

PFAS: Regulation, Risk, and Remediation

Management Summary

Per- and polyfluoroalkyl substances (PFAS), also known as “forever chemicals,” have become the center of a global environmental and public health crisis. These synthetic compounds—numbering over 10,000—are used across industries due to their water, heat, and stain resistance. However, PFAS persist in the environment and accumulate in human bodies over time, and exposure to them has been definitively linked to serious health outcomes including various cancers, immune system suppression, liver damage, and reproductive harm ([Totaro, 2024](#)).

PFAS reach the natural environment and human bodies through a variety of pathways, including consumer goods and industrial processes. Of particular concern is transfer from biosolids, or sewage sludge, applied as fertilizer. This practice is authorized on nearly 70 million acres of US farmland ([Environmental Working Group, 2025](#)) and threatens farmers, those living near treated farmland, and those who consume crops and other products associated with treated farmland. Legislation has been introduced across fourteen US states to address concern over biosolid application and its threat to human health ([Safer States, 2025](#)).

As awareness grows, broader regulatory momentum is accelerating. The European Union is pursuing a near-total ban on PFAS in all consumer products by 2030. France has implemented a groundbreaking PFAS emissions tax tied to facility-level disclosures ([EHS Law Insights, 2025](#)), while Canada has formally classified PFAS as toxic substances and is preparing nationwide bans ([Osler, 2024](#)). In contrast, federal efforts in the U.S remain highly uncertain, with previous progress being rolled back or reevaluated by the current administration. Still, 30 states have adopted their own PFAS regulation, and 10 others have proposed initial legislation, creating a fragmented and complex compliance landscape ([Safer States, 2025](#)).

Legal and financial risks are rising. Major manufacturers like 3M and DuPont have already agreed to multibillion-dollar settlements over PFAS, and hundreds of lawsuits are pending across the U.S (Kepler Cheuvreux, 2023). PFAS lawsuits frequently involve:

- Drinking water contaminated by industry.
- Firefighting foam used at airports, by the military, and firefighting professionals.
- Food packaging including anti-grease coatings.
- Household products including non-stick cookware, waterproof clothing, and types of carpeting.

Legal theories in PFAS lawsuits include:

- Product liability.
- Environmental contamination.
- Medical monitoring claims.
- Public nuisance.

Investors are increasingly considering PFAS exposure as a material ESG risk, placing companies under mounting pressure to disclose, substitute, and remediate.

This paper examines the regulatory trends, industry vulnerabilities, and corporate strategies shaping the global response to PFAS—and offers a framework for navigating the path forward.

Introduction: The PFAS Dilemma

Per- and polyfluoroalkyl substances (PFAS) are a large class of synthetic chemicals characterized by strong carbon-fluorine bonds. Given their unique ability to resist water, oil, heat, and stains, they have been used for over 70 years in a wide range of consumer and industrial products. PFAS have become indispensable to industries such as aerospace, textiles, packaging, and electronics. Yet the same characteristics supporting widespread use also make it nearly impossible to break down in nature. As a result, PFAS accumulate in soil, water, animals, and human bodies, where they can remain for decades (J.P. Morgan, 2025).

This durability has earned PFAS the nickname “forever chemicals.” Exposure is now widespread and nearly unavoidable. Studies have shown that 99% of Americans have PFAS in their bloodstreams (Calafat et al., 2019), and contamination has been found in breast milk, food products, and rainwater. Once absorbed, they build up over time, posing long-term health risks.

The scientific community is beginning to reach consensus on the dangers of PFAS exposure. PFOA and PFOS, two of the most well-studied compounds, have been linked to the development of multiple cancers, while broadly PFAS have been associated with immune system suppression, organ damage, metabolic disorders, and reproductive issues (Totaro, 2024). The scale of contamination and the depth of health impacts have drawn comparisons to historical environmental crises involving asbestos and tobacco.

As a regulatory patchwork evolves, companies across sectors face escalating risks—legal, financial, reputational, and operational. With lawsuits mounting, investor scrutiny intensifying, and consumers growing increasingly aware, PFAS has transitioned from a niche regulatory issue into a central ESG and financial materiality concern. The following sections explore the full scope of the PFAS crisis, assess its implications for businesses, and outline strategies for reducing exposure and mitigating risk.

The Health and Environmental Impact of PFAS

Health authorities and scientific bodies now agree that long-term PFAS exposure poses significant health risks. Given the vast family of over 10,000 compounds encompassed by PFAS, health impacts are varied. They often depend on the degree of exposure, which ranges from acute in those living near industrial facilities to mild through contact with household items. In adults, chronic exposure has been linked to infertility, reproductive complications including low birth weight, and increased odds of gestational hypertension (Darrow et al, 2013). Exposure in children can also lead to the development of attention deficit hyperactivity disorder (ADHD), asthma, dyslipidemia (imbalance of lipids with harmful cardiovascular implications), impaired immune responses, and early onset of first menstruation (Rappazzo et al., 2017). Finally, high levels of PFAS exposure is associated with the various cancers, including liver, thyroid, bladder, kidney, and testicular cancer, and with chronic conditions including high cholesterol, impaired glucose metabolism, and ulcerative colitis (Totaro, 2024). PFOA and PFOS have both been designated potential carcinogens by NHI working groups (NHI, 2025).

The negative impacts of PFAS also extend to ecosystems. PFAS have become ubiquitous in the environment, with significant amounts detected in samples of surface water, rainwater, wastewater, biota, particulate matter, groundwater, and soil (Dimitrakopoulou et al., 2024). 120 unique PFAS compounds

have also been documented in 625 animal species ([Andrews et al., 2023](#)). Often mirroring health effects in humans, contamination in various species has been shown to disrupt reproduction and hormone regulation. Marine ecosystems are at particular risk, as bioaccumulation appears most prevalent in fish and other aquatic species, though ecological consequences are not yet conclusive. Terrestrially, PFAS is absorbed by crops and wild plants growing in contaminated soil or irrigated with polluted water, introducing yet another pathway for exposure and contributing to accumulation in humans and wildlife alike ([Dimitrakopoulou et al., 2024](#)).

The scale of exposure in both humans and ecosystems is staggering. According to the U.S. Centers for Disease Control and Prevention (CDC), 99% of Americans tested have detectable levels of PFAS in their blood ([Calafat et al., 2019](#)). In Europe, a 2021 study revealed that 14.3% of teenagers had PFAS blood levels exceeding health-based safety thresholds (Kepler Cheuvreux, 2024). PFAS have also been detected in breast milk, underscoring their capacity for intergenerational transmission.

Despite growing awareness, only a fraction of PFAS compounds have been comprehensively studied, and long-term studies proving correlation between PFAS and negative health effects are difficult to conduct given confounding variables. This knowledge gap creates regulatory and legal uncertainty, complicating efforts to mitigate health and environmental consequences. Still, the evidence to date is sufficient that public agencies and investors are increasingly treating PFAS as a serious environmental and financial liability.

Where PFAS Are Found and Why It Matters

PFAS have become omnipresent in the environment in part due to their near universal application in modern industrial and consumer applications. Their unique chemical properties, particularly their resistance to heat, water, and oil, have made them popular across multiple sectors. PFAS can be found in food packaging, waterproof clothing, carpets, upholstery, nonstick cookware, stain-resistant furniture, firefighting foams, cosmetics, semiconductors, aviation equipment, and medical devices (J.P. Morgan, 2025). The frequently overlooked presence of PFAS has also made them a silent risk multiplier across global supply chains.

The industries most heavily exposed to PFAS regulation include:

- Textiles and apparel: Used in stain- and water-resistant treatments.
- Food packaging: Coatings on fast-food wrappers, microwave popcorn bags, and grease-resistant containers.
- Cosmetics and personal care: Added for smooth textures and long wear.
- Aerospace and automotive: PFAS appear in wire coatings, hydraulic fluids, and fuel system components.
- Water utilities: Affected due to PFAS infiltration into public drinking water systems
- Chemical manufacturers: Especially those producing or processing PFAS-based materials.

These industries now face heightened scrutiny. France, for example, has published detailed emissions disclosures showing that just 5.4% of facilities account for 99% of the country's PFAS emissions which generated immense pressure from stakeholders to remediate this imbalance ([EHS Law Insights, 2025](#)). In the U.S., dozens of companies have already been named in lawsuits, including packaging firms,

chemical giants, and water system operators (Kepler Cheuvreux, 2023). Brands that rely on PFAS-containing materials, whether directly or indirectly—face legal, reputational, and financial consequences.

Importantly, regulation varies by geography, making compliance difficult to standardize. In the US, state legislation requires a broad spectrum of enforcement action, from limited disclosures to large scale bans. Canada's new classification of PFAS as "toxic substances" is expected to phase out their use in firefighting foams, cosmetics, and packaging (Osler, 2024). And in Europe, companies face looming sector-wide bans by 2030 (J.P. Morgan, 2025).

For businesses, the risk is not just about product liability, it's also about access to capital, insurance, and consumer trust. Investors are increasingly flagging PFAS exposure in ESG assessments. At the same time, regulatory bodies are beginning to require disclosures of PFAS use under chemical safety laws and environmental regulations. In this context, identifying where PFAS appear across operations, products, and supply chains is not just prudent—it's urgent.

PFAS in Sewage Sludge

PFAS also persists in sewage sludge through secondary contamination of wastewater. These ubiquitous compounds transfer into wastewater treatment plants in a variety of ways, including industrial releases, commercial releases, and down-the-drain consumer releases (U.S. EPA, n.d.). As wastewater moves through treatment plants, larger PFAS compounds are separated from liquids with solid waste. The PFAS compounds then remain in sewage sludge when disposed of or sold for commercial use. A 2023 metanalysis demonstrated that a wide range of PFAS compounds exist in sewage sludge at varied concentrations (Hagemann & Harclerode, 2024).

Research demonstrates clear PFAS contamination in the soil, air, and crops as a result of biosolid application (Wang & Cousins, 2023). Significant threat to people living near the application sites of sewage sludge, including farm families and those who share water sources with farms, and those involved in the direct consumption of crops produced in areas where sludge has been applied, has been modeled by the EPA. In their January 2025 draft assessment, EPA concluded there "may be human health risks exceeding the EPA's acceptable thresholds for some modeled scenarios when land-applying sewage sludge that contains 1 part per billion (ppb) of PFOA or PFOS," noting that such estimates were not conservative, as in fact most applications far exceed 1 part per billion and persons are often subject to more than one source of contamination (EPA, 2025). EPA has declined to rule on effect to the health of the general public.

Currently there is no federal regulation in the U.S. or Europe which regulates PFAS concentration in sewage sludge. Moreover, biosolids may be applied to pastures, feed crops, and crops for direct human consumption; forests, tree farms, golf courses, turf farms, and other types of land; and bagged and sold at stores to the public for use on lawns or in home gardens (EPA, n.d.). This vast array of application settings coupled with a lack of comprehensive federal regulation on PFAS in biosolids demands urgent action from state governments to protect the public from severe health risks.

Fourteen states have introduced legislation to address PFAS contamination in biosolids (Safer States, 2025). Most recently, the New York State Senate introduced a bill which would impose a moratorium on all biosolid applications in the state and require testing of soil and groundwater for contamination. The proposal also forms state task forces to support mitigation efforts on farms with PFAS contamination surpassing regulatory limits, organize financial support, and evaluate potential strategies for removal (NYS Senate, 2025).

While most legislation imposes either moratoriums or strict limitations which effectively prohibit the land application of biosolids, governments and private companies are seeking methods to effectively reduce PFAS contamination in sewage sludge to a safe and usable level for land application. In the vein of biological treatment, success in anaerobic digestion has been limited. Laboratory studies have demonstrated unclear results and will require additional process modification before becoming scalable (Hagemann & Harclerode, 2024).

Thermal treatment methods, which primarily include incineration, pyrolysis, and hydrothermal carbonization, have demonstrated more promising results, with laboratory experiments demonstrating degradation of up to 96% of PFAS contamination present in samples (Hagemann & Harclerode, 2024). However, these strategies remain limited by potentially harmful byproducts of treatment and a lack of data from full-scale operations. Continued action and funding from states legislatures will provide momentum essential for developing such experimentation into large scale, reliable solutions for PFAS remediation in sewage sludge.

Evolving Policy Landscapes: United States, France, and Canada

As scientific consensus around the health risks of per- and polyfluoroalkyl substances (PFAS) strengthens, governments across the globe are adopting increasingly aggressive regulatory strategies. Yet the pace, scope, and enforcement mechanisms of these efforts remain highly variable. In the United States, the Environmental Protection Agency (EPA) has taken historic steps through its PFAS Strategic Roadmap (2021–2024) to regulate PFAS in drinking water, industrial discharges, and consumer products (U.S. EPA, 2024). Still, federal progress remains vulnerable to political shifts, prompting states to enact their own regulations.

Meanwhile, countries like France and Canada are pursuing nationally coordinated efforts, each reflecting different regulatory philosophies—from France’s precautionary bans on consumer uses to Canada’s emphasis on industrial monitoring and pollution prevention. For multinational companies, this patchwork of national and subnational regulations creates both compliance risks and opportunities for environmental leadership.

This section compares the U.S. federal-state dynamics, New York’s proactive model, and emerging policies in France and Canada, highlighting the diverse regulatory landscapes shaping the global PFAS response.

U.S: EPA and States

The U.S. Environmental Protection Agency (EPA) has undertaken its most aggressive and multifaceted campaign yet to combat PFAS through the PFAS Strategic Roadmap, first released in 2021 and updated in 2024 (U.S. EPA, 2024). The Roadmap is built around three pillars: Restrict, Remediate, and Research, which together guide the EPA’s strategy to prevent PFAS releases, clean up contamination, and expand scientific understanding of these chemicals.

Notably, in April 2024 EPA announced its first-ever enforceable national drinking water standards for PFAS, which placed enforceable limits on six PFAS and is projected to reduce exposure for approximately 100 million Americans (U.S. EPA, 2024). The EPA has also finalized rules designating PFOA and PFOS as hazardous substances under CERCLA (Superfund law)—giving the agency power to force polluters to pay for PFAS cleanup rather than relying on taxpayers (U.S. EPA, 2024). Finally,

through the Bipartisan Infrastructure Law (BIL), over \$10 billion has been allocated for water infrastructure improvements, with billions specifically set aside to combat PFAS in vulnerable communities (U.S. EPA, 2024).

The EPA's Roadmap underscores a systems-level understanding of PFAS. It recognizes not only health and environmental risk but also economic burdens on farmers, municipal waste systems, and low-income communities.

Yet these federal advances remain politically vulnerable. The 2025 shift in presidential administration has introduced executive uncertainty, with proposed freezes and rollbacks on certain enforcement actions. Without bipartisan support codifying PFAS regulation, many of the EPA's rules—particularly under the Clean Water Act and CERCLA—may be delayed or reversed. This fragile political environment has contributed to an uneven regulatory landscape, where states are advancing more comprehensive safeguards than the federal government. Specifically, 30 states have introduced or enacted their own PFAS-related laws—targeting PFAS in consumer products, firefighting foam, water systems, and industrial emissions ([Safer States, 2025](#)). For example:

- Maine mandates the disclosure of PFAS in all products by 2025 and plans a full ban by 2030.
- California prohibits the sale of PFAS-containing food packaging and cosmetics.
- New York has banned PFAS in apparel and firefighting gear and introduced legislation regulating application of biosolids.

This decentralized regulatory landscape poses major challenges for businesses operating nationwide. Companies must now navigate inconsistent state requirements, track evolving legislation, and prepare for future federal shifts should a new administration revisit the EPA's role. Meanwhile, lawsuits are proliferating. Thousands of legal claims have been filed against chemical manufacturers, water utilities, and consumer goods companies—resulting in over \$13 billion in settlements to date (Kepler Cheuvreux, 2023).

In the near term, emphasis on data transparency, hazard designation, and community-driven remediation funding offers a meaningful—if incomplete—path forward for national PFAS response. However, long-term success will depend on consistent legislative follow-through and thoughtful action from the private sector.

France: Polluter Pays and Transparent Emissions Tracking

France has adopted one of the most aggressive and transparent PFAS regulatory frameworks in the world. Under its 2025 PFAS emissions law, the country introduced:

- A PFAS emissions tax of €100 per 100 grams discharged into the environment or wastewater systems.
- A mandatory emissions disclosure system that publicly reports facility-level PFAS data.
- A national goal to eliminate industrial PFAS emissions entirely by 2030 ([EHS Law Insights, 2025](#)).

France's emissions disclosures revealed that 5.4% of facilities accounted for 99% of PFAS pollution, with major contributors including Solvay, Arkema, BASF, and TotalEnergies ([EHS Law Insights, 2025](#)). By focusing on transparency and direct economic penalties, France has built a regulatory model that encourages rapid corporate behavioral change. The tax has prompted several companies to invest in

PFAS treatment systems or reevaluate material sourcing, especially in sectors like chemicals, manufacturing, and consumer goods ([EHS Law Insights, 2025](#)).

Canada: A National Strategy Based on Toxic Substance Designation

Canada has taken a unified federal approach by formally designating PFAS as toxic substances under the Canadian Environmental Protection Act in 2025 (Osler, 2024). This decision triggers a phased regulatory process that will begin with:

- A ban on PFAS in firefighting foams by 2027.
- Proposed restrictions on PFAS in cosmetics, food packaging, paints, and textiles.

Canada's centralized regulatory model allows for more consistent enforcement compared to the U.S. patchwork approach. While industry consultation is ongoing, companies with operations or exports to Canada must prepare for enhanced disclosure requirements and eventual PFAS substitution mandates.

Implications for Industry

These contrasting policy landscapes are reshaping how businesses manage PFAS risks. In decentralized systems like the U.S., companies face higher compliance costs and legal exposure. In centrally regulated markets like France and Canada, enforcement is more predictable but often more aggressive. For global firms, the key challenge is building adaptable supply chains and compliance systems that can respond to regulatory divergence without sacrificing ESG credibility or investor confidence.

Industry Response and Mitigation Strategies

As PFAS regulation intensifies across the globe, companies are under increasing pressure to respond—not just to avoid legal liability, but to preserve brand value, investor trust, and operational continuity. Industry responses can generally be grouped into three main categories: remediation and cleanup, product substitution, and ESG disclosure and governance.

Remediation and Cleanup Technologies

Many firms in high-exposure industries are investing in PFAS decontamination technologies. These efforts are especially prominent among utilities and chemical companies, where regulatory mandates have already taken effect.

Daikin, a PFAS producer and user, has implemented on-site filtration and emission control technologies to reduce environmental discharge. SciDev, a U.S.-based water treatment company, has secured contracts to remediate PFAS in municipal systems and is expanding its chemical treatment capabilities for industrial sites. Clean Harbors and other environmental service firms are scaling up mobile and permanent PFAS treatment infrastructure in response to growing municipal demand (Kepler Cheuvreux, 2023).

Technologies used include granular activated carbon (GAC), ion exchange resins, and reverse osmosis—all of which offer tradeoffs in cost, efficiency, and effectiveness relative to PFAS type and contamination levels (J.P. Morgan, 2025).

Product Substitution and Material Innovation

Another key industry strategy involves transitioning away from PFAS-based materials—a particularly urgent issue in textiles, consumer goods, and packaging.

Brands like Tefal have begun developing PFAS-free cookware lines, while apparel companies such as VFC (The North Face) and H&M are adopting fluorine-free coatings in outerwear (Kepler Cheuvreux, 2023). In the personal care sector, several multinational cosmetics brands have pledged to eliminate PFAS ingredients in makeup and skincare formulations, replacing them with biodegradable alternatives (J.P. Morgan, 2025).

However, the shift away from PFAS is not always simple. In sectors like aerospace and electronics, suitable alternatives may not yet exist on a scale. Companies in these industries are seeking regulatory exemptions or investing in R&D partnerships to accelerate material innovation, representing an enormous opportunity for substitute developers (Kepler Cheuvreux, 2024).

ESG Disclosure and Governance Reform

Investors are increasingly incorporating PFAS into their ESG frameworks. Companies are now expected to disclose PFAS usage across products and supply chains, engage proactively with regulators and stakeholders, and implement governance mechanisms to track and reduce PFAS-related risks (J.P. Morgan, 2025).

For example, SGS has quadrupled its PFAS testing capacity and now offers PFAS-specific ESG advisory services, responding to growing corporate demand (J.P. Morgan, 2025). Likewise, Veolia has outlined PFAS remediation as a core component of its growth strategy, projecting over €1 billion in related revenue by 2030 (J.P. Morgan, 2025).

Firms that fail to address PFAS-related ESG risks may find themselves excluded from investment portfolios, downgraded in ESG rankings, or targeted by activist shareholders. Transparent and forward-looking governance is increasingly a differentiator in both public and private markets.

Financial, Legal, and ESG Risk Implications

The financial consequences of PFAS exposure are no longer theoretical. In recent years, companies have faced mounting litigation costs, regulatory fines, cleanup expenses, and reputational damage, all of which have begun to materially impact balance sheets and valuations.

In the United States, legal action has accelerated sharply. Chemical manufacturers such as 3M and DuPont have agreed to more than \$13 billion in PFAS-related settlements, primarily tied to water contamination claims brought by municipalities and utilities (Kepler Cheuvreux, 2023). These cases often end in settlement because the burden of proving long-term health effects remains scientifically and legally complex. However, the scale of payouts underscores the materiality of PFAS liabilities. Thousands of additional lawsuits are still pending, and a growing number are now targeting downstream users, not just producers (Kepler Cheuvreux, 2023).

Related cases in Europe are also expanding. While litigation based on health claims remains rare in the EU, there is increasing momentum behind suits centered around economic loss. Food producers, for example, may sue over PFAS-contaminated land that renders crops unsellable or requires costly remediation. Insurance company Praedicat has ranked PFAS as the top emerging litigation risk globally, particularly for firms operating in North America and Europe (J.P. Morgan, 2025).

Beyond direct legal costs, PFAS also pose a broader financial risk through their effect on ESG ratings, investor perception, and regulatory compliance costs. According to a European Commission estimate, the total annual cost of PFAS-related health and environmental damage could exceed €84 billion across the EU if left unaddressed (J.P. Morgan, 2025). This figure reflects not only cleanup and treatment but also healthcare, productivity loss, and biodiversity damage.

From an investment perspective, PFAS exposure is increasingly flagged as a negative ESG indicator. Asset managers are beginning to screen portfolios for PFAS-related liabilities, especially among chemical, utility, and consumer goods holdings. Companies that lack transparency on their PFAS footprint may be excluded from ESG funds or face shareholder pressure to disclose more information. In some cases, investors have initiated resolutions demanding clearer reporting on PFAS risk, product exposure, and mitigation plans (J.P. Morgan, 2025).

Insurers are also taking note, raising premiums for industries with high PFAS exposure or refusing coverage altogether for contamination-related events. These changes not only increase operating costs but also limit a company's ability to manage risk through traditional means.

It is evident the financial implications of PFAS extend far beyond cleanup costs. Litigation, regulation, investor scrutiny, and insurance dynamics are converging to make PFAS a defining liability issue for the next decade. For companies unprepared to confront this challenge, the cost of inaction will likely be measured in both dollars and long-term reputational harm.

Conclusion and Recommendations

The global response to PFAS is entering a new phase—one defined not by uncertainty, but by accountability. What was once viewed as a technical chemical issue has evolved into a full-scale environmental, financial, and regulatory crisis. Governments are moving from passive monitoring to active enforcement. Investors are embedding PFAS exposure into ESG risk models, courts are awarding billions in damages, and consumers are increasingly aware of the health and environmental risks.

The industries most affected—from textiles and cosmetics to chemicals, packaging, and utilities—are now at a crossroads. For some, the costs of inaction are already being felt through legal settlements, regulatory penalties, and declining investor trust. For all, there is still time to act.

To transition to and thrive in a post-PFAS economy, companies must take the following steps:

1. **Audit exposure across products and supply chains:** Identify where PFAS are used in materials, manufacturing, or packaging. Many firms are still unaware of how deeply PFAS are embedded in their operations.
2. **Engage with regulators proactively:** Rather than waiting for enforcement, companies should participate in consultations, anticipate upcoming regulations, and prepare for evolving compliance standards across jurisdictions.
3. **Invest in substitution and R&D:** Transitioning away from PFAS requires time and innovation. Companies should prioritize scalable alternatives where available and begin investing in R&D for long-term replacements in hard-to-substitute applications.

4. Enhance ESG transparency: Disclose PFAS-related risks and mitigation plans in annual reports, sustainability disclosures, and investor communications. Transparency is increasingly seen as a sign of responsibility, not vulnerability.
5. Strengthen governance and accountability: Assign cross-functional teams or executives to oversee PFAS compliance and transition strategy. This issue is no longer just a compliance matter—it is a business continuity and risk management challenge.

As PFAS regulation continues to accelerate globally, companies that move swiftly and strategically will gain a competitive advantage. Those that delay face increasing legal liability, reputational damage, and operational disruption. The era of voluntary action is over. PFAS accountability is no longer optional, it is inevitable.

Appendix

Common PFAS Compounds and Their Primary Uses

PFAS Compound	Primary Use
PFOA	Nonstick cookware, textiles, carpet, firefighting foam
PFOS	Firefighting foam, stain repellents, hydraulic fluids
GenX	Replacement for PFOA in fluoropolymer production
PFNA	Chemical manufacturing, surfactants, food packaging
PFHxS	Firefighting foams, textiles, metal plating
PFBS	Replacement for PFOS in cleaners and coatings

Note: These substances are among the most studied, but over 10,000 PFAS compounds exist.

Overview of PFAS Alternatives

The transition away from PFAS is advancing across industries, but the availability and effectiveness of substitutes vary.

Application Area	PFAS-Free Alternatives	Notes
Textiles and apparel	Silicone-based coatings, wax emulsions	Slightly reduced performance but consumer-accepted
Cookware	Ceramic, enamel, stainless steel	Growing adoption by leading brands
Food packaging	Clay-based coatings, cellulose films	Effective under most conditions, increasing adoption
Firefighting foam	Fluorine-free foams (FFF)	Effective for standard fires, not yet for jet fuel
Cosmetics	Mica, silica, plant-based emollients	Still developing; may alter product texture or wear
Industrial applications	Teflon-free lubricants, plasma coatings	Often industry-specific and under development

Sources

Andrews, D. Q., Stoiber, T., Temkin, A. M., & Naidenko, O. V. (2023). Discussion. has the human population become a Sentinel for the adverse effects of pfas contamination on wildlife health and Endangered Species? *Science of The Total Environment*, 901, 165939. <https://doi.org/10.1016/j.scitotenv.2023.165939>

Calafat, A. M., Kato, K., Hubbard, K., Jia, T., Botelho, J. C., & Wong, L.-Y. (2019). Legacy and alternative per- and polyfluoroalkyl substances in the U.S. general population: Paired serum-urine data from the 2013–2014 National Health and Nutrition Examination Survey. *Environment International*, 131, 105048. <https://doi.org/10.1016/j.envint.2019.105048>

Darrow, L.A.; Stein, C.R.; Steenland, K. (2013). Serum perfluorooctanoic acid and perfluorooctane sulfonate concentrations in relation to birth outcomes in the Mid-Ohio Valley, 2005–2010. *Environ. Health Perspect.* 121, 1207–1213.

Dimitrakopoulou, ME., Karvounis, M., Marinos, G. et al. Comprehensive analysis of PFAS presence from environment to plate. *npj Sci Food* 8, 80 (2024). <https://doi.org/10.1038/s41538-024-00319-1>

EHS Law Insights. (2025, March 4). *French ban on PFAS*. <https://www.ehslawinsights.com/2025/03/french-ban-on-pfas/>

Environmental Working Group (EWG). (2025, January). *‘Forever chemicals’ in sludge may taint nearly 70 million farmland acres*. <https://www.ewg.org/news-insights/news/2025/01/forever-chemicals-sludge-may-taint-nearly-70-million-farmland-acres>

Hagemann, N., & Harclerode, M. (2024). *Assessment of PFAS exposure pathways from biosolids to food: An emerging risk to sustainable agriculture*. *Environmental Sciences Europe*, 36(1). <https://enveurope.springeropen.com/articles/10.1186/s12302-024-01031-3>

J.P. Morgan. (2025, January 14). *Forever Changed: Screening PFAS Risks & Opportunities Exposure in EMEA & Takeaways from Expert Calls*. [PDF].

Kepler Cheuvreux. (2023, November 30.) *Climate Change & Natural Capital: PFAS – Industry Risk, Regulation & Substitution*. [PDF].

Kepler Cheuvreux. (2024, September 9). *PFAS: Phase-Out Risks and Clean-Up Opportunities* [PDF].

New York State Senate. (2025). *Senate Bill S5759: Management of PFAS in Biosolids*. 2025–2026 Regular Legislative Session. <https://www.nysenate.gov/legislation/bills/2025/S5759/amendment/A>

Osler, 2024. (2024, April). *Regulation of “Forever Chemicals” (PFAS) in Canada*. <https://www.osler.com/en/insights/updates/regulation-of-forever-chemicals-pfas-in-canada/>

Paul Hastings LLP. (2025, Q1). *PFAS Legislative and Regulatory Developments: First Quarter 2025*. <https://www.paulhastings.com/insights/phast-track-legal-insights-on-environment-energy-and-infrastructure/pfas-legislative-and-regulatory-developments-first-quarter-2025>

Rappazzo KM, Coffman E, Hines EP. Exposure to Perfluorinated Alkyl Substances and Health Outcomes in Children: A Systematic Review of the Epidemiologic Literature. *Int J Environ Res Public Health*. 2017 Jun 27;14(7):691. doi: 10.3390/ijerph14070691.

Safer States. (2025). *PFAS Bill Tracker*. https://www.saferstates.org/bill-tracker/?toxic_chemicals=PFAS

Safer States. (2025). *PFAS-related biosolid legislation tracker*. https://www.saferstates.org/bill-tracker/?toxic_chemicals=PFAS&issue_sectors=Biosolids/Sludge&status=Introduced&year=2025:2025

Totaro, Callie Sierra, "PFAS Exposure and Human Health Risk Management - A Policy Review" (2024). Master's Projects and Capstones. 1707. <https://repository.usfca.edu/capstone/1707>

U.S. Environmental Protection Agency (EPA). (2025, January). *Fact Sheet: Draft Sewage Sludge Risk Assessment for PFOA and PFOS*. <https://www.epa.gov/system/files/documents/2025-01/fact-sheet-draft-sewage-sludge-risk-assessment-pfoa-pfos.pdf>

U.S. Environmental Protection Agency (EPA). (2024, November). *EPA's PFAS Strategic Roadmap: Three Years of Progress*. EPA-800-K-24-002. https://www.epa.gov/system/files/documents/2024-11/epas-pfas-strategic-roadmap-2024_508.pdf

U.S. Environmental Protection Agency (EPA). (n.d.). *Per- and Polyfluoroalkyl Substances (PFAS) in Sewage Sludge*. <https://www.epa.gov/biosolids/and-polyfluoroalkyl-substances-pfas-sewage-sludge>

Wang, Z., & Cousins, I. T. (2023). *Sorption of per- and polyfluoroalkyl substances (PFASs) to biosolids: Environmental risks and implications*. *Chemical Engineering Journal*, 452, 139471. <https://www.sciencedirect.com/science/article/abs/pii/S1385894722054444>