PFAS Ban Under the Stockholm Convention: A Planetary Governance Analysis

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I. Introduction

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS), also known as “forever chemicals” have long polluted the earth. They are found in soil, humans, water, and wildlife. Despite decades of scientific evidence documenting their harm, the existing regulatory systems struggle to deliver the protection needed at a planetary scale. This paper approaches PFAS as a planetary health law case study with a focus on the listing of PFOS under Annex B of the Stockholm Convention and proposes reforms within existing institutions to address the enduring structural gaps.

3M, one of the earliest and largest manufacturers of PFOS, began producing fluorochemicals for consumer products like Scotchgard (a fabric protector) and Scotchban (a food packaging coating). Company concerns surfaced in the late 1990s, when Kris Hansen (3M chemist) led an internal investigation and discovered PFOS in the blood of factory workers (who had no known occupational hazardous exposure). Findings also showed PFAS in the blood of the general population. Prior studies showed equally concerning findings but were concealed by the company. Over the years, it became clear that PFAS was carcinogenic and able to be passed intergenerationally. At the time, EPA had recently mandated companies to report safety information on their products, obliging 3M to release their findings and publicly announce phasing out PFOS from their Scotchgard and Scotchban products (1). The issue later gained enough international attention to be listed in the Annex B list of the Stockholm Convention in 2009. While this event marked a significant milestone, the existing regulatory system continues to fall short in addressing PFAS contamination around the world.

II. Background

What is PFAS?

PFAS made its breakthrough in the 1950s in the US industry for its chemically stable properties allowing them to be non-stick, waterproof, grease proof, and resistance to breakdown. PFAS is an umbrella term for a class of over 15,000 synthetic chemical compounds characterized by chains of carbon atoms bound to fluorine. This carbon-fluorine bond is known to be one of the strongest in organic chemistry, making it highly persistent and harmful. This stability is what keeps environmental conditions and chemical reactions from breaking it down, hence the name “forever chemicals” (2). Their resistance is appealing for commercial industries including textiles, food packaging, firefighting foam, semiconductors, and cookware.

These compounds vary in their chain length and structure, and behavior (in the body or in the environment). Long chain compounds like PFOS and PFOA have been studied extensively and are associated with the greatest health risks. As a means for remediation, short chain compounds were developed, assuming to be safer, but subsequent studies show that they are equally toxic or more toxic than long chain PFAS (3,4)). This represents a common technique manufacturing companies use to bypass PFOS and PFOA bans. Because of the numerous types of PFAS,

substituting a restricted compound with another (not yet banned) becomes a straightforward workaround.

How is PFAS a Planetary Health Problem?

The planetary health threat of PFAS can be analyzed through assessing human and animal health risks while looking through the planetary boundaries' lens. The health risks associated with PFAS are that they are linked to various cancers such as liver, kidney, prostate, and testicular. Exposure also causes decreased immune response to infection and may even hinder protective effects of vaccines (5). PFAS has the capability to act as an endocrine disruptor by mimicking hormones like estrogen which usually binds to a receptor that functions to produce bodily responses, creating disruptive hormonal activity. In neonates, low birthweight risk is observed along with developmental delays and accelerated puberty (2). Decreased fertility is a growing concern globally. According to a growing body of research, male sperm has decreased around the world by 50% (6). Overall, PFAS is bioaccumulative and can be passed intergenerationally.

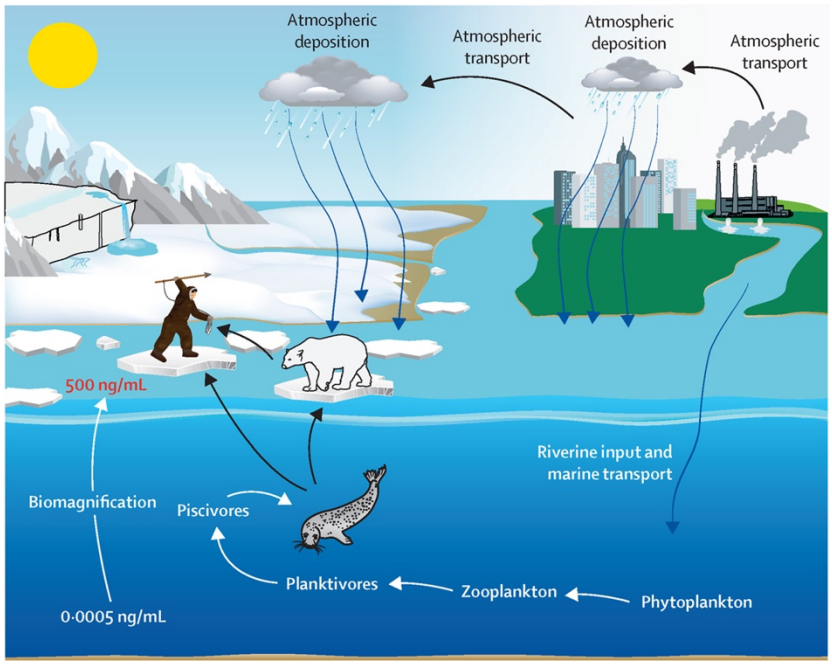


Figure 1. Fate and transport of PFAS through atmospheric deposition, riverine input, and marine transport, illustrating biomagnification from phytoplankton (0.0005 ng/mL) to human hunters (500 ng/mL). Source: Sonne C, Desforges JP, Gustavson K, Bossi R, Bonefeld-Jørgensen EC, Long M, Rigét FF, Dietz R. Assessment of exposure to perfluorinated industrial substances and risk of immune suppression in Greenland and its global context: a mixed-methods study. *Lancet Planet Health.* 2023;7:e570–e579. doi:10.1016/S2542-5196(23)00106-7

PFAS Bioaccumulation is best understood in its fate and transport. Fate and transport is a toxicological term used to describe how toxicants move through our environment. As illustrated in Figure 1, PFAS circulates through air, condenses, then becomes rainfall, distributing PFAS across land and ocean before evaporating and becoming air again. This cycle highlights the biomagnification of PFAS and how it exists at the lowest level (phytoplankton) to the highest level (whale). The greater the mammal the more PFAS it is likely to contain. Humans who

consume these mammals have a million-fold increased PFAS exposure because of biomagnification (5). Thus, it is evident that no living organism is shielded from PFAS.

When examining through the lens of planetary boundaries, PFAS is considered a novel entity and has exceeded the safe operating space based on its spread. One way to measure the spread is through drinking water. Figure 2 displays the distribution of PFAS contamination in surface and groundwater around the world. While most of the global north appears to carry the greatest burden, surrounding regions showing no detected contamination do not necessarily indicate clean water, in fact, they reflect gaps in monitoring and testing rather than absence of contamination.

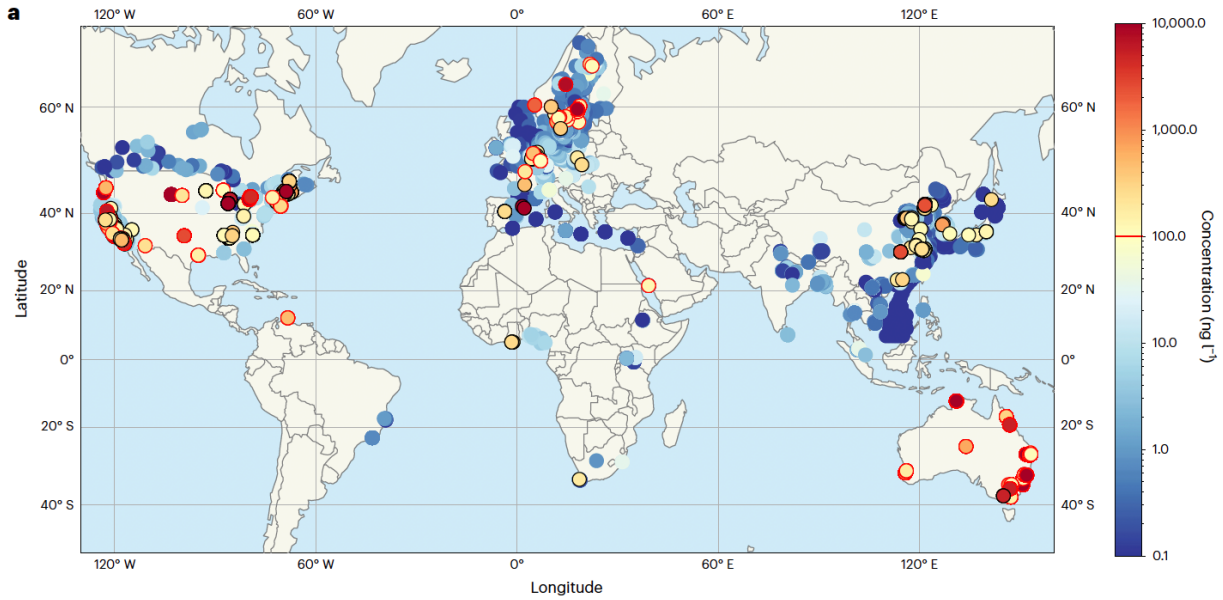


Figure 2. Global PFAS concentrations in surface and groundwater. Source: Ackerman Grunfeld D, et al. Nature Geoscience. 2024;17(4):340–346. doi:10.1038/s41561-024-01402-8

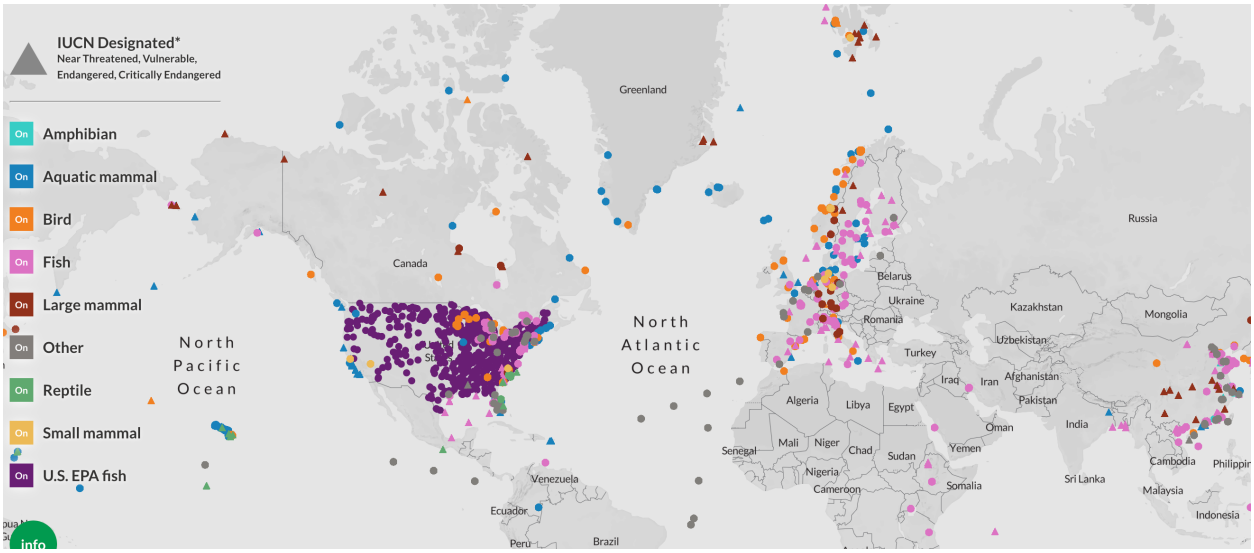


Figure 3. Global distribution of PFAS detection across wildlife species. Triangles denote IUCN-designated threatened species. Source: Environmental Working Group. Global danger: Wildlife at risk from PFAS exposure [Internet]. EWG; 2023 Sep 26 [cited 2026 May 12]. Available from: https://www.ewg.org/interactive-maps/pfas_in_wildlife/map/

As for PFAS in wildlife, Figure 3 illustrates the spread of PFAS among species globally. Forever chemicals have been detected in amphibians, birds, fish, aquatic and large mammals, and reptiles in continents where testing took place. Additionally, several species carry endangered designations, indicating that PFAS exposure intersects with existing biodiversity burdens. Similarly to Figure 2, the density of detections in North America and Europe reflects where testing is most conducted, not where contamination is most severe (7).

III. Legal Infrastructure, Instruments, & Shortcomings:

Stockholm Convention and BRS Framework

The existing legal tools and entities for PFAS regulation operate across multiple levels, including international treaties, as well as regional and national frameworks. The primary entity for PFAS regulation is the Stockholm Convention, which held its first convention in 2001 with the help of the United Nations Environment Programme (UNEP). Prior to the Stockholm Convention, the UNEP worked to address twelve persistent organic pollutants (POPs) and established a temporary committee (known as the International Negotiating Committee (INC)) to process POP assessments and take legally binding action.

The Stockholm Convention was ratified in 2004 after fifty countries submitted their approval. Provisions of the convention include: elimination and restriction of POPs, reduction of environmental release, update chemical databases/lists, support global implementation, and manage waste safely. Once a POP is annexed, it can either be listed under Annex A, B, or C, where A prohibits use and production of a compound, B restricts usage by allowing for specific purposes and if listed under C, countries must reduce and eventually eliminate the compound's release into the environment. It operates as a part of the Basel, Rotterdam, and Stockholm convention (BRS) where Basel convention functions to address POPs through trade while Rotterdam focuses on safe disposal of POPs (9).

The case study timeline exhibits a nine-year period between the time 3M phased out PFOS and when it reached the Stockholm Convention Annex B list. Several factors explain why this is. Firstly, at the time of the phaseout, the Stockholm Convention had not yet been adopted, it was signed in 2001 but did not enter into force until 2004. At that point the listing process demanded rigorous review and international agreement before the Conference of Parties could vote (9). Additionally, safety information was suppressed by companies like 3M to delay public awareness (1). All of these combined with the fact that the US never ratified the convention played a role through weakening political support given that the US is a major player in this realm with lots of power. As a result, there is less contributing force in terms of enforcement and influence (9).

The Stockholm Convention currently uses a chemical-by-chemical technique to assess each individual PFAS compound and treat them separately. As a result, manufacturers are permitted to simply substitute a banned PFAS with one that has not yet been assessed for health risk. Given the multifaceted approach to regulate PFAS, efforts to scale to planetary governance seem promising, but in reality, fall short, and the consequences of this shortcoming are evident at different levels of governance.

National Framework from US Perspective

Scaling down to the national level in the US, the key entity that played a crucial role in banning PFOS was the Environmental Protection Agency (EPA), responsible for developing and enforcing environmental regulations. It enacted the Toxic Substance Control Act (TSCA) mandating companies to report chemical environmental health risks imposed by the chemicals they used and developed under 15 U.S.C. 2615(b). The penalty for failing to do so at the civil level was up to $37,500 per day, with grounds for criminal prosecution for "willful noncompliance" (10). Though these measures instill accountability on companies, there are loopholes manufacturers can use to remain innocent. For instance, companies could fulfill their obligation to report through internal reporting procedures (as 3M did) without reporting to the EPA directly. Such a mechanism permits manufacturers to conceal findings for decades before it reaches the EPA. Based on the ProPublica article, 3M had been aware of the risks of PFOS long before Hansen's investigation. Additionally, when Hansen's findings were disclosed to the EPA, the response yielded voluntary phase out rather than a legal order or ban (1).

Other legal instruments at the national level include the Safe Drinking Water Act (SDWA), and Toxic Release Inventory (TRI). SDWA sets safe federal limits of contaminants in water that are enforceable, the limit is set at 4 parts per trillion for PFOA and PFOS as of 2024 (11). This is a stronger approach compared to TSCA for holding operators of public water systems accountable. However, it does not affect manufacturers who can often cause the contamination in the first place. As for TRI, industries are required to report annual toxic release of chemicals into the environment. Currently, 205 types of PFAS are reportable, meaning that only a small fraction of PFAS is being controlled, further supporting the issue of a chemical-by-chemical assessment approach (12).

International Entities

In addition to the Stockholm Convention, several legal entities operate to govern PFAS in various regions of the world. Firstly, there is the European Union's Registration, Evaluation, Authorization, and Restriction of Chemicals (EU REACH) regulation, which functions to ensure the safety of chemicals in products entering the EU by trade (13). Secondly, there is the EU POPs Regulation which complements REACH by implementing Stockholm Convention requirements into EU law with stricter limits (14). In the UK, a version of EU REACH is

established mirroring the framework and EU standards (15). Lastly, there's the Global Framework on Chemicals created by the UNEP, which sets management goals by 2030, though it has no legally binding power (16). Overall, these instruments play a role in extending the efforts of the Stockholm Convention, but they operate separately.

Furthermore, when analyzing the legal infrastructure at a planetary level, it is evident that there is not a clearly defined effort for PFAS regulation nor governance body. At the national level, there are defined entities and instruments like the EPA and TSCA, SDWA, and TRI. Internationally, there is the BRS convention, EU REACH, UK REACH, EU POPs Regulation, and Global Framework on Chemicals. However, at the planetary level, no such coordination appears to exist. The lack of planetary coordination is foundational to the regulatory pitfall. The gravity of this problem is explained in Figure 4, where various thresholds of PFAS contaminated water are set by each country independently, resulting in a poor understanding of PFAS contamination across countries (7). The differences in countries who significantly surpass their national thresholds (Canada) and those who barely do like Australia, differ solely based on political choice rather than a common scientific assessment.

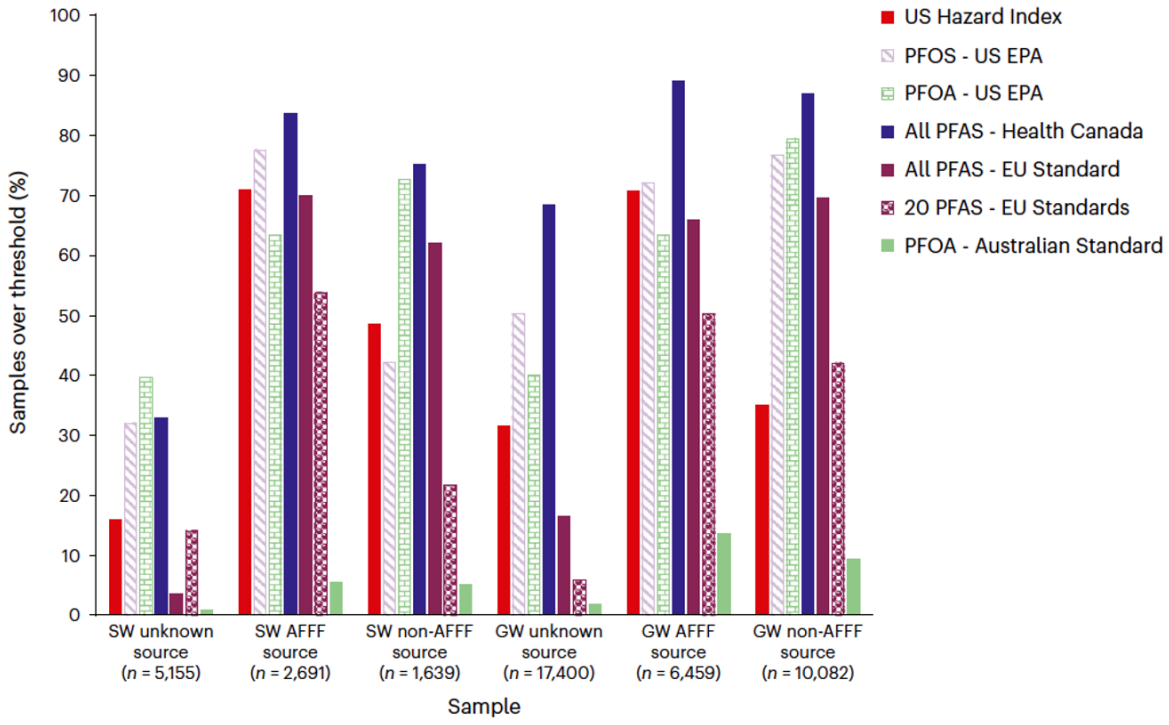


Figure 4. Incidence of exceedance of PFAS regulatory standards across surface water (SW) and groundwater (GW) sample categories, measured against seven national and regional standards. Source: Ackerman Grunfeld D, et al. Nat Geosci. 2024;17(4):340–346. doi:10.1038/s41561-024-01402-8

Another example of uncoordinated efforts is observed in this case study. When 3M disclosed its findings to the EPA, there was no mechanism in place to catapult PFOS restriction internationally. The Stockholm Convention had not yet been created, but even afterwards, it took five years from ratification to happen. This disconnect portrays the fundamental nature of

fragmented governance delaying progress. Without harmonizing efforts, planetary action remains challenged.

IV. Recommendations

The case study provides a multi-level policy perspective for regulating PFAS, first at the US national level, and then at the international level. However, the planetary level lacks effort and coordination for impactful planetary outcomes on health. Additionally, national efforts for measuring PFAS remain fragmented and hinder planetary action. It was also evident that testing varied all over the globe, which may be creating a disparity in awareness and attempted effort leaving certain populations disproportionately exposed without legal consequences.
This fragmentation stems from the still developing legal infrastructure itself. At the national level, instruments like TSCA, SDWA, and TRI have established accountability apparatuses, but had certain issues. The shortcomings that were highlighted were loopholes in the TSCA obligations that allowed manufacturers to manage findings internally without disclosing directly to the EPA. At the international level, the nine-year delay for PFOS listing reveals significant structural issues. For instance, when PFOS was discovered to be hazardous to health, the Stockholm Convention had not yet been adopted or entered into force. With lengthy processes around scientific review and voting, nine years had passed before it reached the annex B list. Further compounding the tardiness, the chemical-by-chemical assessment approach for PFAS was inefficient. Since there are 15,000 different types, manufacturers easily replaced one type with another. At the planetary level, no specific governance body exists to manage PFAS, and there are no binding instruments that treat PFAS as a class or establish universal standards. Overall, scalability is the key ingredient to transforming the legal infrastructure to a planetary one.

Three recommendations for addressing the pitfalls of the legal infrastructure include: 1) a class based PFAS restriction, 2) establishing a universal PFAS threshold in drinking water, and 3) promoting UNEP as the governance body for PFAS regulation at the planetary level. At both the national level and international level, it is imperative that the EPA and the Stockholm Convention work to ban PFAS collectively instead of the singular compound approach they are using. Secondly, to gain a better understanding of PFAS contamination around the world, and given that several countries are already measuring PFAS in drinking water, the logical next step would be to standardize PFAS contamination to establish a strong baseline of exposure by country. Lastly, elevating the UNEP to act as a planetary governance body would be crucial as this is a vacant position. This role would require granting UNEP binding enforcement authority over existing legal instruments.

V. Conclusion

To improve livelihood on earth, novel entities like PFAS require a planetary approach where governance scales beyond the international level. PFAS is widespread and persists in humans, water, soil, and wildlife, pushing the planetary boundary of novel entities into the high-risk zone.

The effort requires numerous active entities working collaboratively in accordance with binding agreements, with shared standards, coordinated monitoring, and the collective will to regulate chemicals not one by one, but as the planetary threat they have already become.

References:

1. Lerner S. Toxic Gaslighting: How 3M Executives Convinced a Scientist the Forever Chemicals She Found in Human Blood Were Safe [Internet]. ProPublica; 2024 May 20 [cited 2026 May 11]. Available from: https://www.propublica.org/article/3m-forever-chemicals-pfas-pfos-inside-story

2. Yale Sustainability. Yale experts explain PFAS "forever chemicals." Yale University. Accessed April 21, 2026. https://sustainability.yale.edu/explainers/yale-experts-explain-pfas-forever-chemicals

3. Jiang Y, et al. Short-chain PFAS: A global challenge — environmental fate, health risks, and promising removal technologies. *Environ Res.* 2025. Available from: https://www.sciencedirect.com/science/article/pii/S2211715625009841

4. Decoding PFAS immunotoxicity: a NAMs-based comparison of short vs. long chains. *Front Toxicol.* 2025. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC12672224/

5. Sonne C, Desforges JP, Gustavson K, Bossi R, Bonefeld-Jørgensen EC, Long M, Rigét FF, Dietz R. Assessment of exposure to perfluorinated industrial substances and risk of immune suppression in Greenland and its global context: a mixed-methods study. *Lancet Planet Health.* 2023;7:e570–e579. doi:10.1016/S2542-5196(23)00106-7

6. Levine H, Jørgensen N, Martino-Andrade A, et al. Temporal trends in sperm count: a systematic review and meta-regression analysis of samples collected globally in the 20th and 21st centuries. *Hum Reprod Update*. 2023;29(2):157-176. https://academic.oup.com/humupd/article/29/2/157/6824414

7. Ackerman Grunfeld D, Gilbert D, Hou J, Jones AM, Lee MJ, Kibbey TCG, O'Carroll DM. Underestimated burden of per- and polyfluoroalkyl substances in global surface waters and groundwaters. *Nat Geosci.* 2024;17(4):340–346. doi:10.1038/s41561-024-01402-8

8. Environmental Working Group. Global danger: Wildlife at risk from PFAS exposure [Internet]. EWG; 2023 Sep 26 [cited 2026 May 11]. Available from: https://www.ewg.org/interactive-maps/pfas_in_wildlife/map/

9. Stockholm Convention. Stockholm Convention on Persistent Organic Pollutants [Internet]. [cited 2026 Apr 22]. Available from: https://www.pops.int/Home/tabid/10001/Default.aspx

10. United States Environmental Protection Agency. Criminal provisions of the Toxic Substances Control Act (TSCA) [Internet]. EPA; [cited 2026 May 12]. Available from: https://www.epa.gov/enforcement/criminal-provisions-toxic-substances-control-act-tsca

11. United States Environmental Protection Agency. EPA establishes first-ever national drinking water standards for PFAS [Internet]. EPA; 2024 Apr [cited 2026 May 12]. Available from: https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas

12. United States Environmental Protection Agency. Toxics Release Inventory (TRI) PFAS [Internet]. EPA; [cited 2026 May 12]. Available from https://www.epa.gov/toxics-release-inventory-tri-program

13. European Chemicals Agency. Understanding REACH [Internet]. ECHA; [cited 2026 May 12]. Available from: https://echa.europa.eu/regulations/reach/understanding-reach

14. Source Intelligence. POPs Regulation [Internet]. Source Intelligence; [cited 2026 May 14]. Available from: https://blog.sourceintelligence.com/pops-regulation

15. Health and Safety Executive. UK REACH [Internet]. HSE; [cited 2026 May 12]. Available from: https://www.hse.gov.uk/reach/about.htm

16. UNEP Global Framework on Chemicals: United Nations Environment Programme. Global Framework on Chemicals [Internet]. UNEP; 2023 [cited 2026 May 12]. Available from: https://www.unep.org/global-framework-chemicals#:~:text=The%20Global%20Framework%20on%20Chemicals,while%20avoiding%20their%20negative%20impacts.