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PFC Distribution at Three Unique Release Sites and the Implications on Characterization Design

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Background/Objectives. Several perfluorinated compounds (PFCs) have recently been identified in drinking water supply wells at a number of locations in New England above United States Environmental Protection Agency (EPA) guidelines for long-term exposure of 70 parts per trillion (ppt) in drinking water. Characterizing the extent and degree of PFC contamination in various environmental media is made challenging due to the chemical characteristics of PFCs and the need for ppt quantification levels. High solubility, low adsorption coefficients, and resistance to biodegradation allow extensive advective transport of PFCs in groundwater with little attenuation. Differing manufacturing processes using PFCs also result in varying methods for introduction to the environment. Characterization approaches and methods must be designed in consideration of these factors to efficiently and effectively define PFC impacts. Three sites with PFC contaminated drinking water wells having different release methods and differing geologic settings will be reviewed to illustrate the need for unique characterization method design.
The North Bennington, Vermont site released perfluorooctanoic acid (PFOA) via airborne emissions and potentially spills. The geologic setting has thin soils atop a complex bedrock regime utilized by hundreds of individual water well users. The Pownal, Vermont site released PFOA via wastewater and potential spills to a deep sand and gravel aquifer with municipal and residential well users. In Portsmouth, New Hampshire perfluorooctane sulfonate (PFOS) utilized in fire fighting foam at several locations proximal to multiple municipal water supplies pumping from the shallow sand and gravel aquifer.

Approach/Activities. Hundreds of shallow and bedrock aquifer drinking water supply, surficial soil, surface water, wastewater sludge, and fish samples have been analyzed at these sites. We have utilized these extensive data sets and georeferenced mapping to produce comprehensive contaminant distribution maps. Utilizing the contaminant databases, geologic mapping information and knowledge of PFC interaction with environmental media, we have developed conceptual models for the release and distribution of PFCs at these sites.

Results/Lessons Learned. The persistence of PFCs in the natural environment can lead to contaminant distribution which is not predicted using typical conceptual modelling methods. The release methods, geologic conditions and aquifer uses result in confounding and overlapping PFC transport scenarios. The historic use of the aquifers at these sites has resulted in redistribution of PFCs in areas which are not easily predicted using standard conceptual site model methods. Redistribution methods identified include, discharge of PFC wastewater to individual on-site leachfields, wastewater sludge and agricultural manure spreading on farm fields, and aquifer pump testing. PFC characterization plans must be designed considering potential redistribution of impacted media.

Geophysical well logging, and comprehensive source release data will be available by May. This will provide additional instructive data for the distribution maps and conceptual models.