Abstracts

Wednesday, April 30

Session I4: Contaminants of Emerging Concern: Perfluorinated Compounds (PFCs)

3:30 – 5:00 pm | Room 237

Occurrence of Perfluorinated Compounds in New Jersey Public Water Supplies

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Abstract
Perfluorinated chemicals (PFCs), a group of anthropogenic chemicals with many commercial and industrial applications, are of interest as emerging drinking water contaminants because of their frequent detection in surface and ground water sources of drinking water, extreme environmental persistence, and potential health effects. Several PFCs have human half-lives of several years and are detected ubiquitously in human serum; drinking water is an important human exposure source. PFCsare currently unregulated in water, and nationwide drinking water monitoring for 6 PFCs required by USEPA is currently underway. To our knowledge, New Jersey is the first state to have conducted statewide monitoring for PFCs. In 60 NJ public water supplies (PWS) tested in 2005-13, perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) were found in 60% and 43%, respectively, at up to 280 ng/L and 48 ng/L, respectively. Raw water from 31 of these PWS was also monitored for eight additional PFCs. Between one and eight PFCs were detected (>5 ng/L) in raw water from 74% of these PWS, at totals of 5-330 ng/L. Although PFOA was the most commonly detected PFC and was found at the highest maximum concentration, some of the higher levels of other PFCs were at sites with little or no PFOA. PFNA was detected more frequently (35%) and at higher concentrations (up to 96 ng/L) than in drinking water studies from other locations; PFNA was often the sole or predominant PFC, a pattern not reported elsewhere. PFOS, perfluoropentanoic acid (PFPeA), and perfluorohexanoic acid (PFHxA) were each detected in more than 20% of samples, while perfluoroheptanoic acid (PFHpA), perfluorobutane sulfonic acid (PFBS), and perfluorohexane sulfonic acid (PFHxS) were detected less frequently. Perfluorobutanoic acid (PFBA) was found only once (6 ng/L), and perfluorodecanoic acid (PFDA) was not detected. Possible sources of PFCs were identified at some PWS but are unknown for others. Total PFCs were not associated with percent developed land use near the monitoring sites. These results show that multiple PFCs are commonly found in raw water from NJ PWS. Future work is needed to develop approaches for assessing risks from mixtures of PFCs found in drinking water.

Presence of Perfluorinated Compounds in Source and Treated Drinking Waters from 25 Drinking Water Treatment Plants in the United States

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Abstract
The USEPA and USGS conducted a national study sampling source and treated water from 25 drinking water treatment plants (DWTPs) in the US for the detection of over 200 contaminants of emerging concern (CECs). The source waters from these facilities included aquifers, reservoirs, and rivers. Seventeen perfluorinated compounds (PFCs) were analyzed in both source and treated water by the current method developed by the USEPA Environmental Chemistry Laboratory using LC/MS/MS detection. At least one PFC was detected at all sampling locations. Based upon the mean concentration in both source and treated water from the 25 sites, the most abundant PFCs in descending order were: PFPeA > PFOA > PFBA > PFHpA > PFHxA > PFOS > PFHxS > PFNA = PFDA = PFBS > PFUnDA > PFDoDA; and upon detection frequency, the most prevalent PFCs in descending order were: PFHxA > PFBS > PFBA = PFPeA = PFHpA > PFNA > PFHxS > PFOS > PFOA > PFDA > PFUnDA > PFDoDA. Five PFCs were

never detected: PFTrDA, PFTeDA, PFHxDA, PFOcDA, and PFDS. The highest individual level of detected PFCs (ng/L: ppt) were: PFPeA (510), PFHpA (180), PFOA (110), PFBA (100), PFHxA (60), PFOS (50), PFHxS (50), PFNA (40), and PFDA (30). The concentrations of individual PFCs in treated waters were similar to their source waters at all sites tested but one. At that site, powdered and granular activated carbon (PAC and GAC) was used, and the PFCs detected were measurably reduced: PFHpA, PFOA, PFNA, PFDA, PFUnDA, PFHxS, and PFOS (>96%), PFHxA (75%), PFPeA (40%), and PFBA (20%). This DWTP had the highest amount of GAC, with the longest reportable empty bed contact time (EBCT), and the shortest activated carbon replacement time. Six other DWTPs used PAC, and eleven other DWTPs used GAC. In most cases, the levels of PFCs were not affected by the more commonly used drinking water treatment processes. While this study was designed to provide important baseline information on CECs in source and treated drinking waters, it was not designed to be representative of all such sources and drinking waters throughout the United States.

PFC Contamination at the Former Wurtsmith Air Force Base; Extent, Sources, Fish Uptake, Human Exposure, Fate and Transport

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Abstract
Perfluoroalkyl Chemical (PFC) contamination in the environment, food supplies, and human populations is raising concern around the world. Recent epidemiological studies of various human populations have increased alarm that PFCs are causing population-wide adverse health effects at background levels in the general population. The State of Michigan, in cooperation with the United States Air Force, has been investigating widespread PFC contamination at the former Wurtsmith Air Force Base in Oscoda, Michigan associated with historical use of Aqueous Fire Fighting Foam (AFFF). Although AFFF was only released in a relatively small area, contamination is now widespread suggesting that there are numerous other sources of PFC contamination at the base. Approximately 4.6 square miles of aquifer, 9.4 miles of the Au Sable River, two square miles of swamp, and three miles of Van Etten Lake shoreline are impacted. All surface water samples and fish tissue samples downgradient of the site are impacted, to varying degrees, with PFCs.

Fish tissue contaminant levels are some of the highest recorded in the literature. Maximum fish tissue levels of PFOS, PFOA and PFOSA have been measured at 73,200 ppb, 8.52 ppb, and 182 ppb respectively. Sufficient data has been collected to develop preliminary site conceptual models, tracing contaminant fate and transport, likely source identification, treatment effectiveness, fish uptake, and pathways to human receptors.

The data and analysis generated at the former Wurtsmith Air Force Base is valuable for anyone addressing PFC contamination at military bases, urban areas, and airports.