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Variable PFC Attenuation Rates across a Discrete Aquifer Horizon below a Former Manufacturing Facility

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Background/Objectives. Fate and transport of mixed perfluorinated compounds (PFC) were evaluated under variable water quality conditions across a discrete aquifer horizon underlying a project site (Site). The intent of the evaluation was to identify the primary parameters promoting substantially different migration rates under similar lithologic conditions. The approximate 700-acre Site in New England is underlain by fill, alluvium, lacustrine silt and clay, and till in the overburden and dolomite, sandstone, and quartzite in the underlying bedrock. The data for this project represent groundwater in the overburden horizon. The Site was engaged in manufacturing of electronic components since at least the 1960s.

Approach/Activities. PFC concentration gradients were evaluated to identify conditions possibly contributing to variability in migration rates of individual PFC compared to groundwater geochemical parameters. The findings indicate that certain geochemical conditions may affect migration/attenuation of PFC. Possible effects of salinity, redox potential, and pH are being evaluated.

Results/Lessons Learned. The data suggest that the major contributing factor in the attenuation process appears to be adsorption / absorption under higher salinity conditions and, potentially, biological or chemical reduction under strongly reducing conditions and elevated pH. The salinity appears to be a function of dissolved divalent cations. The data suggest that decrease of PFC concentrations with distance may be faster with increasing divalent cation concentrations over the same distance.

Contrary to most reported PFC fate and transport results suggesting that chlorinated and/or BTEX plumes are attenuated more efficiently than PFC, the attenuation rate of PFC in a number of the areas of concern underlying the Site is substantially greater than the attenuation rate of both chlorinated solvents and BTEX. The PFC sources that are comingled with chlorinated solvent/BTEX sources makes this site an ideal location to evaluate the specific attenuation processes and the efficiency of the processes on typical PFC components including: PFHpA, PFOA, PFNA, PFBS, PFHxS, and PFOS.

This data evaluation is based upon limited time-sequence data and longer-term monitoring is required to confirm trends and controlling geochemical parameters. We are in the process of collecting data based upon the observed trends.