

High organofluorine concentration in municipal wastewater affect downstream drinking water supplies for millions of Americans

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Wastewater receives per- and polyfluoroalkyl substances (PFAS) from diverse consumer and industrial sources, and discharges are known to be a concern for downstream drinking water quality. The PFAS family includes thousands of potential chemical structures. Exposures to a few well-studied PFAS, mainly perfluoroalkyl acids (PFAs), have been associated with increased risk of many adverse health outcomes, prompting United States (USA) drinking water regulations for six compounds in 2024. Here, we find that the six regulated PFAS (mean = 7 to 8%) and 18 measured PFAA (mean = 11 to 21%) make up only a small fraction of the extractable organofluorine (EOF) in influent and effluent from eight large municipal wastewater treatment facilities across the USA. Most of the EOF in influent (75%) and effluent (62%) consists of mono- (-CF) and polyfluorinated (-CF₂- or -CF₃) pharmaceuticals. The treatment technologies and sizes of the treatment facilities in this study are similar to those serving 70% of the USA population. Despite advanced treatment technologies, the maximum EOF removal efficiency among facilities in this work was <25%. Extrapolating our measurements to other large facilities across the USA results in a nationwide EOF discharge estimate of 1.0 to 2.8 million moles F y⁻¹, which agrees with our estimate of the amount of organofluorine in prescription medications (1.9 million moles F y⁻¹). Using a national model that simulates connections between wastewater discharges and downstream drinking water intakes, we estimate that the sources of drinking water for 1% of utilities serving 15 million Americans could be contaminated above regulatory thresholds by wastewater-derived PFAS under average hydrological conditions. Drought conditions that represent the future climate increase the impact of wastewater-derived PFAS to 23 million Americans. These results emphasize the importance of further curbing ongoing PFAS sources and additional evaluations of the fate and toxicity of fluorinated pharmaceuticals.