Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.28626

Distribution and fate of per- and polyfluorinated alkyl substances (PFAS) across a salinity gradient in a coastal urban river

MICHELLE M LORAH[1], ADAM C MUMFORD[1], EMILY H. MAJCHER[2], ANDREA K TOKRANOV[3], ZACHARY HOPKINS[2], ANNA MCCLAIN[2], TYLER BOWSER[2], EMILY O'DONNELL[2], SINDY MEJIA[2] AND DENISE M. AKOB[3]

[1]US Geological Survey, MD-DE-DC Water Science Center
[2]US Geological Survey
[3]U.S. Geological Survey

Potential sources of per- and polyfluorinated alkyl substances (PFAS) can be densely spaced in coastal urban estuaries from a myriad of industrial uses, waste treatment and disposal, and military facilities. PFAS distribution and composition in estuaries can be complicated by salinity variations that affect physical and biogeochemical fate processes. We studied the PFAS distribution in surface water, porewater, and bottom sediment across a salinity gradient in the urbanized lower Delaware Estuary, collecting samples from 12 sites in a one-day event across a 21-kilometer distance.

Chloride concentrations decreased from 2,000 to 45 milligrams per liter moving upriver. Consistent chloride concentrations in shallow and deep surface-water samples and the porewater indicated well-mixed conditions. PFAS concentrations decreased upriver in all matrices as chloride decreased. In the bottom sediment and porewater, total concentrations of PFAS and the number of compounds observed were greatest across the two sites where the steepest change in chloride occurred. Total PFAS concentrations in the sediment were as high as 8.4 nanograms per gram (ng/g) with 18 compounds detected but decreased to less than 0.3 ng/g with 3 or 4 compounds detected. The maximum total PFAS concentration in the porewater of 180 nanograms per liter (ng/L) coincided with the maximum sediment concentration, but only 8 compounds were detected. The PFAS distribution indicated greater sediment partitioning with high salinity, whereas organic carbon content, protein content, and grain size did not show a relation. A steadier decline in PFAS concentrations was observed in the surface water, from 48 ng/L to 13 ng/L across the 12 sites, with the same 4 compounds dominant. Perfluorinated carboxylates were dominant in all matrices with lower carbon chain compounds indicative of transformations present in all samples. Perfluorooctane sulfonate was dominant in porewater and surface water but was only observed in the sediment where chloride was high. The sediment and porewater could act as sources of PFAS to the surface water, which is used as a drinking water source in the upper estuary, and to groundwater where tidal pumping affects flow. Ongoing studies are exploring the role of microbial transformations in the PFAS distribution and bioavailability.