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An Assessment of the Global PFAS Burden to Our Waters

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Per- and polyfluoroalkyl substances (PFAS) have been used extensively in a range of consumer and industrial products since the 1950s, including in fire-fighting foam, given their exceptional interfacial properties and stability. However, concerns related to PFAS (eco)toxicity have only become widely known in the last 25 years. Passage of PFAS regulations and advisories has now proceeded at a much quicker rate than for many groups of anthropogenic chemicals, with the breadth of PFAS subject to regulation continually increasing and deemed acceptable levels continually decreasing. Here, we summarize global surface and groundwater PFAS data ($n > 45,000$) to quantify the extent to which PFAS water concentrations exceed drinking water advisories and regulations globally (e.g., European Union Directive 2020/2184, US EPA, Health Canada) as well as in the context of the Stockholm Convention for the protection of human health and the environment from persistent organic pollutants. For example, our analysis suggests that 32% and 16% of sampled groundwater and surface water exceed the threshold of 1.0 for the unitless US PFAS hazard index for drinking water, respectively, when there is no known source of PFAS contamination, with the rate of exceedance increasing when there is a known source. The extent of exceedances for other jurisdictions will be discussed. Further, analysis of PFAS embodied in consumer products suggests that typical methods used to quantify PFAS in surface and groundwater likely underestimate total PFAS concentration. Given this the future environmental burden posed by PFAS is likely underestimated.