Poly and perfluoroalkyl substances (PFAS) source identification and concentration distribution changes with distance using radar chart patterns

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Introduction/background

Characterizing sources of PFAS and their fate and transport in groundwater is increasingly important as regulatory standards are established or lowered. Given multiple sources in the environment, the sheer number of PFAS compounds, changes in manufacturing source composition over time, and varying degrees of mobility between PFAS compounds, PFAS signatures will vary by sources over distance and time.

This poster evaluates spatial variability of PFAS within groundwater plumes using radar plots, an effective graphical tool for assessing and visualizing fate and transport of common contaminants. Radar plots of PFAS concentrations from known/potential source areas are shown over distance from source to assess changes in PFAS concentration distributions.

The authors have previously used radar plots to explore PFAS signatures over time and found, with a few exceptions, stable patterns over time. Figure 1 serves as a key to the nine PFAS compounds represented in the radar plots. Figure 2 shows multiple monitoring rounds with comparable signatures over a 4-year period plotted together.

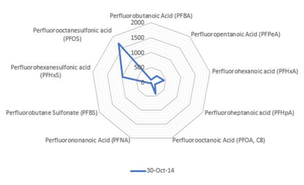

Figure 1

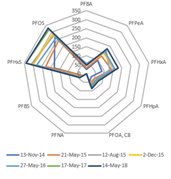

Figure 2

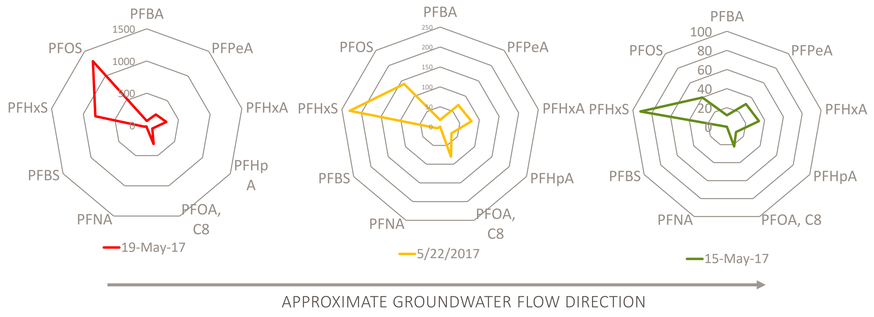

Figure 3 – Site 1 PFAS in glaciofluvial sand aquifer (concentrations in ng/L)

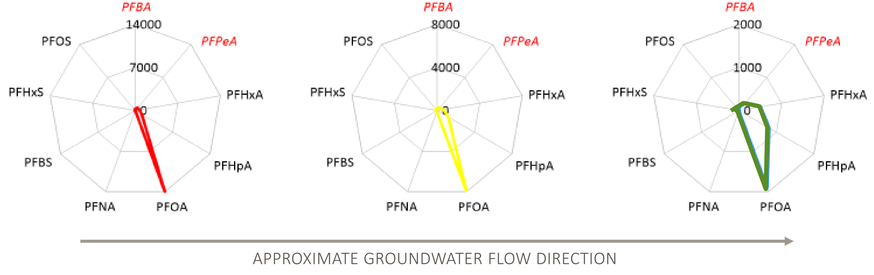

Figure 4 – Site 2 PFAS in glacial till aquifer (concentrations in ng/L (compounds in red not analyzed))

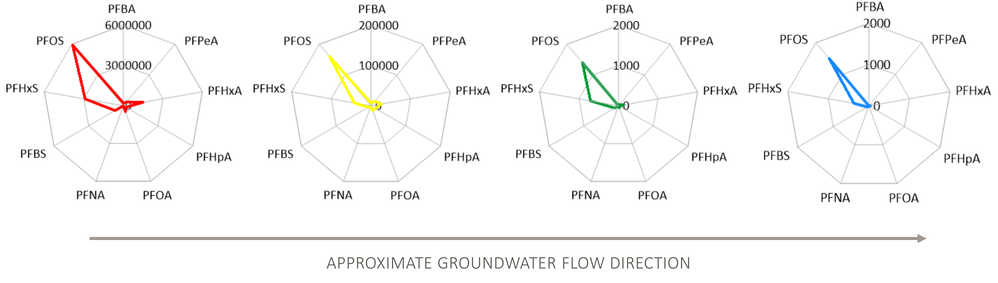

Figure 5 – Site 3 PFAS in interbedded, fine-grained soils overlying karstic carbonate bedrock (concentrations in ng/L)

Methodology

Figures 3 through 5 show radar plots from three sites where releases occurred. PFAS data are plotted, left to right, with increasing distance from the source area.

Results and discussion

In Figures 2 through 5, the radar plots generally demonstrate:

- Consistent PFAS signatures over time.
- Consistent PFAS signatures, with decreasing concentrations, over distance from the source area due to attenuation.
- Attenuation mechanisms that may be altering the signature include increased sorption/retardation of longer-chain PFAS compounds.
- PFAS signatures may also be altered by laboratory reporting limits.

Plume stability, geology, and other site-related physical properties are important to consider when evaluating PFAS signatures

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