

PFNA-Dominated Groundwater Contamination Associated with AFFF Use and Manufacturing

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Background/Objectives. Numerous studies have been conducted at sites where aqueous film-forming foam (AFFF) has been used during fire training and in emergency responses. However, nearly all of these studies have occurred at U.S. Department of Defense sites where foams used met the Military Specifications (MILSPEC). Groundwater at sites where MILSPEC foams were used are often dominated by perfluorooctane sulfonic acid (PFOS) and/or perfluorooctanoic acid (PFOA). As more is learned about AFFF manufacturing and use, sites where soil or groundwater contamination is dominated by perfluorononanoic acid (PFNA) are being identified. A gap currently exists in the scientific literature regarding the existence of these PFNA-dominated sites, the full breadth and variety of AFFF formulations over time, and the existence of AFFF that leads to PFNA-dominated groundwater contamination downgradient of release areas. However, a number of sites have been identified that tie AFFF use to PFNA-dominated groundwater.

Approach/Activities. Data collected during site investigation activities at a former refinery site, a fire station, an AFFF manufacturing site, and an area where AFFF training occurred highlight the existence of AFFF where PFNA is the dominant per- and polyfluoroalkyl substance (PFAS) detected in groundwater. As part of a site investigation in the greater Fairbanks, Alaska, area, data were collected from potable wells, monitoring wells, and surface water bodies and used to delineate the extent of PFAS in groundwater. The resulting data set identified a PFAS plume where elevated concentrations of PFNA are present both on a former refinery property and at a nearby fire station. Further investigation identified specific brands of AFFF that had been used at the refinery. Review of site investigation reports from one of the brand's manufacturing facilities identified historical PFNA groundwater at concentrations greater than 85,000 ng/L, and in present-day downstream surface water at concentrations greater than 1,000 ng/L. Additional sites where this brand of AFFF has been used have also been identified. Results of recent sampling of AFFF by other researchers has also confirmed the existence of PFNA-dominant AFFF formulations.

Results/Lessons Learned. The presence of PFNA-dominated groundwater contamination at a number of sites highlights a shortcoming in the current scientific literature. Many of the detailed analyses of AFFF have been conducted on foams manufactured after 2000, when products were being reformulated to shorter-chain chemistries. There has been limited study of non-MILSPEC foams manufactured from the 1960s through the 2000s even though much of the AFFF from this era has been used in training or fire responses. A more complete view of the range of legacy AFFF formulations is emerging as more samples of older formulations of AFFF are analyzed and more site data become available.