Detailed Site Investigation of Unsaturated and Saturated Zones of a Fire Training Area for Per-and Polyfluoroalkyl Substances (PFASs) Using Advanced Analytical Tools

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Background/Objectives. A preliminary assessment of a fire training area determined that part per billion concentrations of per- and polyfluoroalkyl substances (PFASs) were present in groundwater due to frequent historical applications of aqueous film forming foams (AFFFs). At this location multiple long and short chain perfluoroalkyl acids (PFAAs) and 6:2 fluorotelomer sulfonate are regulated in drinking water. Thus, the distribution of AFFF-derived PFAA precursors that may form 6:2 fluorotelomer sulfonate and PFAAs are considered of significant importance at this site. The objectives of the secondary, more detailed site investigation were to characterize the fire training area to determine the distribution of both PFAAs and PFAA precursors in soil and groundwater in relation to biogeochemical parameters, lithology and co-contaminant distribution. In order to develop a more robust site conceptual model, further objectives were to determine if the presence of co-contaminants such as total petroleum hydrocarbons (TPH) enhanced PFAA precursor sorption and to determine the extent to which redox conditions have influenced PFAA precursor transformation.

Approach/Activities. Groundwater and soil samples were characterized for PFASs using a targeted analyte list as well as the total oxidizable precursor assay (TOPA) and adsorbable organofluorine (AOF) to indirectly measure total PFASs. The PFAS distribution in soils was assessed in relation to total organic carbon, fractionated TPH and particle size distribution. Groundwater was characterized for major anions, including fluoride, cations, total organic carbon, TPH, and biogeochemical parameters. The PFAS distribution was measured in the lithology at multiple horizons to target distinctly different zones such that both migratory and non migratory horizons were assessed for PFAS content.

Results/Lessons Learned. The vertical and horizontal delineation of PFASs at this site will be presented in relation to the site's hydrogeology and lithology. Field derived partitioning coefficients were determined for individual PFASs and total PFAA precursors in relation to TPH. Ratios of PFAA precursor concentrations to PFAAs were determined in different redox zones of the site and, after controlling for mass flux, were used to determine PFAA precursor susceptibility to biotransformation in the presence of multiple types of terminal electron acceptors. Lessons learned on how to selectively utilize advanced characterization tools to provide the most value in determining the location of contaminant mass will be discussed.