RELATIVE RISK SITE EVALUATION

Ellington Field Air National Guard Base, Texas

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 (ANG). 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, we began Site Inspections, or SIs, 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 Ellington Field Air National Guard Base (ANGB) PFAS PA and SI can be found at the AFCEC 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, scroll down the Installation List and click on Ellington Field JRB (Houston), TX, then enter the AR Number 474983 in the “AR #” field for the PA. For the SI, enter the AR Number 581287. 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

ANG - Air National Guard

ANGB - Air National Guard Base

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

PFOA - Perfluorooctanoic acid

PFOS - Perfluorooctane sulfonate

RF – Receptor Factor

RI – Remedial Investigation

RRSE – Relative Risk Site Evaluation

PRL - Potential Release Location

SI – Site Inspection

RELATIVE RISK SITE EVALUATION, cont.

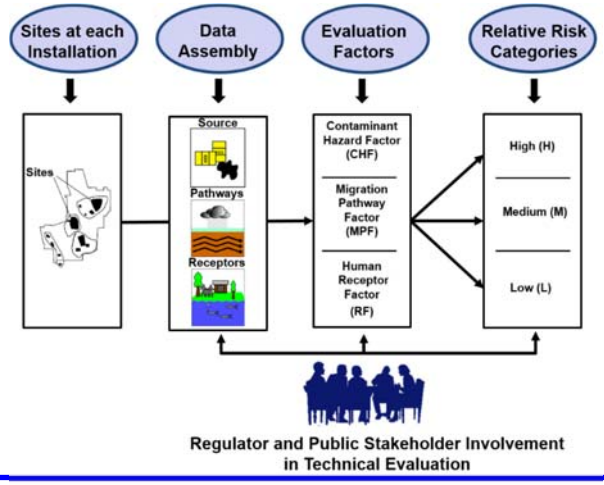
Q. What is the Relative Risk Site Evaluation (RRSE)?

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 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

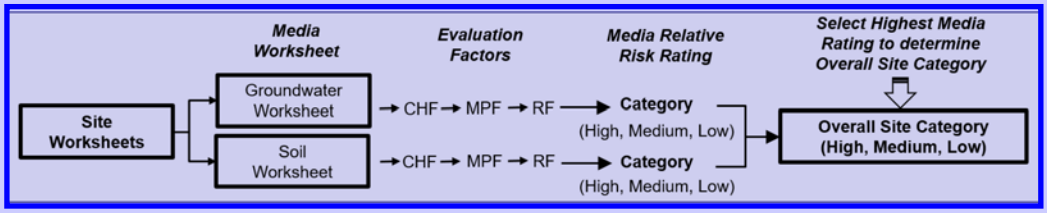


Sites at Each Installation

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 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 **CHF** is determined by dividing the maximum level for a contaminant at each site by the approved screening values (i.e., risk-based comparison values). Contaminant concentration ratios are totaled to arrive at a **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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Q. How is the Migration Pathway Factor (MPF) determined?

A. The movement of contamination at a site is evaluated and assigned a **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?

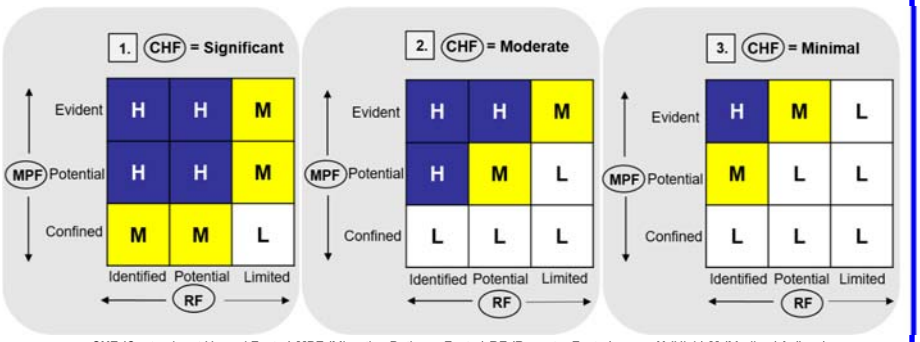
A. The **RF**)is determined by a receptor's, such as humans, potential to come into contact with contaminated media. **RFs** are designated as: identified, potential, or limited **(High, Medium, and Low). Identified** rating is given when receptors are in contact or threat of contact with contaminated 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



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**.

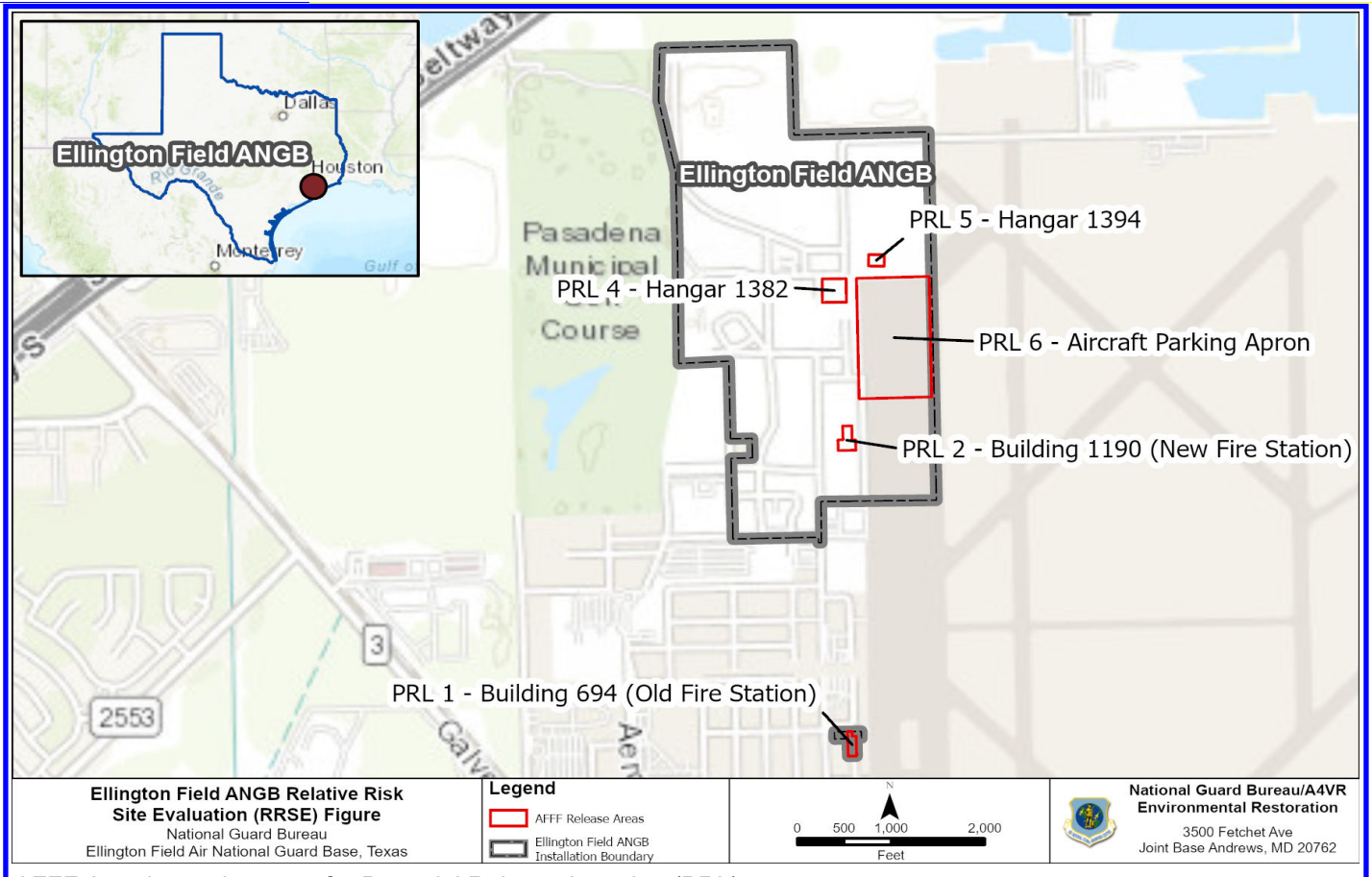
Regulatory and Stakeholder Involvement

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 Ellington Field ANGB, TX

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



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

Site Background Information			
Installation:	Ellington Field ANGB	**Date:**	10/4/2021
Location (State):	Texas	**Media Evaluated:**	Groundwater, Soil
Site Name and ID:	Old Fire Station - Bldg 694 - PRL 1	**Phase of Execution (e.g., RI, Record of Decision (ROD)):**	N/A
RPM's Name:	Jim King	**Agreement Status (e.g., Federal Facility Agreement date signed):**	N/A
OVERALL SITE CATEGORY: HIGH			

Site Summary	
Brief Site Description:	Building 694 was the location of the old Fire Department (FD) pre-1988 to 2012. Building 694 is located on a Federal reservation parcel owned by the Air Force. It is not located on Ellington Field ANGB but just south of it. According to personnel that worked in the FD since 1988, aqueous film forming foam (AFFF) was stored at this location in fire/crash response vehicles, fire engines, and a foam trailer. AFFF stored at this location ranged from 50 gallon (gal) fire engines to a 500 gal foam trailer. It was reported that 11 trucks were housed at this location. FD personnel indicated that minor leaks from the trucks occurred over the years. Vehicles were washed in the wash rack located outside the north end of Building 694 as well as in the vehicle bays and concrete ramp outside the station.
Brief Description of Pathways:	The primary hydrogeological unit is the Gulf Coast Aquifer System (GCAS), which consists of complex interbedded clays, silts, sands, and gravels which are hydrologically connected to form a large, leaky artesian aquifer system. Multiple aquifers compose the GCAS. Maximum total sand thickness ranges from 700 feet in the south to 1,300 feet in the northern extent. PRL wells are screened in the shallow hydrogeological unit, and may be hydraulically connected to the GCAS. The average depth to groundwater at the Base is typically around 10 ft. below ground surface (bgs) and generally flows to the east. PRL 1 is located on separate parcel, with a well located adjacent to the base boundary for the parcel; this well was used for evaluating potential off-base groundwater migration for potential southerly movement. Surface water flow is dictated by the Base's man-made surface drainage system. The system contains a large detention pond and multiple ditches/channels that are discharged through six stormwater discharge outfalls. Stormwater moves by open channel flow and underground drainage pipes until the runoff reaches Horsepen Bayou, located approximately 2 miles south of the ANGB, which flows easterly, eventually combining with Armand Bayou. Exposed soils and grassy areas surround the old fire station.
Brief Description of Receptors:	The shallow hydrogeological unit may be hydraulically connected to the GCAS where downgradient potable wells may be screened; given this information, and the relatively high PFOS/PFOA concentrations detected during the SI, it is a potentially, though very unlikely, complete pathway. There are 70 wells within a 1-mile radius of the Base. One well is listed on the U.S. Geological Survey (USGS) database, which usually lists monitoring or test wells. The remaining 69 water wells are on the state's database. The Base obtains drinking water from the city of Houston. The area surrounding the Base is also served by city of Houston public water supply, though use of groundwater for potable use in this area cannot be ruled out. At least two domestic wells and two public supply wells were identified within a 1 mile radius of the base. These wells are hydraulically upgradient and are screened significantly deeper than the monitoring wells on base. The old fire station is located in a multipurpose area of the base, with a control tower building and small aviation companies in neighboring properties. The old Fire Station has controlled-gated access. PFAS including PFOA, PFOS, and PFBS have been detected at multiple on-site wells at varying concentrations. RRSE scores do not necessarily indicate risk to human health for public concern but rather the relative risk for comparison with other Air Force/Air National Guard Installations. Future investigations will include a full risk assessment which will determine the actual site specific risk to human health and the environment at Ellington Field ANGB.

Groundwater Worksheet

Installation: Ellington Field JRB

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

Contaminant	Maximum Concentration (ug/L)	Comparison Value (ug/L)	Ratios
PFOS	47	0.04	1175.0
PFOA	14	0.04	350.0
PFBS	3.2	0.602	5.3

CHF Scale	CHF Value	Contamination Hazard Factor (CHF)	1530.3
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)	
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)	
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)	M
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).	M
	Groundwater Category	**HIGH**

Soil Worksheet

Installation Ellington Field ANGB

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

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
PFOS	2.4	0.126	19.0
PFOA	0.097	0.126	0.8
PFBS	0.0012	1.9	0.0

CHF Scale	CHF Value	Contamination Hazard Factor (CHF)	19.8
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**

Site Background Information			
Installation:	Ellington Field ANGB	**Date:**	10/4/2021
Location (State):	Texas	**Media Evaluated:**	Groundwater, Soil
Site Name and ID:	New Fire Station Bldg 1190 - PRL 2	**Phase of Execution (e.g., RI, Record of Decision (ROD)):**	N/A
RPM's Name:	Jim King	**Agreement Status (e.g., Federal Facility Agreement date signed):**	N/A
OVERALL SITE CATEGORY: HIGH			

Site Summary	
Brief Site Description:	Building 1190 was constructed in 2012 to house the new Fire Station at Ellington Field ANGB. The building contains a 1,000-gal, double walled oil/water separator (OWS) that discharges to the sanitary sewer system per the 2015 Base Stormwater Pollution Prevention Plan. At the time of the preliminary assessment (PA) visit, AFFF was stored at this location in 5-gal pails in the utility room at the rear of the building, and in Fire/Crash Response vehicles ranging in volumes from 50 gal fire engines to a 500 gal foam trailer. FD personnel indicated that leaks or spills have not occurred from the equipment at the new Fire Station.
Brief Description of Pathways:	The primary hydrogeologic unit present in the Gulf Coast Plain physiographic province is the GCAS. The GCAS consists of complex interbedded clays, silts, sands, and not all formations are present throughout the system. Maximum total sand thickness ranges from 700 ft. in the south to 1,300 ft. in the northern extent. The average depth to groundwater at the Base is typically around 10 ft. bgs and generally flows to the east. Surface water flow is dictated by the Base's man-made surface drainage system. The system contains a large detention pond and multiple ditches/channels that are discharged through six stormwater discharge outfalls. Stormwater moves by open channel flow and underground drainage pipes until the runoff reaches Horsepen Bayou, located approximately 2 miles south of the ANGB, which flows easterly, eventually combining with Armand Bayou. The new fire station is surrounded by grassy areas and exposed soils.
Brief Description of Receptors:	The shallow hydrogeological unit may be hydraulically connected to the GCAS where downgradient potable wells may be screened; given this information, and the relatively high PFOS/PFOA concentrations detected during the SI, it is a potentially, though very unlikely, complete pathway. There are 70 wells within a 1-mile radius of the Base. One well is listed on the USGS database, which usually lists monitoring or test wells. The remaining 69 water wells are on the state's database. The Base obtains drinking water from the city of Houston. The area surrounding the Base is also served by city of Houston public water supply, though use of groundwater for potable use in this area cannot be ruled out. At least two domestic wells and two public supply wells were identified within a 1 mile radius of the base. These wells are hydraulically upgradient and are screened significantly deeper than the monitoring wells on base. The new fire station does not have restricted access. PFAS including PFOA, PFOS, and PFBS have been detected at multiple on-site wells at varying concentrations. RRSE scores do not necessarily indicate risk to human health for public concern but rather the relative risk for comparison with other Air Force/Air National Guard Installations. Future investigations will include a full risk assessment which will determine the actual site specific risk to human health and the environment at Ellington Field ANGB.

Groundwater Worksheet

Installation: Ellington Field JRB

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

Contaminant	Maximum Concentration (ug/L)	Comparison Value (ug/L)	Ratios
PFOS	2.2	0.04	55.0
PFOA	0.35	0.04	8.7
PFBS	0.87	0.602	1.4

CHF Scale	CHF Value	Contamination Hazard Factor (CHF)	65.2
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)	
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)	M
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).	M
	Groundwater Category	**MEDIUM**

Soil Worksheet

Installation Ellington Field ANGB

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

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
PFOS	0.43	0.126	3.4
PFOA	0.0046	0.126	0.0
PFBS	0.0018	1.9	0.0

CHF Scale	CHF Value	Contamination Hazard Factor (CHF)	3.5
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**

Site Background Information			
Installation:	Ellington Field ANGB	**Date:**	10/4/2021
Location (State):	Texas	**Media Evaluated:**	Groundwater, Soil
Site Name and ID:	Hangar 1382 - PRL 4	**Phase of Execution (e.g., RI, Record of Decision (ROD)):**	N/A
RPM's Name:	Jim King	**Agreement Status (e.g., Federal Facility Agreement date signed):**	N/A
OVERALL SITE CATEGORY: HIGH			

Site Summary	
Brief Site Description:	Hangar 1382 previously contained AFFF in fire suppression equipment. The AFFF fire suppression system was replaced with a high-expansion foam system in 2014. At the time of the PA visit, the building had no AFFF. Base personnel indicated that a few minor leaks of AFFF in the building have occurred. Potential areas of concern at this location include the concrete ramp to the east of the hangar and the stormwater system and grassy areas located at the front (east) of the building.
Brief Description of Pathways:	The primary hydrogeologic unit present in the Gulf Coast Plain physiographic province is the GCAS. The GCAS consists of complex interbedded clays, silts, sands, and not all formations are present throughout the system. Maximum total sand thickness ranges from 700 ft. in the south to 1,300 ft. in the northern extent. The average depth to groundwater at the Base is typically around 10 ft. bgs and generally flows to the east. Surface water flow is dictated by the Base's man-made surface drainage system. The system contains a large detention pond and multiple ditches/channels that are discharged through six stormwater discharge outfalls. Stormwater moves by open channel flow and underground drainage pipes until the runoff reaches Horsepen Bayou, located approximately 2 miles south of the ANGB, which flows easterly, eventually combining with Armand Bayou. Soil samples were collected from grassy areas surrounding PRL 4.
Brief Description of Receptors:	The shallow hydrogeological unit may be hydraulically connected to the GCAS where downgradient potable wells may be screened; given this information, and the relatively high PFOS/PFOA concentrations detected during the SI, it is a potentially, though very unlikely, complete pathway. There are 70 wells within a 1-mile radius of the Base. One well is listed on the USGS database, which usually lists monitoring or test wells. The remaining 69 water wells are on the state's database. The Base obtains drinking water from the city of Houston. The area surrounding the Base is also served by city of Houston public water supply, though use of groundwater for potable use in this area cannot be ruled out. At least two domestic wells and two public supply wells were identified within a 1 mile radius of the base. These wells are hydraulically upgradient and are screened significantly deeper than the monitoring wells on base. Soils were collected from areas adjacent to the airfield and the hangar apron. Access is not controlled at the hangar, however, base personnel and maintenance staff are the likely receptors. PFAS including PFOA, PFOS, and PFBS have been detected at multiple on-site wells at varying concentrations. RRSE scores do not necessarily indicate risk to human health for public concern but rather the relative risk for comparison with other Air Force/Air National Guard Installations. Future investigations will include a full risk assessment which will determine the actual site specific risk to human health and the environment at Ellington Field ANGB.

Groundwater Worksheet

Installation: Ellington Field JRB

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

Contaminant	Maximum Concentration (ug/L)	Comparison Value (ug/L)	Ratios
PFOS	26	0.04	650.0
PFOA	2.6	0.04	65.0
PFBS	3.2	0.602	5.3

CHF Scale	CHF Value	Contamination Hazard Factor (CHF)	720.3
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)	
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)	
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)	M
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).	M
	Groundwater Category	**HIGH**

Soil Worksheet

Installation Ellington Field ANGB

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

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
PFOS	1.1	0.126	8.7
PFOA	0.0012	0.126	0.0
PFBS	0.0011	1.9	0.0
CHF Scale	**CHF Value**	**Contamination Hazard Factor (CHF)**	**8.7**
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**

Site Background Information			
Installation:	Ellington Field ANGB	**Date:**	10/4/2021
Location (State):	Texas	**Media Evaluated:**	Groundwater, Soil
Site Name and ID:	Hangar 1394 - PRL 5	**Phase of Execution (e.g., RI, Record of Decision (ROD)):**	N/A
RPM's Name:	Jim King	**Agreement Status (e.g., Federal Facility Agreement date signed):**	N/A
OVERALL SITE CATEGORY: MEDIUM			

Site Summary	
Brief Site Description:	AFFF was previously used at Hangar 1394 in the fire suppression equipment, but the system was removed. At the time of the PA visit, no AFFF was stored at this location. ANGB personnel indicated that a few minor releases of AFFF in the hangar have occurred. Areas likely to have been affected by the minor releases include the concrete ramp south of the hangar, the grassy area in front (south) of the building, and the stormwater system.
Brief Description of Pathways:	The primary hydrogeologic unit present in the Gulf Coast Plain physiographic province is the GCAS. The GCAS framework includes the shallower Chicot aquifer, which is composed of the Pleistocene, Lissie, and Willis formations, and a deeper Evangeline aquifer, which is composed of the upper and lower Pliocene-age Goliad formation. The GCAS consists of complex interbedded clays, silts, sands, and not all formations are present throughout the system. Maximum total sand thickness ranges from 700 ft. in the south to 1,300 ft. in the northern extent. The average depth to groundwater at the Base is typically around 10 ft. bgs and generally flows to the east. Surface water flow is dictated by the Base's man-made surface drainage system. The system contains a large detention pond and multiple ditches/channels that are discharged through six stormwater discharge outfalls. Stormwater moves by open channel flow and underground drainage pipes until the runoff reaches Horsepen Bayou, located approximately 2 miles south of the ANGB, which flows easterly, eventually combining with Armand Bayou. Exposed soils and grassy areas are adjacent to the hangar, as well as asphalted taxi ways.
Brief Description of Receptors:	The shallow hydrogeological unit may be hydraulically connected to the GCAS where downgradient potable wells may be screened; given this information, and the relatively high PFOS/PFOA concentrations detected during the SI, it is a potentially, though very unlikely, complete pathway. There are 70 wells within a 1-mile radius of the Base. One well is listed on the USGS database, which usually lists monitoring or test wells. The remaining 69 water wells are on the state's database. The Base obtains drinking water from the city of Houston. The area surrounding the Base is also served by city of Houston public water supply, though use of groundwater for potable use in this area cannot be ruled out. At least two domestic wells and two public supply wells were identified within a 1 mile radius of the base. These wells are hydraulically upgradient and are screened significantly deeper than the monitoring wells on base. Soils were collected from areas adjacent to the airfield and the hangar apron. Access to the Hangar is limited to base personnel. PFAS including PFOA, PFOS, and PFBS have been detected at multiple on-site wells at varying concentrations. RRSE scores do not necessarily indicate risk to human health for public concern but rather the relative risk for comparison with other Air Force/Air National Guard Installations. Future investigations will include a full risk assessment which will determine the actual site specific risk to human health and the environment at Ellington Field ANGB.

Groundwater Worksheet

Installation: Ellington Field JRB

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

Contaminant	Maximum Concentration (ug/L)	Comparison Value (ug/L)	Ratios
PFOS	1.7	0.04	42.5
PFOA	0.083	0.04	2.1
PFBS	0.13	0.602	0.2

CHF Scale	CHF Value	Contamination Hazard Factor (CHF)	44.8
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)	
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)	M
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).	M
	Groundwater Category	**MEDIUM**

Soil Worksheet

Installation Ellington Field ANGB

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

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
PFOS	0.066	0.126	0.5
PFOA	0.0051	0.126	0.0
PFBS	0.00042	1.9	0.0
CHF Scale	**CHF Value**	**Contamination Hazard Factor (CHF)**	**0.6**
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**	**L**

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	**LOW**

Site Background Information			
Installation:	Ellington Field ANGB	**Date:**	10/4/2021
Location (State):	Texas	**Media Evaluated:**	Groundwater, Soil
Site Name and ID:	Aircraft Parking Apron - PRL 6	**Phase of Execution (e.g., RI, Record of Decision (ROD)):**	N/A
RPM's Name:	Jim King	**Agreement Status (e.g., Federal Facility Agreement date signed):**	N/A
OVERALL SITE CATEGORY: MEDIUM			

Site Summary	
Brief Site Description:	No records of AFFF usage on the aircraft parking apron exist. However, due to the historical presence of aircraft on the concrete apron, the downgradient edges of the apron may have been impacted. In addition, due to its location near Hangars 1382 and 1394, the area may have been impacted with AFFF.
Brief Description of Pathways:	The primary hydrogeologic unit present in the Gulf Coast Plain physiographic province is the GCAS. The GCAS framework includes the shallower Chicot aquifer, which is composed of the Pleistocene, Lissie, and Willis formations, and a deeper Evangeline aquifer, which is composed of the upper and lower Pliocene-age Goliad formation. The GCAS consists of complex interbedded clays, silts, and sands. Not all formations are present throughout the system. Maximum total sand thickness ranges from 700 ft. in the south to 1,300 ft. in the northern extent. The average depth to groundwater at the Base is typically around 10 ft. bgs and generally flows to the east. Surface water flow is dictated by the Base's man-made surface drainage system. The system contains a large detention pond and multiple ditches/channels that are discharged through six stormwater discharge outfalls. Stormwater moves by open channel flow and underground drainage pipes until the runoff reaches Horsepen Bayou, located approximately 2 miles south of the ANGB, which flows easterly, eventually combining with Armand Bayou. The aircraft parking apron is an asphalt surface.
Brief Description of Receptors:	The shallow hydrogeological unit may be hydraulically connected to the GCAS where downgradient potable wells may be screened; given this information, and the relatively high PFOS/PFOA concentrations detected during the SI, it is a potentially, though very unlikely, complete pathway. There are 70 wells within a 1-mile radius of the Base. One well is listed on the USGS database, which usually lists monitoring or test wells. The remaining 69 water wells are on the state's database. The Base obtains drinking water from the city of Houston. The area surrounding the Base is also served by city of Houston public water supply, though use of groundwater for potable use in this area cannot be ruled out. At least two domestic wells and two public supply wells were identified within a 1 mile radius of the base. These wells are hydraulically upgradient and are screened significantly deeper than the monitoring wells on base. Access to the aircraft parking apron is limited to base personnel. PFAS including PFOA, PFOS, and PFBS have been detected at multiple on-site wells at varying concentrations. RRSE scores do not necessarily indicate risk to human health for public concern but rather the relative risk for comparison with other Air Force/Air National Guard Installations. Future investigations will include a full risk assessment which will determine the actual site specific risk to human health and the environment at Ellington Field ANGB.

Groundwater Worksheet

Installation: Ellington Field JRB

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

Contaminant	Maximum Concentration (ug/L)	Comparison Value (ug/L)	Ratios
PFOS	2.2	0.04	55.0
PFOA	0.39	0.04	9.7
PFBS	0.38	0.602	0.6

CHF Scale	CHF Value	Contamination Hazard Factor (CHF)	65.4
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)	
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)	M
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).	M
	Groundwater Category	**MEDIUM**

Soil Worksheet

Installation: Ellington Field ANGB

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

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
PFOS	0.041	0.126	0.3
PFOA	0.00013	0.126	0.0

CHF Scale	CHF Value	Contamination Hazard Factor (CHF)	0.3
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**