RELATIVE RISK SITE EVALUATION

Fairchild Air Force Base, Washington

Introduction

The Department of Defense (DoD) has identified certain per- and polyfluoroalkyl substances (PFAS) as emerging contaminants of concern which affected installations across the Air Force. Specifically, perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), and perfluorobutanesulfonic acid (PFBS) are components of 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 drinking water lifetime Health Advisories (HAs) for PFOS and PFOA, and health-based soil-based regional screening levels for PFOS, PFOA, and two regional screening values, soil and drinking water for PFBS.

The Air Force has systematically evaluated potential AFFF releases on all Installations and former Installations. It began with the Preliminary Assessments (PAs) that identified potential release areas. Historical records were reviewed and 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 (SIs) were initiated to collect soil and groundwater samples and analyze those media for 16 different PFAS at the potential release areas. The intent of the SI is to determine if a release has occurred and determine if there are impacts to soil and/or groundwater. The next step in the process is the Relative Risk Site Evaluation (RRSE). The RRSE is a DoD-wide methodology to evaluate the relative risks posed by chemical contamination present at a site in relation to other sites. The RRSE is a tool used to sequence funding for which sites/Installations have the highest priority to begin a Remedial Investigation (RI). The DoD premise in site sequencing 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. Air Force Installations are at the beginning of the more detailed RI stage to determine where action is needed and to identify remedial technologies.

Fairchild Air Force base PA and SI can be found at AFCEC Administrative Record (AR): ar.afcec-cloud.af.mil. Scroll to the bottom of the page and click on "Continue to site", then select "Active Duty", scroll down the **Installation List** and click on Fairchild AFB, then enter 2353 in the "AR #" field for the PA. For the SI, enter 2353. 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 PFAS can be found at: https://www.afcec.af.mil/WhatWeDo/Environment/Perfluorinated-Compounds/

Acronyms

AR – Administrative Record

AFFF - Aqueous Film Forming Foam

AST – Aboveground Storage Tank

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act

CHF – Contaminant Hazard Factor

EPA – US Environmental Protection Agency

FTA – Fire Training Area

HA – Health Advisory

MPF – Migration Pathway Factor

PA – Preliminary Assessment

PFAS - Per- and poly-fluoroalkyl substances

PFBS – Perfluorobutane sulfonate

PFOS - Perfluorooctane sulfonate

PFOA - Perfluorooctanoic acid

RCRA – Resource Conservation and Recovery Act

RF – Reception Factor

RI – Remedial Investigation

RRSE – Relative Risk Site Evaluation

SI – Site Inspection

SWMU – Solid Waste Management Unit

RELATIVE RISK SITE EVALUATION

Fairchild Air Force Base, Washington

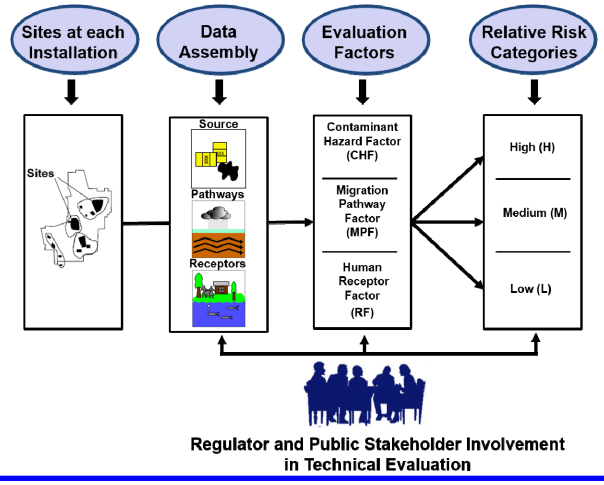
Q. What is the Relative Risk Site Evaluation (RRSE)?

A. RRSE is a methodology to sequence environmental restoration work used by the Department of Defense (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 denix.osd.mil/references/dod/policy-guidance/relative-risk-site-evaluation-primer/RRSE_Primer_Summer1997.pdf.

Q. What is the RRSE framework?

A. The RRSE framework provides a DoD-wide approach for evaluating the relative risks 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 in the Comprehensive Environmental Response, Compensation, and Liability Act (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.

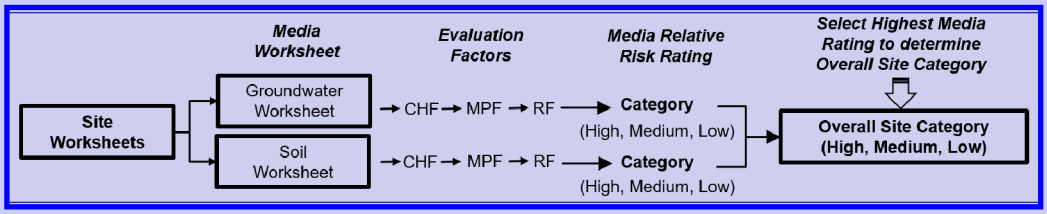
Relative Risk Site Evaluation Concept Summary



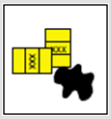
Sites at Each Installation

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 RRSE process. Worksheets are developed for environmental media (such as, groundwater and surface soil) at each site. Environmental media lacking sufficient information to conduct a relative risk evaluation are assigned a "Not Evaluated" designation. 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-specific relative risk rating determines the Overall Site Category.



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



A. The Contaminant Hazard Factor (CHF) is calculated by dividing the maximum concentration of a contaminant by the approved screening value, or comparison value. Contaminant concentration ratios are totaled to arrive at the **Contaminant Hazard Factor (CHF).** A CHF of greater than 100 earns a **High** rating. If the CHF is 2 to 100 it earns a **Moderate** rating. A **Minimal** rating is assigned when a CHF is less than **2.**

FOR MORE INFORMATION

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

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

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.

POINT OF CONTACT

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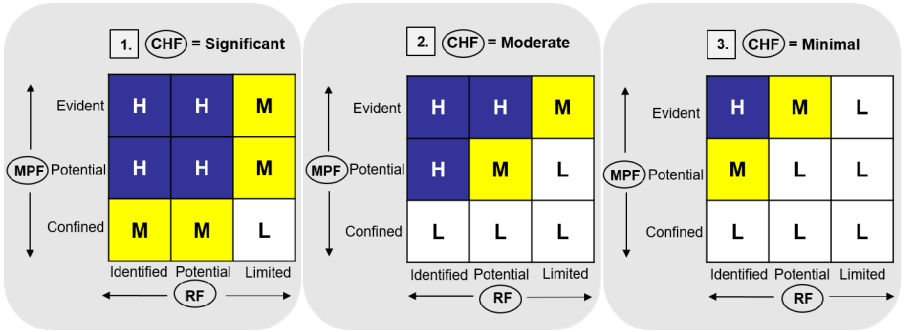
RELATIVE RISK SITE EVALUTION PROCESS, cont.

Media Relative Risk Rating

Q. How is the media-specific relative risk rating determined?
A. Use the chart to determine the relative risk rating for each media evaluated. Start by choosing the **CHF** result in 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-specific 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



CHF (Contaminant Hazard Factor) **MPF** (Migration Potential 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**.

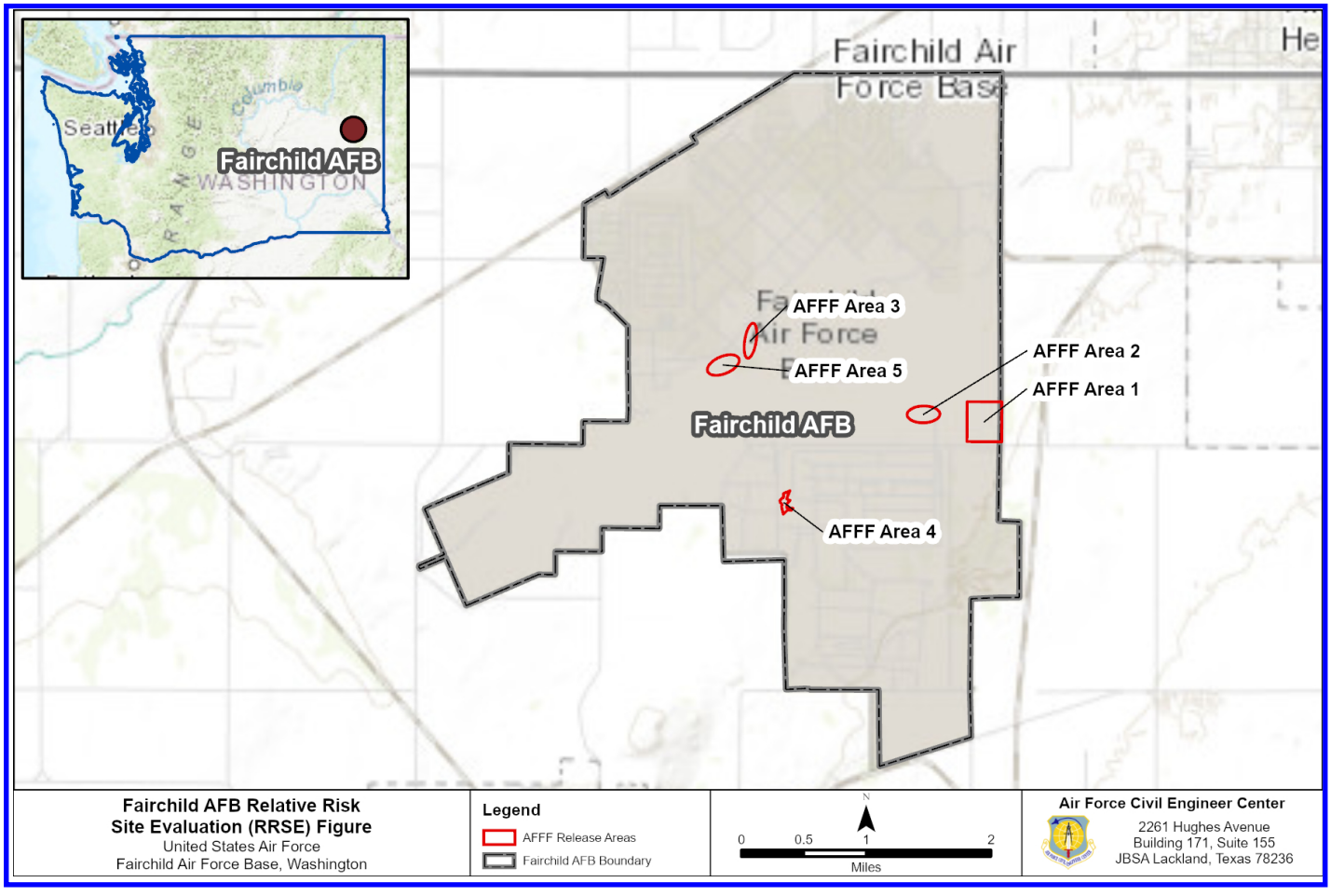
Regulatory and Stakeholder Involvement

Q. How do I participate as Stakeholder?

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

Relative Risk Site Evaluation Summary for Fairchild Air Force Base

Overall Site Category	Site Name (Sites are shown on the map below and RRSE Worksheets are attached)
HIGH	FT004 (AFFF Area 1), AFFF Area 2, SS008 (AFFF Area 3), AFFF Area 4, and AFFF Area 5
MEDIUM	N/A
LOW	N/A



Site Background Information			
Installation:	Fairchild Air Force Base	**Date:**	8/16/2021
Location (State):	Washington	**Media Evaluated:**	Groundwater, Soil
Site Name and ID:	FT004 (FT-01) - (AFFF Area 1)	**Phase of Execution (e.g., RI, Record of Decision (ROD)):**	Remedial Investigation (RI)
RPM's Name:	Megan R	**Agreement Status (e.g., Federal Facility Agreement date signed):**	
OVERALL SITE CATEGORY: HIGH			

Site Summary	
Brief Site Description:	The former FTA was used after 1970 through approximately 1991. During this period, an estimated 125 gallons or more of AFFF were used during each training exercise. After each exercise, the remaining water, fuel, and foam were drained into an OWS, which discharged effluent water into a low area east of the training location. (API 2019a)
Brief Description of Pathways:	Site has surficial alluviual deposits, which consist of sands and gravels with some silts and clays. Groundwater flow is generally from west to east across the base. Groundwater levels typically occurs between 3-12 feet below ground surface. (API 2019a)
Brief Description of Receptors:	Groundwater receptors are not present on Fairchild AFB because the installation obtains drinking water from off-base water supply wells located well outside of the off-base impacted areas. Off-base potential exposure receptors for groundwater were initially identified by the USAF and continue to be identified in an ongoing process overseen by AFCEC during the off-base follow-on investigation. Surface soil at Fairchild AFB is potentially accessible by onsite workers, site visitors, and/or trespassers. Subsurface soil is primarily accessible by onsite construction workers involved with excavating, drilling, or any activity that exposes them to subsurface soil. Access to source area soil is not expected to change in the future. Potential exposure routes for soil include inhalation of impacted surface soil dust particles and dermal contact of contaminants in soil. (API 2019a)

Groundwater Worksheet

Installation: Fairchild Air Force Base

Site ID: FT004 **AFFF Release Area #:** AFFF 1

Contaminant	Maximum Concentration (ug/L)	Comparison Value (ug/L)	Ratios
PFBS	2.9	0.602	4.8
PFOA	22	0.04	550.0
PFOS	55	0.04	1375.0

CHF Scale	CHF Value	Contamination Hazard Factor (CHF)	1929.8
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)	H
Potential	Contamination in the groundwater has moved beyond the source or insufficient information available to make a determination of Evident or Confined	
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).	H

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: Fairchild Air Force Base

Site ID: FT004 **AFFF Release Area #:** AFFF 1

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
PFOA	0.00046	0.126	0.0
PFOS	0.0088	0.126	0.1
CHF Scale	**CHF Value**	**Contamination Hazard Factor (CHF)**	**0.1**
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CHF Value		**CHF VALUE**	**L**

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

Migratory Pathway Factor		
Evident	Analytical data or observable evidence that contamination is present at a point of exposure	
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	M
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).	M

Receptor Factor		
Identified	Receptors identified that have access to contaminated soil	H
Potential	Potential for receptors to have access to contaminated soil	
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).	H
	Soil Category	**MEDIUM**

Site Background Information			
Installation:	Fairchild Air Force Base	**Date:**	8/16/2021
Location (State):	Washington	**Media Evaluated:**	Groundwater, Soil
Site Name and ID:	Calibration Area - (AFFF Area 2)	**Phase of Execution (e.g., RI, Record of Decision (ROD)):**	Remedial Investigation (RI)
RPM's Name:	Megan R	**Agreement Status (e.g., Federal Facility Agreement date signed):**	
OVERALL SITE CATEGORY: HIGH			

Site Summary	
Brief Site Description:	AFFF was sprayed onto an old taxiway where it flowed south to an unpaved area at AFFF Release Area 2 (API 2019).
Brief Description of Pathways:	Site has surficial alluviual deposits, which consist of sands and gravels with some silts and clays. Groundwater flow in this part of the installation is generally from west to east across the base. Once the groundwater flow leaves the base it turns to the northeast and is principally controlled by a preferential flow path (a paleofilled channel incised into the Basalt bedrock). Groundwater levels are typically between 3-12 feet below ground surface. (API 2019a)
Brief Description of Receptors:	Groundwater receptors are not present on Fairchild AFB because the installation obtains drinking water from off-base water supply wells located well outside of the off-base impacted areas. Based on the results of ongoing off-base sampling of private and public water supply wells and existing monitoring wells, PFAS in groundwater have migrated off-base into the adjacent community and into unincorporated areas. The current off-base area extends up to approximately 6 miles from the base (to the northeast) and includes 372 private wells and four municipal wells. (API 2019a)

Groundwater Worksheet

Installation: Fairchild Air Force Base

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

Contaminant	Maximum Concentration (ug/L)	Comparison Value (ug/L)	Ratios
PFBS	1.2	0.602	2.0
PFOA	0.69	0.04	17.2
PFOS	21	0.04	525.0

CHF Scale	CHF Value	Contamination Hazard Factor (CHF)	544.2
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)	H
Potential	Contamination in the groundwater has moved beyond the source or insufficient information available to make a determination of Evident or Confined	
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).	H

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: Fairchild Air Force Base

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

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
PFOA	0.0016	0.126	0.0
PFOS	0.79	0.126	6.3
CHF Scale	**CHF Value**	**Contamination Hazard Factor (CHF)**	**6.3**
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CHF Value		**CHF VALUE**	**M**

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

Migratory Pathway Factor		
Evident	Analytical data or observable evidence that contamination is present at a point of exposure	
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	M
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).	M

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	**MEDIUM**

Site Background Information			
Installation:	Fairchild Air Force Base	**Date:**	8/16/2021
Location (State):	Washington	**Media Evaluated:**	Groundwater, Soil
Site Name and ID:	Aircraft Crash Location SS008 (PS-4/9)-(AFFF Area 3)	**Phase of Execution (e.g., RI, Record of Decision (ROD)):**	Remedial Investigation (RI)
RPM's Name:	Megan R	**Agreement Status (e.g., Federal Facility Agreement date signed):**	
OVERALL SITE CATEGORY: HIGH			

Site Summary	
Brief Site Description:	AFFF Release Area 3 is the location of a KC-135 aircraft crash in a former grassy field near present-day Buildings 2005 and 2007. An unknown quantity of AFFF was used to extinguish the fire resulting from the crash in March 1987 (API 2019).
Brief Description of Pathways:	Site has surficial alluvial deposits, which consist of sands and gravels with some silts and clays. Groundwater flow in this area of the base is generally to the north or northeast across the base. Groundwater levels typically occur between 30 to 40 feet below ground surface on base. (API 2019a)
Brief Description of Receptors:	Groundwater receptors are not present on Fairchild AFB because the installation obtains drinking water from off-base water supply wells located well outside of the off-base impacted areas. Based on the results of ongoing off-base sampling of private and public water supply wells and existing monitoring wells, PFAS in groundwater have migrated off-base into the adjacent community and into unincorporated areas. The current off-base area extends up to approximately 6 miles from the base (to the northeast) and includes 372 private wells and four municipal wells. (API 2019a)

Groundwater Worksheet

Installation: Fairchild Air Force Base

Site ID: SS008 **AFFF Release Area #:** AFFF 3

Contaminant	Maximum Concentration (ug/L)	Comparison Value (ug/L)	Ratios
PFBS	0.77	0.602	1.3
PFOA	1.5	0.04	37.5
PFOS	17	0.04	425.0

CHF Scale	CHF Value	Contamination Hazard Factor (CHF)	463.8
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)	H
Potential	Contamination in the groundwater has moved beyond the source or insufficient information available to make a determination of Evident or Confined	
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).	H

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: Fairchild Air Force Base

Site ID: SS008 **AFFF Release Area #:** AFFF 3

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
PFOA	0.00041	0.126	0.0
PFOS	0.02	0.126	0.2
CHF Scale	**CHF Value**	**Contamination Hazard Factor (CHF)**	**0.2**
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CHF Value		**CHF VALUE**	**L**

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

Migratory Pathway Factor		
Evident	Analytical data or observable evidence that contamination is present at a point of exposure	
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	L
Migratory Pathway Factor	DIRECTIONS: Record the single highest value from above in the box to the right (maximum value = H).	L

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:	Fairchild Air Force Base	**Date:**	8/16/2021
Location (State):	Washington	**Media Evaluated:**	Groundwater, Soil
Site Name and ID:	B-52 Crash Location (1994) - (AFFF Area 4)	**Phase of Execution (e.g., RI, Record of Decision (ROD)):**	Remedial Investiation (RI)
RPM's Name:	Megan R	**Agreement Status (e.g., Federal Facility Agreement date signed):**	
OVERALL SITE CATEGORY: HIGH			

Site Summary	
Brief Site Description:	AFFF Release Area 4 is the location of a 1994 B-52 crash in a grass-covered open field where an unknown quantity of AFFF was released while extinguishing a JP-4 fire resulting from the crash (API 2019).
Brief Description of Pathways:	Site has surficial alluviual deposits, which consist of sands and gravels with some silts and clays. Groundwater flow is generally from west to east across the base. Groundwater levels typically occurs between 3-12 feet below ground surface. (API 2019a)
Brief Description of Receptors:	Groundwater receptors are not present on Fairchild AFB because the installation obtains drinking water from off-base water supply wells located well outside of the off-base impacted areas. Based on the results of ongoing off-base sampling of private and public water supply wells and existing monitoring wells, PFAS in groundwater have migrated off-base into the adjacent community and into unincorporated areas. The current off-base area extends up to approximately 6 miles from the base (to the northeast) and includes 372 private wells and four municipal wells. (API 2019a)

Groundwater Worksheet

Installation: Fairchild Air Force Base

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

Contaminant	Maximum Concentration (ug/L)	Comparison Value (ug/L)	Ratios
PFBS	0.62	0.602	1.0
PFOA	2.5	0.04	62.5
PFOS	22	0.04	550.0

CHF Scale	CHF Value	Contamination Hazard Factor (CHF)	613.5
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)	H
Potential	Contamination in the groundwater has moved beyond the source or insufficient information available to make a determination of Evident or Confined	
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).	H

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: Fairchild Air Force Base

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

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
PFBS	0.00035	1.9	0.0
PFOA	0.00067	0.126	0.0
PFOS	0.26	0.126	2.1
CHF Scale	**CHF Value**	**Contamination Hazard Factor (CHF)**	**2.1**
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	
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	M
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).	M
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:	Fairchild Air Force Base	**Date:**	8/16/2021
Location (State):	Washington	**Media Evaluated:**	Groundwater, Soil
Site Name and ID:	Fire Station 1 (Building 3) - (AFFF Area 5)	**Phase of Execution (e.g., RI, Record of Decision (ROD)):**	Remedial Investigation (RI)
RPM's Name:	Megan R	**Agreement Status (e.g., Federal Facility Agreement date signed):**	
OVERALL SITE CATEGORY: HIGH			

Site Summary	
Brief Site Description:	AFFF Release Area 5 consists of a grassy area south of the Fire Station 1 fire engine garage between the paved area and a wall that divides the fire station from the airfield. Calibration tests using AFFF occurred on the paved area directly south of the fire engine garage. The paved area drains through a gap in the curb and into the grassy area. (API 2019a)
Brief Description of Pathways:	Site has surficial alluvial deposits, which consist of sands and gravels with some silts and clays. Groundwater flow in this vicinity of the base is generally to the north-northeast. Groundwater levels typically occur between 15 to 30 feet below ground surface. (API 2019a)
Brief Description of Receptors:	Groundwater receptors are not present on Fairchild AFB because the installation obtains drinking water from off-base water supply wells located well outside of the off-base impacted areas. Based on the results of ongoing off-base sampling of private and public water supply wells and existing monitoring wells, PFAS in groundwater have migrated off-base into the adjacent community and into unincorporated areas. The current off-base area extends up to approximately 6 miles from the base (to the northeast) and includes 372 private wells and four municipal wells. (API 2019a)

Groundwater Worksheet

Installation: Fairchild Air Force Base

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

Contaminant	Maximum Concentration (ug/L)	Comparison Value (ug/L)	Ratios
PFBS	9.2	0.602	15.3
PFOA	17	0.04	425.0
PFOS	150	0.04	3750.0

CHF Scale	CHF Value	Contamination Hazard Factor (CHF)	4190.3
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)	H
Potential	Contamination in the groundwater has moved beyond the source or insufficient information available to make a determination of Evident or Confined	
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).	H

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: Fairchild Air Force Base

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

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
PFBS	0.0042	1.9	0.0
PFOA	0.011	0.126	0.1
PFOS	8.2	0.126	65.1
CHF Scale	**CHF Value**	**Contamination Hazard Factor (CHF)**	**65.2**
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	
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	M
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).	M
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	**MEDIUM**