

# UNRAVELING PFAS SOURCES AND TRANSPORT PATHWAYS AT A FORMER MILITARY SITE IN ALASKA

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## **Background/Objectives:**

This study investigates the presence and variability of per- and polyfluoroalkyl substances (PFAS) in soil, sediment, surface water, and groundwater at a remote former military installation located along the Yukon River in interior Alaska. The site's remoteness and lack of regional industrial activity suggest that background PFAS contributions from non-military sources are minimal. However, the site presents significant complexity due to its multiple potential PFAS releases and overlapping source contributions. Adding to the complexity, groundwater flow at the site is strongly influenced by the adjacent Yukon River and exhibits a seasonal reversal in flow direction due to the river's freeze-thaw cycle, further complicating PFAS transport pathways.

The remedial investigations focuses on four aqueous film-forming foam (AFFF) release areas that include:

- A former fire protection training area, used for over four decades
- A former fire station where emergency vehicles were maintained and washed, and a 150-gallon AFFF storage tank was stored, later moved, emptied, and demolished
- A second former fire station where AFFF was stored in drums and released during a flood
- A sanitary sewer outfall, which likely received wastewater containing both AFFF-related and non-AFFF PFAS sources.

The primary objective of this study is to improve understanding of the PFAS sources and their subsequent transport across the site by analyzing the variability and distribution of PFAS in soils, subsurface soils, sediment, groundwater, and surface water.

## **Approach/Activities:**

Samples of surface soil, subsurface soil, sediment, groundwater, and surface water samples were collected during remedial investigations. The remedial investigations included sampling and analyses of over 100 surface (0 to 2 feet below ground surface) soil locations, over 100 subsurface soil boring locations, 11 surface water samples, and over 100 groundwater monitoring wells.

## **Results/Lessons Learned:**

Radar plots of PFAS detected in groundwater, combined with statistical evaluations of PFAS concentrations and distributions across all media, allowed the following important observations:

- PFAS detected in samples collected near and downgradient of the fire protection training area were consistent with AFFF use and indicative of multiple formulations of AFFF.
- Similar evidence of multiple AFFF formulations were observed at the former fire stations.
- A separate groundwater plume down- and cross-gradient of the fire protection training area appeared consistent with the location of a potential AFFF release from a reported civilian crash site. However, the presence of both fluorotelomer sulfonic acid and perfluorooctane sulfonic acid are inconsistent with a one-time use of AFFF.
- N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) was found in limited soil samples collected from the two former fire stations (8% and 36%) but was present in 72% of the surface soils and 100% of the surface water samples collected at the sanitary sewer system outfall. The source of NMeFOSAA is likely related to the wastewater treatment system discharge.

- Short chain perfluoroalkyl carboxylic acids and perfluoroalkyl sulfonic acids found in background groundwater wells are typical of AFFF or environmental degradation products of precursors.

These insights will help unravel the contributions of distinct release areas and inform remedial strategies for this complex site.

### **About The Author**

Dr. Jennifer Benning is currently a senior project engineer at Parsons, where she is working on PFAS investigations with DoD clients. She holds a B.S. in Civil and Environmental Engineering from Rutgers University, an M.S. in Environmental Engineering from Virginia Tech, and a Ph.D. in Environmental Engineering from University of Alaska Fairbanks. She was formerly an Associate Professor at South Dakota School of Mines and Technology, where she developed and managed a minor degree program in Sustainable Engineering, and an Instructor at Virginia Tech. Her CV includes extensive peer-reviewed manuscripts and 50+ conference presentations on various environmental and sustainability topics, including environmental design, life cycle analyses, indoor air quality, subsurface contaminant transport, and engineering education.

