The Role of Surface Water and Stormwater Transport of Perfluoroalkyl Substances (PFAS) in the Creation of a Groundwater "Mega-Plume", Washington County, Minnesota

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Background/Objectives. Since 2004, the Minnesota Department of Health (MDH) and Minnesota Pollution Control Agency (MPCA) have been investigating perfluoralky substance (PFAS) contamination at a manufacturing facility and its three main disposal sites in Washington County, Minnesota, in suburban and exurban communities east of the Minneapolis-St. Paul metropolitan area. The commingled plumes emerging from these sites created a "mega-plume" that affects the groundwater in an area over 130 square miles, contaminating eight municipal drinking water supplies and over 2,000 private wells. Early investigations focused on groundwater transport and the influence of bedrock structures, but these alone cannot account for the full extent of contamination observed, the distribution of individual PFAS compounds (especially perfluoroctane sulfonate, PFOS, and perfluorooctanoate, PFOA), and the presence of areas of elevated PFAS apparently "disconnected" from the groundwater plume. PFOS contaminant transport in particular appeared to be related in some way to a local stream. This led MDH and MPCA to sample surface waters in the area, the results of which helped guide the private well sampling program and ensure that all affected drinking water wells are identified.

Approach/Activities. Evaluation of the chemical signature of the mixture of PFAS compounds in the source areas and their relative distribution in the groundwater helped to provide early identification of Raleigh Creek as a major surface water pathway for the transport of PFAS beyond areas predicted by early groundwater modeling. Investigations into the history of local stormwater management projects also revealed pathways by which PFAS were transported across a groundwater divide and into additional surface water bodies that make up a drainage system that ultimately discharges to the St. Croix River, on the eastern border of Minnesota. Sampling of lakes, ponds, ditches, and other elements of this drainage system identified PFAS concentrations above state drinking water guidance values and led to expanded sampling of private drinking water wells nearby.

Results/Lessons Learned. The well sampling confirmed that infiltration along the course of the surface water / stormwater drainage system is acting as a "linear" source of groundwater contamination. As a result, hundreds of additional drinking water advisories have been issued to residents in the affected communities and drinking water treatment systems have been installed to remove the PFAS. Well sampling continues at the time of abstract submission as MDH and MPCA continue to try to define the full extent of the contaminated area.

The results to date highlight the importance of evaluating the potential for surface water and/or stormwater transport of PFAS. These may create groundwater recharge "sources" that appear to be disconnected from the original PFAS release site(s). Analysis of PFAS chemical signatures may also provide a useful tool for distinguishing sources, but must be viewed in the context of possible changes in source area inputs over time and the possible partitioning of various PFAS along the transport pathways.