due to geological structures or physical controls)	
Migratory Pathway Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	M

Receptor Factor

Identified	Impacted drinking water well with detected contaminants or existing downgradient water supply well within 4 miles and groundwater is current source of drinking water (EPA Class I or IIA groundwater)	H
Potential	Existing downgradient drinking water well beyond 4 miles with no contaminant detection(s) or no known drinking water wells downgradient and groundwater is currently or potentially usable for drinking water (i.e., EPA Class I or II groundwater) or other beneficial use (e.g., agricultural)	
Limited	No known water supply wells downgradient and groundwater is not considered potential drinking water source and is of limited beneficial use (Class III)	
Receptor Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	H
	Groundwater Category	**HIGH**

Soil Worksheet

Installation: Klamath Falls ANGB

Site ID: PRL 2 **AFFF Release Area #:** AFFF 2

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
PFOS	0.39	0.126	3.1
PFOA	0.0022	0.126	0.0
PFBS	0.0051	1.9	0.0
CHF Scale	**CHF Value**	**Contamination Hazard Factor (CHF)**	**3.1**
CHF > 100	**H (High)**	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CHF Value		**CHF VALUE**	**M**

Migratory Pathway Factor		
Evident	Analytical data or observable evidence that contamination is present at a point of exposure	H
Potential	Contamination has moved beyond the source, could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined	
Confined	Low possibility for contamination to be present at or migrate to a point of exposure	
Migratory Pathway Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	H
Receptor Factor		
Identified	Receptors identified that have access to contaminated soil	
Potential	Potential for receptors to have access to contaminated soil	
Limited	No potential for receptors to have access to contaminated soil	L
Receptor Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	L
	Soil Category	**MEDIUM**

Site Background Information			
Installation:	Kingsley Field ANGB	**Date:**	9/23/2021
Location (State):	Oregon	**Media Evaluated:**	Groundwater, Soil
Site Name and ID:	FETA South - PRL 3	**Phase of Execution (e.g., RI, Record of Decision (ROD)):**	N/A
RPM's Name:	Lt Col. Lydia Stefanik	**Agreement Status (e.g., Federal Facility Agreement date signed):**	N/A
OVERALL SITE CATEGORY: HIGH			

Site Summary	
Brief Site Description:	From approximately 1995 to 2005, AFFF testing from three fire trucks would occur every Monday at one of three locations: the North FETA, the South FETA, or the Compass Rose FETA. Typically, the FD utilized 3% AFFF. The estimated amount of AFFF released weekly was 3 to 4 gal per testing event; exact discharge quantities are unknown. The South FETA is a flat, grass- and dirt-covered area (an estimated approximately 1- to 2- acre area) located along the northern side of the far western end of Runway 725, west of Taxiway D. Fire trucks would typically pull up along the northern edge of Runway 725 at the far western end and conduct foam testing in a northerly direction. AFFF released during testing would likely have infiltrated permeable surface soils in this area. The Preliminary Assessment (PA) Report identified the northern portion of this PRL to be within the Base boundary. More recent updates to the Base boundary show this PRL to be fully outside the Base boundary, and this information was confirmed during the Installation site visit.
Brief Description of Pathways:	Klamath Falls is situated in an area that was covered by ancestral Lake Klamath during the Pleistocene Era. The facility is underlain by thick Quaternary alluvial sediments. The actual thickness is unknown, however, geothermal test wells have been drilled to depths greater than 1500 ft, without encountering bedrock. The sediments underling the facility are composed of sand, silt, and clay that are laterally discontinuous. The widespread occurrence of clay and silt layers with low hydraulic conductivity restricts the vertical movement of potentially contaminated shallow groundwater to deeper aquifers. Where these shallow clay and silt strata are not present, however, there is a greater potential for downward movement of contaminants. The discontinuous nature of the clay and silt layers make the likelihood this pathway is complete is medium to high. Groundwater movement is to the southeast towards the Lost River and the Lost River diversion channel. PRL 3 is covered in grass and is located at the end of Runway 725 and Taxiway D.
Brief Description of Receptors:	There are no federal or public water wells within a 1-mile radius of the Base. Two water wells are within one mile that are likely observational or test wells. No drinking water wells are located at the Base, with water supplied from the city of Klamath Falls. City water wells are obtained from deep groundwater wells ranging in depth from 300 to more than 1000 ft bgs. Multiple domestic (drinking water) water wells were identified within one mile and hydraulically downgradient of the base. State requested sampling of private drinking water wells. PRL 3 is now outside of the base boundary but is at the end of an active runway; therefore, access is limited.

Groundwater Worksheet

Installation: Kingsley Field ANGB

Site ID: PRL 3 **AFFF Release Area #:** AFFF 3

Contaminant	Maximum Concentration (ug/L)	Comparison Value (ug/L)	Ratios
PFOS	6.1	0.04	152.5
PFOA	0.29	0.04	7.2
PFBS	0.18	0.602	0.3

CHF Scale	CHF Value	Contamination Hazard Factor (CHF)	160.0
CHF > 100	H (High)	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		
CHF Value		CHF VALUE	H

Migratory Pathway Factor

Evident	Analytical data or direct observation indicates that contamination in the groundwater has moved to a point of exposure (e.g., well)	
Potential	Contamination in the groundwater has moved beyond the source or insufficient information available to make a determination of Evident or Confined	M
Confined	Analytical data or direct observation indicates that the potential for contaminant migration from the source via groundwater is limited (possibly due to geological structures or physical controls)	
Migratory Pathway Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	M

Receptor Factor

Identified	Impacted drinking water well with detected contaminants or existing downgradient water supply well within 4 miles and groundwater is current source of drinking water (EPA Class I or IIA groundwater)	H
Potential	Existing downgradient drinking water well beyond 4 miles with no contaminant detection(s) or no known drinking water wells downgradient and groundwater is currently or potentially usable for drinking water (i.e., EPA Class I or II groundwater) or other beneficial use (e.g., agricultural)	
Limited	No known water supply wells downgradient and groundwater is not considered potential drinking water source and is of limited beneficial use (Class III)	
Receptor Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	H
	Groundwater Category	**HIGH**

Soil Worksheet

Installation: Kingsley Field ANGB

Site ID: PRL 3 **AFFF Release Area #:** AFFF 3

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
PFOS	0.0034	0.126	0.0
PFOA	0.00037	0.126	0.0
PFBS	0.00021	1.9	0.0

CHF Scale	CHF Value	Contamination Hazard Factor (CHF)	0.0
CHF > 100	H (High)		
100 > CHF > 2	M (Medium)	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
2 > CHF	L (Low)		
CHF Value		CHF VALUE	L

Migratory Pathway Factor		
Evident	Analytical data or observable evidence that contamination is present at a point of exposure	H
Potential	Contamination has moved beyond the source, could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined	
Confined	Low possibility for contamination to be present at or migrate to a point of exposure	
Migratory Pathway Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	H

Receptor Factor		
Identified	Receptors identified that have access to contaminated soil	
Potential	Potential for receptors to have access to contaminated soil	
Limited	No potential for receptors to have access to contaminated soil	L
Receptor Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	L
	Soil Category	**LOW**

Site Background Information			
Installation:	Kingsley Field ANGB	**Date:**	9/23/2021
Location (State):	Oregon	**Media Evaluated:**	Groundwater, Soil
Site Name and ID:	Fire Equip Testing Area - Compass Rose - PRL 4	**Phase of Execution (e.g., RI, Record of Decision (ROD)):**	N/A
RPM's Name:	Lt Col. Lydia Stefanik	**Agreement Status (e.g., Federal Facility Agreement date signed):**	N/A
OVERALL SITE CATEGORY: HIGH			

Site Summary	
Brief Site Description:	From approximately 1995 to 2005, AFFF testing from three fire trucks would occur every Monday at one of three locations: the North FETA, the South FETA, or the Compass Rose FETA. Typically, the FD utilized 3% AFFF. The estimated amount of AFFF released weekly was 3 to 4 gal per testing event; exact discharge quantities are unknown. The Compass Rose FETA is a flat, grass- and dirt-covered area located off the eastern edge of the Base's Compass Rose used for the calibration of aircraft directional control systems. Fire trucks would typically pull up near the eastern edge of the paved area surrounding the Compass Rose and discharge into the grassy area northeast, east, and southeast from the Compass Rose. Relative to the other FETAs, the Compass Rose FETA site was used much more frequently than the other two FETAs and would likely have the greatest amount of AFFF released to the ground surface. AFFF released during testing would likely have infiltrated permeable surface soils in this area.
Brief Description of Pathways:	Klamath Falls is situated in an area that was covered by ancestral Lake Klamath during the Pleistocene Era. The facility is underlain by thick Quaternary alluvial sediments. The actual thickness is unknown, however, geothermal test wells have been drilled to depths greater than 1500 ft, without encountering bedrock. The sediments underling the facility are composed of sand, silt, and clay that are laterally discontinuous. The widespread occurrence of clay and silt layers with low hydraulic conductivity restricts the vertical movement of potentially contaminated shallow groundwater to deeper aquifers. Where these shallow clay and silt strata are not present, however, there is a greater potential for downward movement of contaminants. The discontinuous nature of the clay and silt layers make the likelihood this pathway is complete is medium to high. Groundwater movement is to the southeast towards the Lost River and the Lost River diversion channel. PRL 4 is covered in grass.
Brief Description of Receptors:	There are no federal or public water wells within a 1-mile radius of the Base. Two water wells are within one mile that are likely observational or test wells. No drinking water wells are located at the Base, with water supplied from the city of Klamath Falls. City water wells are obtained from deep groundwater wells ranging in depth from 300 to more than 1000 ft bgs. Multiple domestic (drinking water) water wells were identified within one mile and hydraulically downgradient of the base. State requested sampling of private drinking water wells. PRL 4 is within the base boundaries in the active airfield. PRL 4 would be only accessible by base personnel.

Groundwater Worksheet

Installation: Kingsley Field ANGB

Site ID: PRL 4 **AFFF Release Area #:** AFFF 4

Contaminant	Maximum Concentration (ug/L)	Comparison Value (ug/L)	Ratios
PFOS	0.1	0.04	2.5
PFOA	0.041	0.04	1.0
PFBS	0.096	0.602	0.2

CHF Scale	CHF Value	Contamination Hazard Factor (CHF)	3.7
CHF > 100	H (High)		
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		

$$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$$

CHF Value	CHF VALUE	M

Migratory Pathway Factor

Evident	Analytical data or direct observation indicates that contamination in the groundwater has moved to a point of exposure (e.g., well)	
Potential	Contamination in the groundwater has moved beyond the source or insufficient information available to make a determination of Evident or Confined	M
Confined	Analytical data or direct observation indicates that the potential for contaminant migration from the source via groundwater is limited (possibly due to geological structures or physical controls)	
Migratory Pathway Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	M

Receptor Factor

Identified	Impacted drinking water well with detected contaminants or existing downgradient water supply well within 4 miles and groundwater is current source of drinking water (EPA Class I or IIA groundwater)	H
Potential	Existing downgradient drinking water well beyond 4 miles with no contaminant detection(s) or no known drinking water wells downgradient and groundwater is currently or potentially usable for drinking water (i.e., EPA Class I or II groundwater) or other beneficial use (e.g., agricultural)	
Limited	No known water supply wells downgradient and groundwater is not considered potential drinking water source and is of limited beneficial use (Class III)	
Receptor Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	H
	Groundwater Category	**HIGH**

Soil Worksheet

Installation: Kingsley Field ANGB

Site ID: PRL 4 **AFFF Release Area #:** AFFF 4

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
PFOS	6.6	0.126	52.4
PFOA	0.026	0.126	0.2
PFBS	0.019	1.9	0.0
CHF Scale	**CHF Value**	**Contamination Hazard Factor (CHF)**	**52.6**
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
2 > CHF	**L (Low)**		
CHF Value		**CHF VALUE**	**M**

Migratory Pathway Factor		
Evident	Analytical data or observable evidence that contamination is present at a point of exposure	H
Potential	Contamination has moved beyond the source, could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined	
Confined	Low possibility for contamination to be present at or migrate to a point of exposure	
Migratory Pathway Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	H
Receptor Factor		
Identified	Receptors identified that have access to contaminated soil	
Potential	Potential for receptors to have access to contaminated soil	
Limited	No potential for receptors to have access to contaminated soil	L
Receptor Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	L
	Soil Category	**MEDIUM**

Site Background Information			
Installation:	Kingsley Field ANGB	**Date:**	9/23/2021
Location (State):	Oregon	**Media Evaluated:**	Groundwater, Soil
Site Name and ID:	Building 573 - PRL 5	**Phase of Execution (e.g., RI, Record of Decision (ROD)):**	N/A
RPM's Name:	Lt Col. Lydia Stefanik	**Agreement Status (e.g., Federal Facility Agreement date signed):**	N/A
OVERALL SITE CATEGORY: HIGH			

Site Summary	
Brief Site Description:	Small discharges of AFFF mixture have occurred at this building after repairs were completed on fire trucks and as they were tested on an as-needed basis approximately one to two times per year. These small amounts of AFFF would have been discharged into the grassy area on the northern side of Building 573, north of the vehicle bays, and also possibly to the west and south over the fence depending on wind or weather conditions at the time.
Brief Description of Pathways:	Klamath Falls is situated in an area that was covered by ancestral Lake Klamath during the Pleistocene Era. The facility is underlain by thick Quaternary alluvial sediments. The actual thickness is unknown, however, geothermal test wells have been drilled to depths greater than 1500 ft, without encountering bedrock. The sediments underling the facility are composed of sand, silt, and clay that are laterally discontinuous. The widespread occurrence of clay and silt layers with low hydraulic conductivity restricts the vertical movement of potentially contaminated shallow groundwater to deeper aquifers. Where these shallow clay and silt strata are not present, however, there is a greater potential for downward movement of contaminants. The discontinuous nature of the clay and silt layers make the likelihood this pathway is complete is medium to high. Groundwater movement is to the southeast towards the Lost River and the Lost River diversion channel. PRL-5 is located primarily in a paved area with some grassy areas.
Brief Description of Receptors:	There are no federal or public water wells within a 1-mile radius of the Base. Two water wells are within one mile that are likely observational or test wells. No drinking water wells are located at the Base, with water supplied from the city of Klamath Falls. City water wells are obtained from deep groundwater wells ranging in depth from 300 to more than 1000 ft bgs. Multiple domestic (drinking water) water wells were identified within one mile and hydraulically downgradient of the base. State requested sampling of private drinking water wells. PRL 5 is within the base boundaries in the active airfield. PRL 5 would be only accessible by base personnel.

Groundwater Worksheet

Installation: Kingsley Field ANGB

Site ID: PRL 5 **AFFF Release Area #:** AFFF 5

Contaminant	Maximum Concentration (ug/L)	Comparison Value (ug/L)	Ratios
PFOS	63	0.04	1575.0
PFOA	6.7	0.04	167.5
PFBS	3.9	0.602	6.5

CHF Scale	CHF Value	Contamination Hazard Factor (CHF)	1749.0
CHF > 100	H (High)	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		
CHF Value		CHF VALUE	H

Migratory Pathway Factor		
Evident	Analytical data or direct observation indicates that contamination in the groundwater has moved to a point of exposure (e.g., well)	
Potential	Contamination in the groundwater has moved beyond the source or insufficient information available to make a determination of Evident or Confined	M
Confined	Analytical data or direct observation indicates that the potential for contaminant migration from the source via groundwater is limited (possibly due to geological structures or physical controls)	
Migratory Pathway Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	M

Receptor Factor		
Identified	Impacted drinking water well with detected contaminants or existing downgradient water supply well within 4 miles and groundwater is current source of drinking water (EPA Class I or IIA groundwater)	H
Potential	Existing downgradient drinking water well beyond 4 miles with no contaminant detection(s) or no known drinking water wells downgradient and groundwater is currently or potentially usable for drinking water (i.e., EPA Class I or II groundwater) or other beneficial use (e.g., agricultural)	
Limited	No known water supply wells downgradient and groundwater is not considered potential drinking water source and is of limited beneficial use (Class III)	
Receptor Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	H
	Groundwater Category	**HIGH**

Soil Worksheet

Installation: Kingsley Field ANGB

Site ID: PRL 5 **AFFF Release Area #:** AFFF 5

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
PFOS	14	0.126	111.1
PFOA	0.062	0.126	0.5
PFBS	0.0067	1.9	0.0

CHF Scale	CHF Value	Contamination Hazard Factor (CHF)	111.6
CHF > 100	H (High)		
100 > CHF > 2	M (Medium)	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
2 > CHF	L (Low)		
CHF Value		CHF VALUE	H

Migratory Pathway Factor

Evident	Analytical data or observable evidence that contamination is present at a point of exposure	H
Potential	Contamination has moved beyond the source, could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined	
Confined	Low possibility for contamination to be present at or migrate to a point of exposure	
Migratory Pathway Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	H

Receptor Factor

Identified	Receptors identified that have access to contaminated soil	
Potential	Potential for receptors to have access to contaminated soil	
Limited	No potential for receptors to have access to contaminated soil	L
Receptor Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	L
	Soil Category	**MEDIUM**

Site Background Information			
Installation:	Kingsley Field ANGB	**Date:**	9/23/2021
Location (State):	Oregon	**Media Evaluated:**	Groundwater, Soil
Site Name and ID:	Current/Former Fire Station - Building 216 - PRL 6	**Phase of Execution (e.g., RI, Record of Decision (ROD)):**	N/A
RPM's Name:	Lt Col. Lydia Stefanik	**Agreement Status (e.g., Federal Facility Agreement date signed):**	N/A
OVERALL SITE CATEGORY: HIGH			

Site Summary	
Brief Site Description:	The new fire station was built in 1995. At the time of the 2015 PA site visit, approximately 1,014 gallon (gal) AFFF were in inventory, including trucks and storage; up to 500 gal AFFF are stored on the 2nd floor in two 250-gal poly storage tanks; six firefighting trucks with AFFF tanks (approximately 800 gal); one support vehicle with 25-gal capacity. Since 2017, firefighting trucks pull up alongside the southern end of the station; AFFF is gravity-fed into their holding tanks. Prior to 2017, the trucks were manually filled with AFFF from 5-gal totes inside the fire station. One release of AFFF at Building 216 occurred in 2000. Approximately 5 gal of AFFF entered the sanitary sewer system via the building's floor drains and then into the city's wastewater treatment plant. Monthly AFFF foam testing of one fire truck is performed in the grassy area north of Building 216, in the location of the former Building 216. The former fire station was in operation from approximately the mid-1940s to 1995, when it was demolished. The site is now a vacant grassy area located immediately north of the current fire station building. Per FD personnel, since the beginning of 2015, monthly foam testing is conducted with one truck within the grassy area; discharge quantities are unknown but reported to be small amounts.
Brief Description of Pathways:	Klamath Falls is situated in an area that was covered by ancestral Lake Klamath during the Pleistocene Era. The facility is underlain by thick Quaternary alluvial sediments. The actual thickness is unknown, however, geothermal test wells have been drilled to depths greater than 1500 ft, without encountering bedrock. The sediments underling the facility are composed of sand, silt, and clay that are laterally discontinuous. The widespread occurrence of clay and silt layers with low hydraulic conductivity restricts the vertical movement of potentially contaminated shallow groundwater to deeper aquifers. Where these shallow clay and silt strata are not present, however, there is a greater potential for downward movement of contaminants. The discontinuous nature of the clay and silt layers make the likelihood this pathway is complete is medium to high. Groundwater movement is to the southeast towards the Lost River and the Lost River diversion channel. PRL 6 is located in a grassy area adjacent to the former fire station and an adjacent small aircraft hangar.
Brief Description of Receptors:	There are no federal or public water wells within a 1-mile radius of the Base. Two water wells are within one mile that are likely observational or test wells. No drinking water wells are located at the Base, with water supplied from the city of Klamath Falls. City water wells are obtained from deep groundwater wells ranging in depth from 300 to more than 1000 ft bgs. Multiple domestic (drinking water) water wells were identified within one mile and hydraulically downgradient of the base. State requested sampling of private drinking water wells. PRL 6 is within the base boundaries and is located in a group of buildings accessible by base personnel and escorted visitors to the fire station.

Groundwater Worksheet

Installation: Kingsley Field ANGB

Site ID: PRL 6 **AFFF Release Area #:** AFFF 6

Contaminant	Maximum Concentration (ug/L)	Comparison Value (ug/L)	Ratios
PFOS	130	0.04	3250.0
PFOA	14	0.04	350.0
PFBS	7.9	0.602	13.1

CHF Scale	CHF Value	Contamination Hazard Factor (CHF)	3613.1
CHF > 100	H (High)	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		
CHF Value		CHF VALUE	H

Migratory Pathway Factor		
Evident	Analytical data or direct observation indicates that contamination in the groundwater has moved to a point of exposure (e.g., well)	
Potential	Contamination in the groundwater has moved beyond the source or insufficient information available to make a determination of Evident or Confined	M
Confined	Analytical data or direct observation indicates that the potential for contaminant migration from the source via groundwater is limited (possibly due to geological structures or physical controls)	
Migratory Pathway Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	M

Receptor Factor		
Identified	Impacted drinking water well with detected contaminants or existing downgradient water supply well within 4 miles and groundwater is current source of drinking water (EPA Class I or IIA groundwater)	H
Potential	Existing downgradient drinking water well beyond 4 miles with no contaminant detection(s) or no known drinking water wells downgradient and groundwater is currently or potentially usable for drinking water (i.e., EPA Class I or II groundwater) or other beneficial use (e.g., agricultural)	
Limited	No known water supply wells downgradient and groundwater is not considered potential drinking water source and is of limited beneficial use (Class III)	
Receptor Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	H
	Groundwater Category	**HIGH**

Soil Worksheet

Installation: Kingsley Field ANGB

Site ID: PRL 6 **AFFF Release Area #:** AFFF 6

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
PFOS	0.96	0.126	7.6
PFOA	0.0067	0.126	0.1
PFBS	0.00099	1.9	0.0

CHF Scale	CHF Value	Contamination Hazard Factor (CHF)	7.7
CHF > 100	H (High)		
100 > CHF > 2	M (Medium)	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
2 > CHF	L (Low)		
CHF Value		CHF VALUE	M

Migratory Pathway Factor

Evident	Analytical data or observable evidence that contamination is present at a point of exposure	H
Potential	Contamination has moved beyond the source, could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined	
Confined	Low possibility for contamination to be present at or migrate to a point of exposure	
Migratory Pathway Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	H

Receptor Factor

Identified	Receptors identified that have access to contaminated soil	
Potential	Potential for receptors to have access to contaminated soil	M
Limited	No potential for receptors to have access to contaminated soil	
Receptor Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	M
	Soil Category	**HIGH**