Welcome

Environmental Advisory Board (EAB) Meeting

Robins Air Force Base

May 4, 2023

Welcome and Program Introduction

Dr. Linda Smyth
EAB Community Co-chair

Acronyms and Abbreviations

- AFFF – Aqueous Fire Fighting Foam
- ASD – Assistant Secretary of Defense
- CERCLA – Comprehensive Environmental Response, Compensation and Liability Act
- CSM – Conceptual Site Model
- DPT – Direct Push Technology
- ERP – Environmental Restoration Program
- HA – Health Advisory
- HQ – Hazard Quotient
- ILCR – Incremental Lifetime Cancer Risk
- IWTP – Industrial Wastewater Treatment Plant
- NPDWR – National Primary Drinking Water Regulation
- NA – Not Applicable/Applicable

Acronyms and Abbreviations

- PA – Preliminary Assessment
- PFAS – Per- and Polyfluoroalkyl Substances
- PFOS – Perfluorooctane Sulfonate
- PFOA – Perfluorooctanoic acid
- ppt – part per trillion
- R&D – Research and Development
- RI – Remedial Investigation
- RSL – Risk-based Screening Level
- SI – Site Inspection
- SRS – Sustainment and Restoration Services
- SSL – Soil Screening Level
- VAS – Vertical Aquifer Sampling
- WWTP – Wastewater Treatment Plant
- US EPA – United States Environmental Protection Agency

Remedial Investigation of Per- and Polyfluoroalkyl Substances (PFAS)

Jennifer L. Ludwig, PE
Environmental Engineer Manager
QRI, LLC

James Griffin, PG, CHMM
Sustainment and Restoration Services (SRS)

May 4, 2023

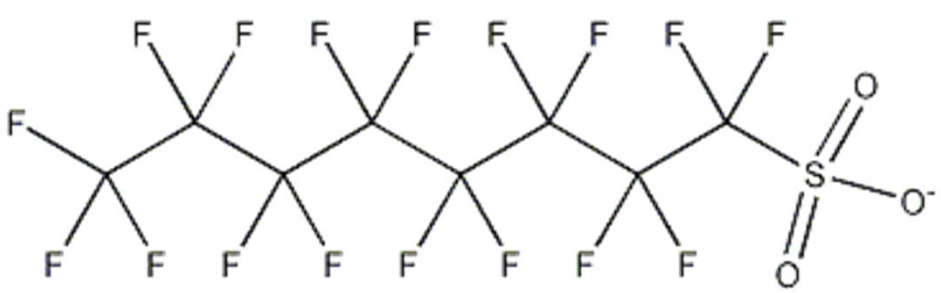
Overview

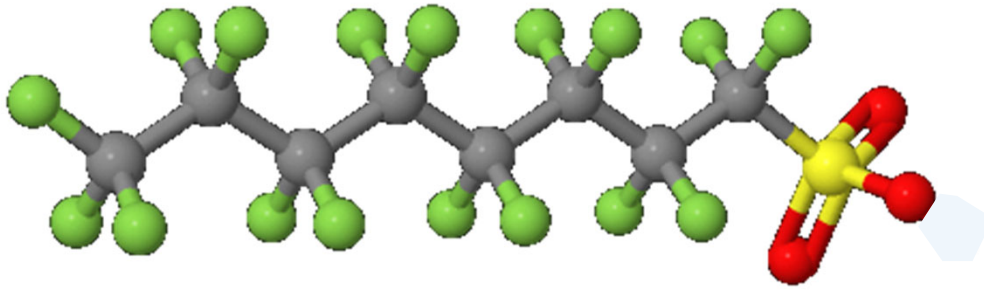
- Background
- Regulatory status
- Air Force response
- Robins AFB status
- Robins AFB Remedial Investigation
- Information sources

Background – Characteristics

- **Per- and Polyfluoroalkyl Substances (PFAS)**
  - **Family of synthetic organic compounds that contain multiple fluorine atoms**

9 19.0
F
Fluorine





Conder et al. (2008)

Example molecular structures for perfluorooctane sulfonate (PFOS)

Background – Characteristics

- **PFAS**
  - **Man-made group of chemicals used in industry and consumer products since the 1940s**
  - **Several thousand individual compounds**
  - **Unique surface-active properties, non-reactive, and stable**
  - **Best known and studied compounds are perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA)**
  - **Found in:**
    - Stain and water repellants used on carpets, upholstery, clothing, etc. (i.e., Gortex ®)
    - Cleaning products
    - Non-stick cookware
    - Paints, varnishes, sealants
    - Certain shampoo, dental floss, cosmetics
    - Grease-resistant paper, fast food containers/wrappers, microwave popcorn bags, pizza boxes, candy wrapper

United States Environmental Protection Agency (US EPA; EPA.gov); March 16, 2023)

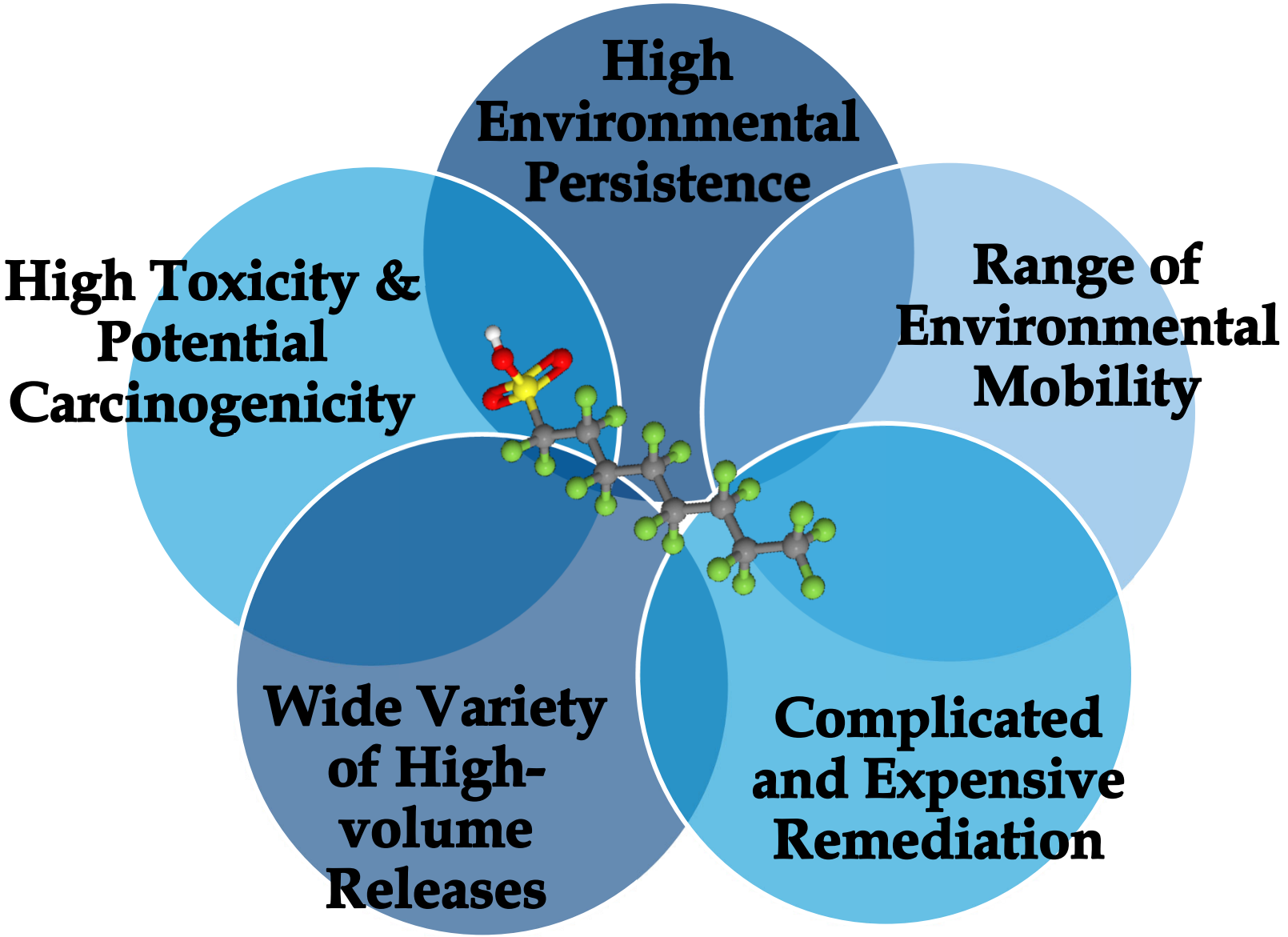
Background – Potential Sources

- **Sites with very high probability of screening or risk-based criteria exceedances**
  - **Aircraft maintenance facilities**
  - **Fire-fighting training areas**
  - **Petrochemical/chemical plants**
  - **Chrome plating facilities**
  - **Textile/carpet manufacturers**
  - **Wastewater Treatment Plants (WWTPs) and sewage sludge land application areas**
  - **Landfills**

Background – Environmental Fate

- Persistent in environment (or transformation to persistent compounds)
- Moderate-high water solubility/mobility
- Can also partition to soils and sediment
- Persistent at contaminated sites; compounds not volatile

Background – Perfect Storm of Environmental Challenges



Regulatory Status

- In 2009, US EPA established provisional Health Advisory (HA) for PFOA at 400 parts per trillion (ppt) and for PFOS at 200 ppt
  - HAs are non-regulatory information for federal, state and local officials to consider when addressing drinking water contamination
- In May 2016, US EPA released revised HAs for PFOA and PFOS
  - Revised HA for both PFOA and PFOS set at 70 ppt
  - HA for the sum of PFOA and PFOS also set at 70 ppt
- US EPA released PFAS Action Plan in February 2019

Regulatory Status

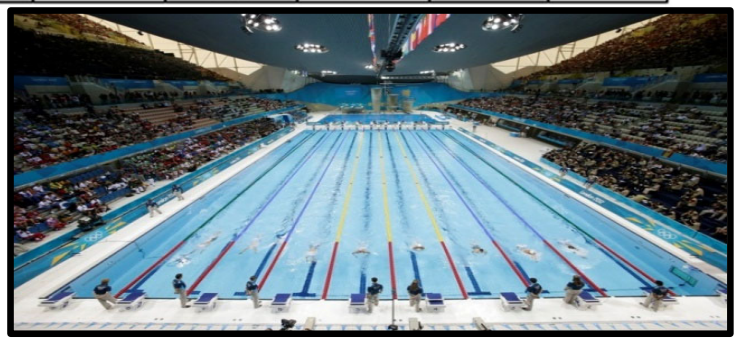
- **Assistant Secretary of Defense (ASD) Memorandum, July 6, 2022, establishes Risk Screening Levels for PFAS in groundwater and soil**

Attachment: Risk Screening Levels Calculated for PFOS, PFOA, PFBS, PFNA, PFHxA, HFPO-DA in Groundwater or Soil Using EPA's RSL Calculator

Chemical	Carcinogenic Slope Factor - Oral (SF) (mg/kg-day)-1	Non-Carcinogenic Reference Dose (RfD) (mg/kg-day)	Residential Scenario Screening Levels Calculated Using EPA RSL Calculator								Industrial/Commercial Composite Worker Screening Levels Calculated Using EPA RSL Calculator			
			Tap Water (ng/L or ppt)				Soil (mg/kg or ppm)				Soil (mg/kg or ppm)			
			HQ = 0.1	HQ = 1.0	ILCR = 1E-06	ILCR = 1E-04	HQ = 0.1	HQ = 1.0	ILCR = 1E-06	ILCR = 1E-04	HQ = 0.1	HQ = 1.0	ILCR = 1E-06	ILCR = 1E-04
PFOS	NA	2.00E-06	4	40	NA	NA	0.013	0.13	NA	NA	0.16	1.6	NA	NA
PFOA	7.00E-02	3.00E-06	6	60	1,100	111,000	0.019	0.19	7.8	775	0.25	2.5	33	3,280
PFBS	NA	3.00E-04	601	6010	NA	NA	1.9	19	NA	NA	25	250	NA	NA
PFNA	NA	3.00E-06	6	59	NA	NA	0.019	0.19	NA	NA	0.25	2.5	NA	NA
PFHxS	NA	2.00E-05	39	394	NA	NA	0.13	1.30	NA	NA	1.6	16	NA	NA
HFPO-DA	NA	3.00E-06	6	60	NA	NA	0.023	0.23	NA	NA	0.35	3.5	NA	NA

HQ=Hazard Quotient
ILCR=Incremental Lifetime Cancer Risk
NA=Not available/applicable

Tap Water @ 4ppt is equivalent to less than 1 drop (0.25) in Olympic Pool



Volume: 660,000 gallons

Regulatory Status

- **March 14, 2023: US EPA announces proposed maximum contaminant levels (MCLs)**
  - **National Primary Drinking Water Regulation (NPDWR) to establish legally enforceable levels – MCLs for six (6) PFAS in drinking water**
  - **Period of public comment open until May 30, 2023**

COMPOUND	PROPOSED MCL
PFOA	4.0 parts per trillion (also expressed as ng/L)
PFOS	4.0 ppt
PFNA	1.0 (unitless) Hazard Index
PFHxS	
PFBS	
HFPO-DA (commonly referred to as GenX Chemicals)	

Regulatory Status

- **Hazard Index**
  - **Tool used to understand health risks from chemical mixtures**
  - **US EPA is proposing a Hazard Index MCL to limit any mixture containing one or more of PFNA, PFHxS, PFBS and/or GenX Chemicals**
  - **Sum of comparison of level of each PFAS measured in water to highest level determined not to have risk of health effects**

Equation

$$\text{Hazard Index} = \left(\frac{[\text{GenX}_{\text{water}}]}{[10\text{ ppt}]}\right) + \left(\frac{[\text{PFBS}_{\text{water}}]}{[2000\text{ ppt}]}\right) + \left(\frac{[\text{PFNA}_{\text{water}}]}{[10\text{ ppt}]}\right) + \left(\frac{[\text{PFHxS}_{\text{water}}]}{[9.0\text{ ppt}]}\right)$$

Regulatory Status

- **Ongoing US EPA Research and Development (R&D) activities**
  - **Human health/toxicity**
    - Understand human health toxicity
    - Inform risk mitigation activities
    - Chemical library and high throughput toxicity testing
  - **Analytical methods**
    - Establish validated methods for measuring compounds in different environmental media
  - **Site characterization/exposure**
    - Develop sampling methods to characterize sources and contaminated sites
    - Identify and estimate human exposure from different sources
  - **Treatment/remediation**
    - Identify/evaluate methods to reduce exposures
    - Identify/evaluate methods to treat and remediate drinking water and contaminated sites

Air Force Response

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)

The Air Force's investigation work and mitigation actions are guided by CERCLA, applicable state laws and Risk-Based Screening Levels (RSLs).

Air Force Civil Engineer Center (AFCEC) is moving forward aggressively in accordance with the CERCLA process to identify, define, and mitigate potential contamination.

The CERCLA process:

- Ensures thorough investigation work
- Promotes accountability, community involvement, and long-term protectiveness

Air Force Response

The Air Force is using a three-step proactive approach to assess the potential for PFOS/PFOA contamination of drinking water and respond appropriately.

1. Identify
- Determine potential Aqueous Film-Forming Foam (AFFF) releases
- Verify releases through sampling
- Determine if contaminant pathways to drinking water exist

2. Respond
- PFOS/PFOA > HA, provide alternate drinking water supply
- If PFOS/PFOA < HA, establish monitoring schedule

3. Prevent
- Legacy AFFF disposal
- Explore alternatives to AFFF
- Retrofit fire vehicles

Air Force Response
Robins AFB Drinking Water

- August 2016 and 2020 – Samples collected from all six (6) active Robins AFB drinking water wells
- All results below US EPA lifetime health advisory of 70 ppt
- All results below detection limits (< 2 ppt)
- No impacts to Robins AFB drinking water

Air Force Response

IDENTIFY:

Preliminary Assessment (PA)
A base-wide records review identifies fire training areas, crash sites and other areas at installations where AFFF may have been released.

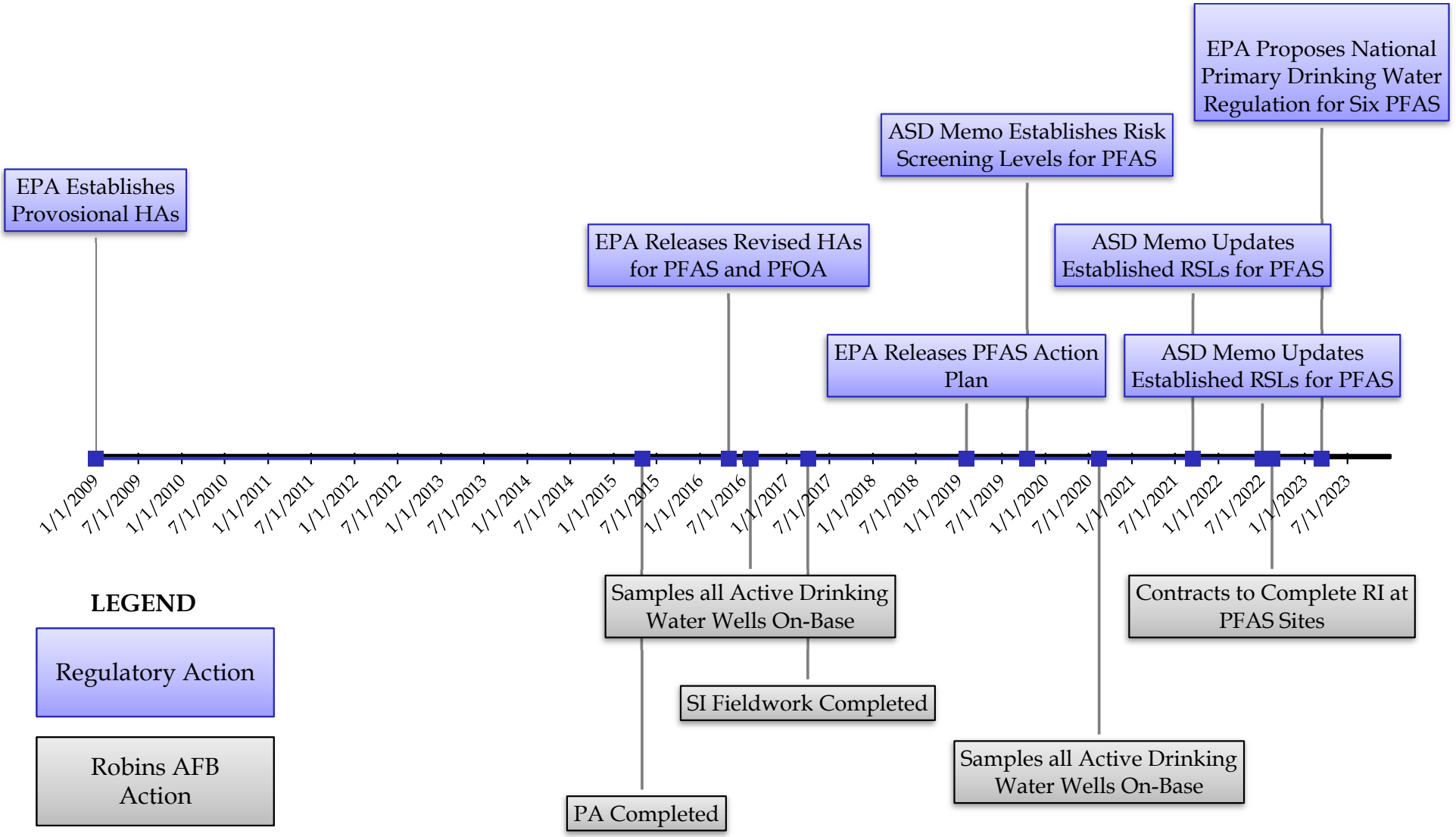
Site Inspection (SI)
AFCEC conducts groundwater, surface water, soil, and sediment sampling to verify releases and map contamination and potential pathways to drinking water.

If SI sampling indicates potential pathways to drinking water supplies, AFCEC expands the SI footprint and may test public water systems and private wells.

Once SI is complete, AFCEC determines if investigation yielded adequate data to fully map contamination or if more investigation work is needed.

Remedial Investigation (RI)
AFCEC identifies sites from the SI requiring additional investigation work. CERCLA process put in place to determine nature and extent of contamination.

Air Force Response



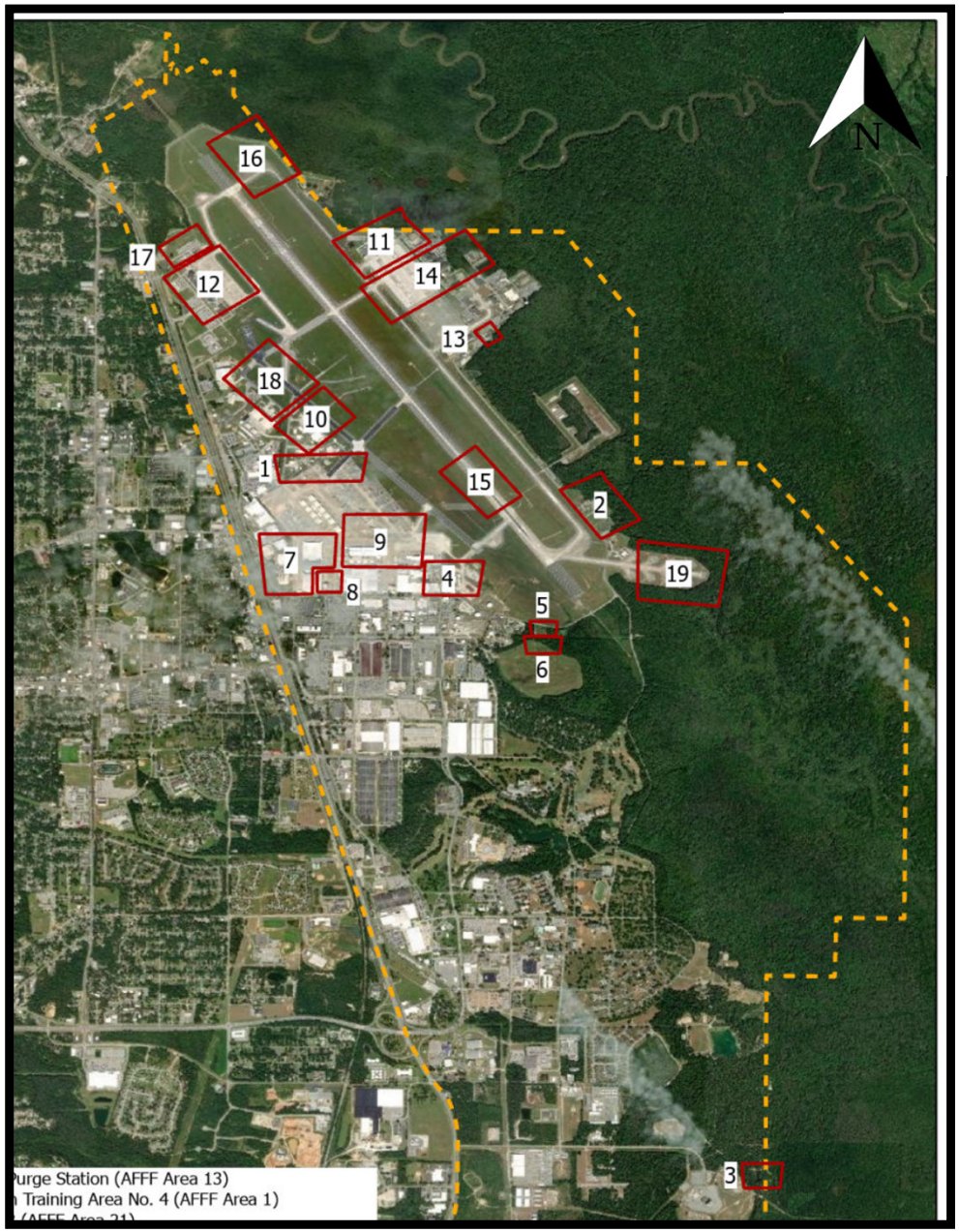
Air Force Response
Robins AFB CERCLA Investigation Status

- **Preliminary Assessment (PA) completed in May 2015**
- **Site Inspection (SI)**
  - **Fieldwork – March to April 2017**
  - **Soil and shallow groundwater sampled at 30 AFFF areas**
  - **Final Report – June 2018**
- **Remedial Investigation (RI)**
  - **Contract awarded August 2022 to perform RI at 19 Environmental Restoration Program (ERP) sites identified in SI**

Robins AFB Remedial Investigation

- **Purpose**
  - **Site characterization to delineate nature and extent of PFAS contamination at Robins AFB**
    - Vertical and lateral extent of PFAS in soil, groundwater, sediment, and surface water
    - Residual soil contamination within unsaturated source zones
  - **Update and/or develop a Conceptual Site Model (CSM) to understand:**
    - Geologic and hydrogeologic conditions at each site
    - Migratory pathways
    - Comingling or interaction with legacy contamination

Robins AFB Remedial Investigation



ERP Sites

1. CG028P-SUB – Aircraft Fuel Purge Station (AFFF Area 13)
2. FT008P-SUB – Fire Protection Training Area No. 4 (AFFF Area 1)
3. LF018P-SUB – Landfill No. 18 (AFFF Area 21)
4. OT020P-SUB – Industrial Waste Treatment Plant (AFFF Area 17)
5. OT023P-SUB – Sanitary Sludge Placement Area (AFFF Area 20)
6. WP014P-SUB – Sludge Lagoon (AFFF Area 19)
7. SS044P – Building 54 (AFFF Area 2)
8. SS045P – Building 89 (AFFF Area 3)
9. SS046P – Building 110 and Former Crash Station (AFFF Areas 4 & 9)
10. SS047P – Building 131 (AFFF Area 5)
11. SS048P – Building 2036 (AFFF Area 6)
12. SS049P – Building 2316 (AFFF Area 7)
13. SS050P – Building 2086 (Fire Training Station #3; AFFF Area 8)
14. SS051P – B-52 Fuel Fire (AFFF Area 10)
15. SS052P – C-141 Landing (AFFF Area 11)
16. SS053P – B1B Tire Fire and Sample Location 14B (AFFF Area 12, 29, & 30)
17. SS054P – Foam Retention Lagoon for B2316 and 2328 (AFFF Area 14)
18. SS055P – Spray Test Area (AFFF Area 15)
19. SS056P – Old Alert Pad (AFFF Area 16)

Robins AFB Remedial Investigation

- ERP sites under remedial investigation originate from various AFFF release types
  - Crash/fire response
  - Fire Dept training activities
  - Releases from hangar systems
  - Disposal sites
  - Industrial Wastewater Treatment Plant (IWTP)

Robins AFB Remedial Investigation

- Crash/fire response
  - Fire department responses to emergencies
  - Direct application of AFFF to ground and paved surfaces
  - Aircraft Fuel Purge Station (AFFF Area 13)
  - SS051P – B-52 Fuel Fire (AFFF Area 10)
  - SS052P – C-141 Landing (AFFF Area 11)
  - SS053P – B1B Tire Fire and Sample Location 14B (AFFF Area 12, 29, & 30)
  - SS056P – Old Alert Pad (AFFF Area 16)

Robins AFB Remedial Investigation

- Fire Dept training activities
  - AFFF was used in trucks and other fire training appliances
  - Direct application to ground
  - FT008P-SUB – Fire Protection Training Area No. 4 (AFFF Area 1)
  - SS055P – Spray Test Area (AFFF Area 15)

Robins AFB Remedial Investigation

- **Releases from hangar systems**
  - Fire suppression system false alarms
  - Actual fire suppression activities
  - SS044P – Building 54 (AFFF Area 2)
  - SS045P – Building 89 (AFFF Area 3)
  - SS046P – Building 110 and Former Crash Station (AFFF Areas 4 & 9)
  - SS047P – Building 131 (AFFF Area 5)
  - SS048P – Building 2036 (AFFF Area 6)
  - SS049P – Building 2316 (AFFF Area 7)
  - SS050P – Building 2086 (Fire Training Station #3; AFFF Area 8)
  - SS054P – Foam Retention Lagoon for B2316 and 2328 (AFFF Area 14)

Robins AFB Remedial Investigation

- Disposal sites
  - Historic disposal of AFFF contaminated materials
  - LF018P-SUB – Landfill No. 18 (AFFF Area 21)
  - OT023P-SUB – Sanitary Sludge Placement Area (AFFF Area 20)
  - WP014P-SUB – Sludge Lagoon (AFFF Area 19)

Robins AFB Remedial Investigation

- **Industrial Wastewater Treatment Plant (IWTP)**
  - **All drains from industrial area buildings**
  - **Incidental releases of AFFF would have passed through this system**
  - **OT020P-SUB – IWTP (AFFF Area 17)**

Robins AFB Remedial Investigation

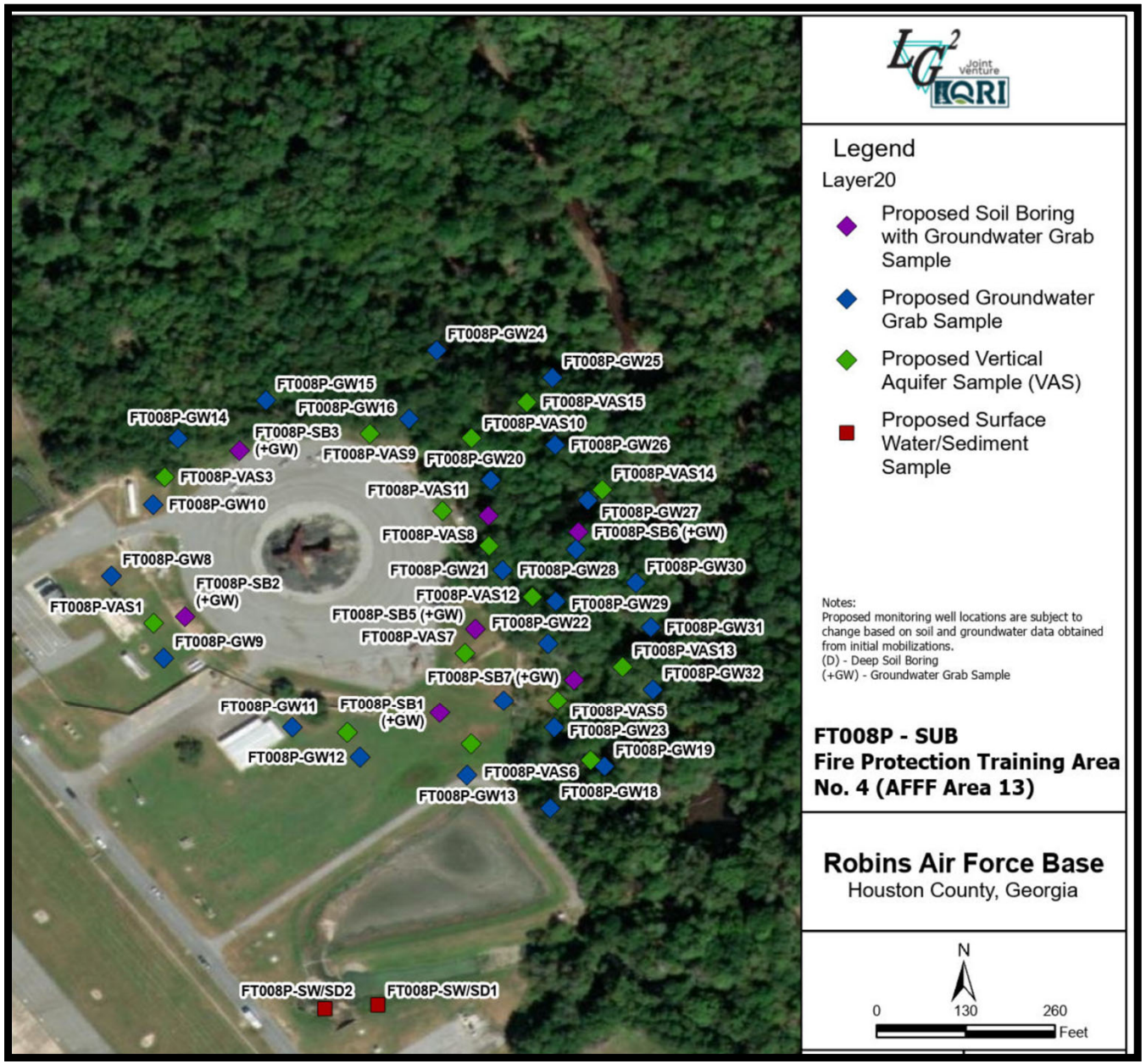
- **Scope of Work**
  - Source area soil sampling
  - Groundwater grab sampling in source area
  - Vertical aquifer sampling
  - Permanent monitoring well installation and sampling
  - Groundwater sampling with lysimeters
  - Surface water and sediment sampling

Robins AFB Remedial Investigation

Sample Type	Quantity
Source Area Soil	591
Groundwater Grab	615
Vertical Aquifer	820
Monitoring Well Soils	410
Monitoring Well Groundwater	354
Surface Water	15
Sediment	15
Total	**2,820**

Robins AFB Remedial Investigation

Source Area Soil and Groundwater Grab Sampling

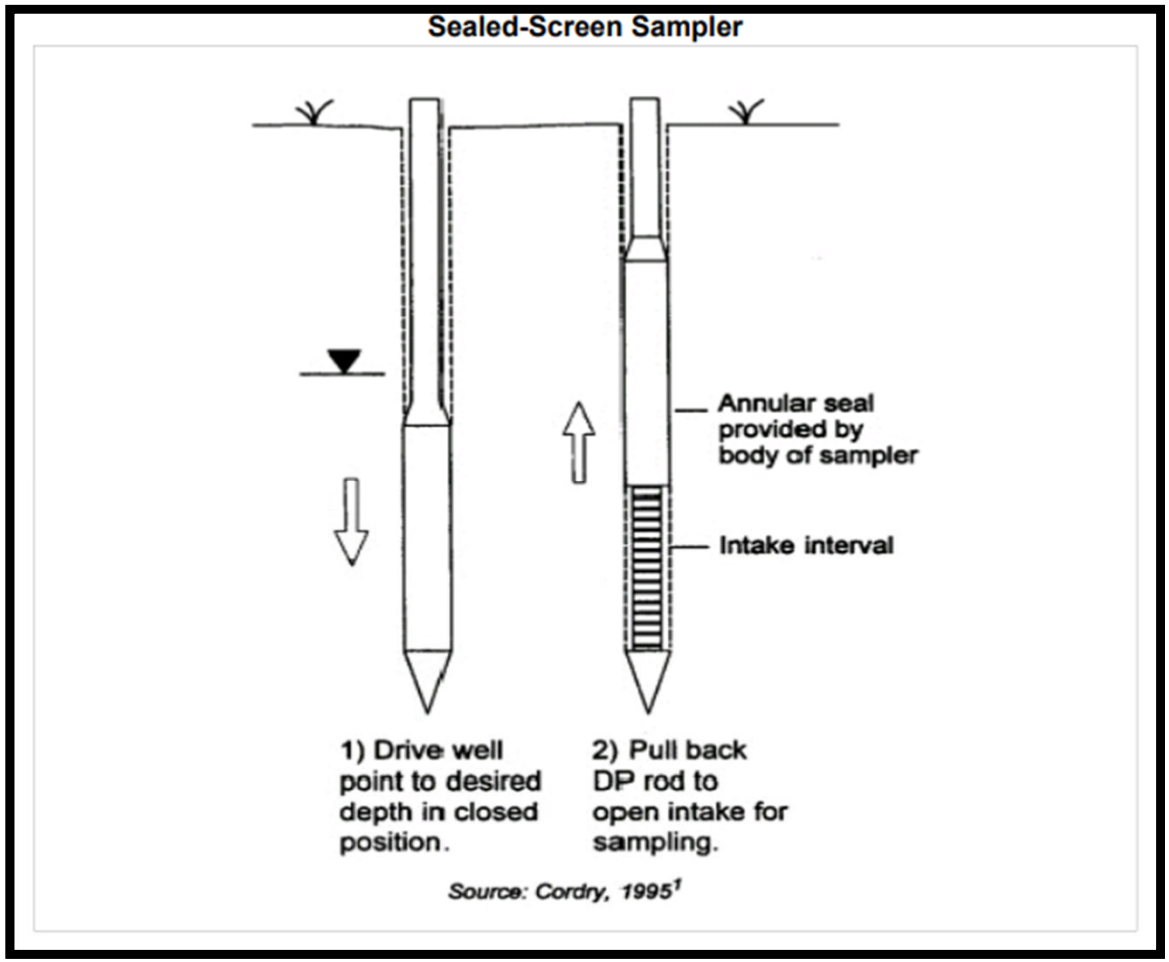


- **Soil samples collected with direct push technology (DPT) drill rig**
  - Samples collected at various intervals in boring
  - Used to delineate source area vertically and horizontally
- **Groundwater grab samples collected at saturated zone concurrent with soil boring**
  - Provides a snapshot of groundwater concentrations to help identify permanent well locations

Robins AFB Remedial Investigation

Vertical Aquifer Sampling (VAS)

- Boring is advanced to desired depth
- Groundwater grab sample is collected using specialized sampling equipment
- Boring is continued to next depth; process is repeated
- Provides a vertical picture of groundwater contamination



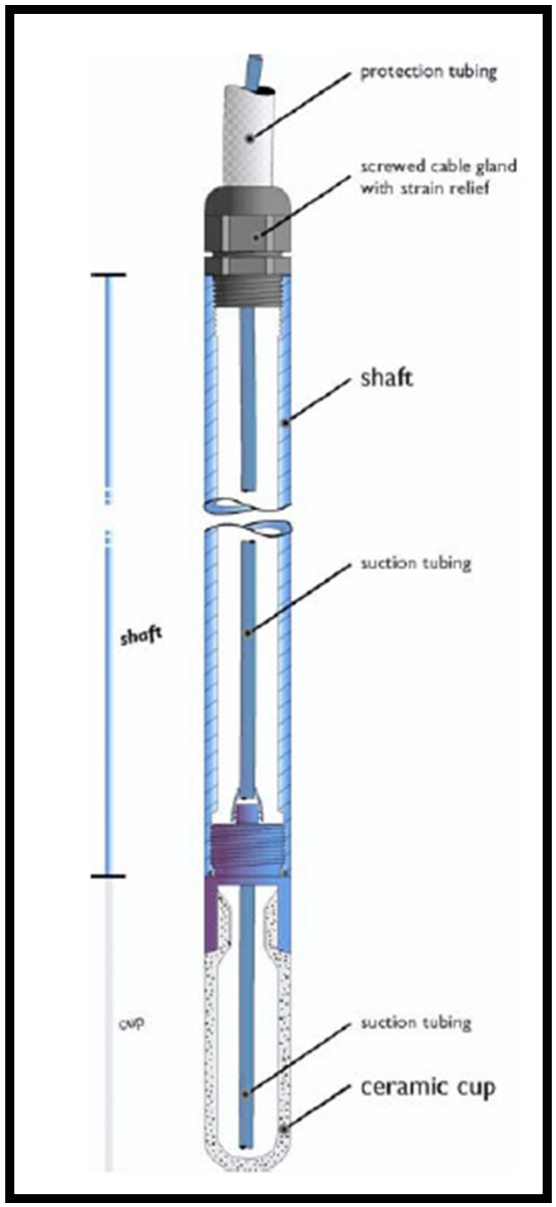
Robins AFB Remedial Investigation

Monitoring Well Installation and Sampling

- Preliminary data from groundwater grab and VAS sampling will be used to determine final monitoring well placement
- Provide delineation horizontally and vertically at each site
- Groundwater sampling completed at existing and new wells

Robins AFB Remedial Investigation

Lysimeter Sampling

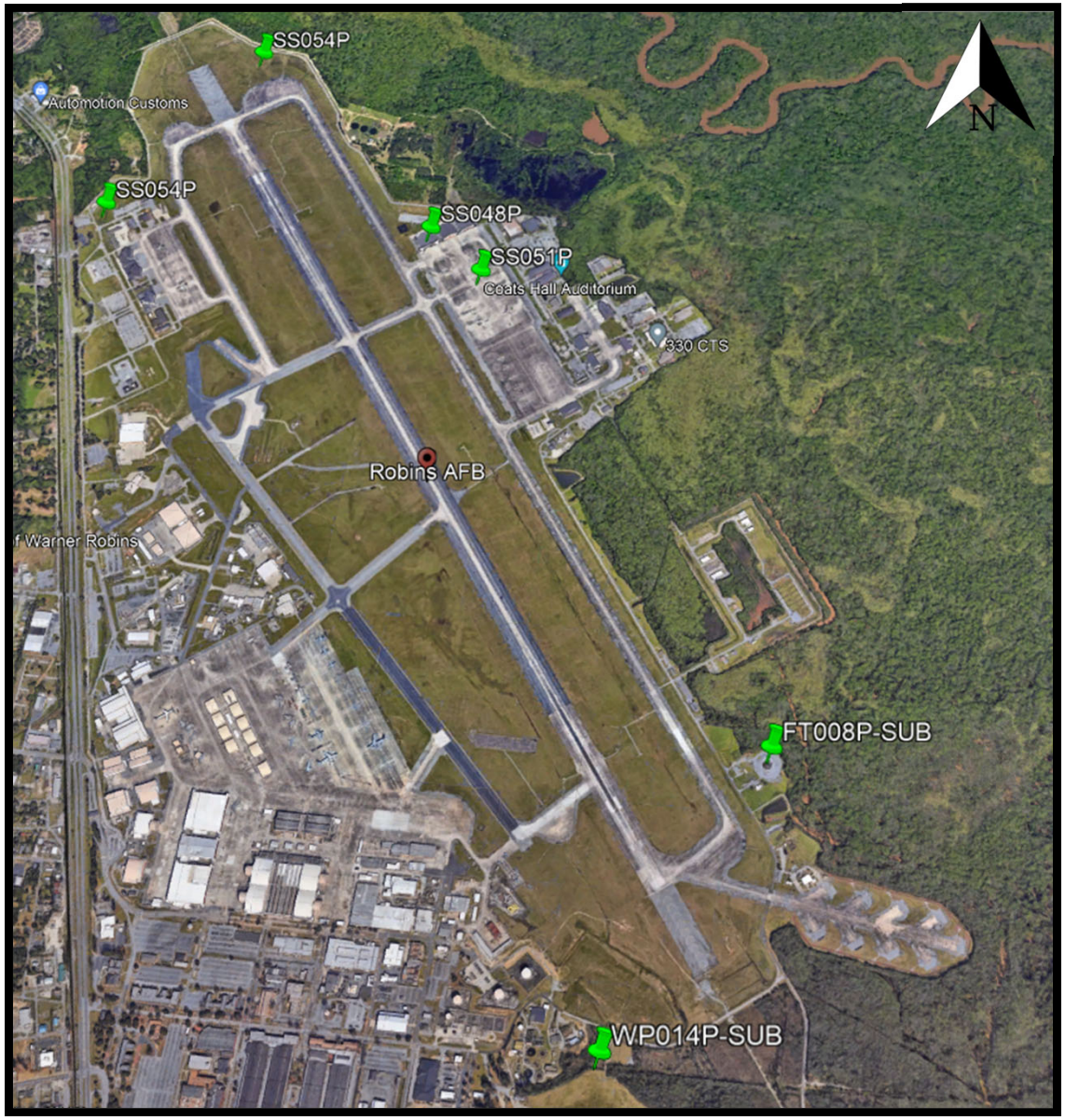


- Used to evaluate potential for PFAS in soil to leach to groundwater
- Lysimeters collect water unbound or free moving water in pores of soil (also called pore water sampling)
- Operate on principle of suction or tension
- A porous device such as ceramic or porous fabric is installed into soil at required depth of measurement
- A tube, connected to this media, runs to soil surface
  - Suction is placed on tube moving water through soil pores and into lysimeter where it is stored for collection

Robins AFB Remedial Investigation

Surface Water and Sediment Sampling

- One means of transport for PFAS contaminants is through stormwater conveyances
- These conveyances typically discharge offsite to creeks/streams/etc.
- Sampling will be conducted of surface water and sediment at these locations to identify any impact to these areas



Robins AFB Remedial Investigation
Timeline

- Contract Award – August 2022
- Planning Documents/Review – March 2023
- Field Preparations – May 2023
- Field Work/Data Collection – September 2023 to August 2025
- Report Preparation – August 2025

Information Sources

For more information, visit:

AFCEC
www.afcec.af.mil/
http://www.afcec.af.mil/WhatWeDo/Environment/Perfluorinated-Compounds

EPA
www.epa.gov/
https://www.epa.gov/pfas/our-current-understanding-human-health-and-environmental-risks-pfas

Agency for Toxic Substances and Disease Registry
www.atsdr.cdc.gov/

Interstate Technology & Regulatory Council
https://pfas-1.itrcweb.org/fact-sheets/

New Business
and
Program Closing

Dr. Linda Smyth
EAB Community Co-chair

Recent Awards

- **General Thomas D. White Award**
  - **Awards established to honor General Thomas D. White, the Air Force Chief of Staff from 1957 to 1961**
  - **General White charted course for Air Force environmental programs**
  - **Awards recognize efforts of installations, teams, and individuals for environmental quality, restoration, pollution prevention, recycling, and conservation of natural and cultural resources**

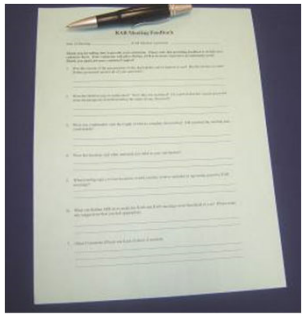
Robins AFB – 78th Civil Engineer Group:
Best Industrial Environmental Quality Program in the Air Force!

Next EAB Meeting

Thursday, August 3, 2023

Please…

Complete the meeting evaluation and feedback form and return to sign-in table or leave at seat



Leave your name tag at the sign-in table or seat for the next meeting

Thank you!