

## Observations at a PFAS-Contaminated Site: Variability and Precursor Occurrence

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**Background/Objectives.** Poly and perfluorinated alkyl substances (PFAS) are increasingly measured at sites where aqueous film forming foams (AFFF) were used in fire suppression systems, fire training activities, and responding to crashes. AFFF products contain a variety of chemicals including perfluoroalkyl acids (PFAAs), such as perfluorooctanoic acid (PFOA) and perfluorooctanesulfonate (PFOS), and PFAA precursors, chemicals which may oxidize to form PFAAs. Some of these precursor chemicals are present to create the desired properties of the product while other chemicals are residuals from the manufacturing and formulation process. In 2016, PFAS site characterization was conducted at Joint Base Elmendorf Richardson in Anchorage, Alaska to evaluate the occurrence of PFAS. During these activities, the US Environmental Protection Agency collected replicate water samples at several locations and analyzed them for 18 PFAAs and 12 PFAA precursors. This sampling effort had three objectives: 1, evaluate the analytical method on samples from a new site; 2, evaluate variability in replicate samples; and 3, characterize when PFAA precursors were likely to be present.

**Approach/Activities.** Replicate water samples were collected from 17 groundwater locations and two surface water locations. The samples were shipped to the Chicago Regional Laboratory and analyzed using ASTM Method 7979. In this method, a 5-mL sample was mixed with methanol and isotopically labeled surrogates, filtered, and analyzed by liquid chromatography with tandem mass spectrometry. Quality control samples included: field, equipment, and lab blanks; matrix spikes; reporting limit checks; lab duplicates; spiked blanks; calibration checks, and second source calibration checks.

The analytical method was evaluated based on quality control acceptance criteria such as lab duplicates and matrix spikes. Several novel approaches were explored to evaluate sample heterogeneity and precursor occurrence using probabilistic graphical models, or Bayesian networks, and principal component analysis. Variables that represent site-related factors, analytical factors, and sampling characteristics were included in this interpretation.

**Results/Lessons Learned.** Many PFAAs were observed including: PFOA, PFOS, perfluorinated butyl sulfonate, perfluorobutanoate, perfluoropentanoate, perfluorohexanoate, perfluoroheptanoate, perfluoro-1-pentanesulfonate, and perfluorohexyl sulfonate. The most commonly observed PFAA precursors were 6:2 fluorotelomer sulfonate (FTS), perfluoro-1-octanesulfonamide, and 8:2 FTS. Preliminary data interpretation shows that the analytical method was adequate for analysis of these samples. Data interpretation to evaluate heterogeneity and precursor observations is continuing.