The Dangers of PFAS in the Textile Industry: Proposed Policy Approaches

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https://doi.org/10.38126/JSPG270104
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Keywords: science policy, PFAS, textiles, environmental health, public health

Executive Summary: Per- and polyfluoroalkyl substances (PFAS) are an anthropogenic group of chemicals used in a variety of manufacturing industries. Due to their water repellent and durable properties, PFAS have been used in waterproof textiles and apparel since their creation. The chemicals are commonly discharged from textile industries, leaching into waterways and affecting environments, wildlife, and society. Current federal and state policy approaches, such as the Toxic Substance Control Act and the Resource Conservation and Recovery Act, provide weak regulation on the full life cycle of PFAS. These gaps underscore the need for updated and more comprehensive approaches that address the chemicals as a class. This proposal aims to influence policymakers to shift the textile industry away from the use of PFAS through the wider and stricter distribution of state bans. The textile PFAS bans in New York, California, and Colorado stand as an example for the adoption of similar legislation in other states. In addition, we propose federal legislative action for company transparency tax credit incentives to promote the shift into sustainable alternatives to PFAS and honor consumer choices. Finally, we emphasize that additional research on alternative finishes for textiles is key to shifting markets away from PFAS as a class.

I. Introduction

Per- and polyfluoroalkyl substances (PFAS) are a class of thousands of chemicals used in multiple industries for their waterproof and durable properties (Agency for Toxic Substances 2023). For example, over 50% of global PFAS use is for waterproof coatings on textiles (Dignes et al. 2024). Despite the widespread use of PFAS in the textile industry, their release into the environment has detrimental effects on human, ecosystem, and environmental health, which will be detailed in the following sections (EWG 2023).

There are two groups of PFAS that are structurally similar, but differ in length. Short-chain PFAS are defined as perfluoroalkyl carboxylic acids (PFCAs) with fewer than seven fluorinated carbons atoms and perfluoroalkyl sulfonic acids (PFSAs) with fewer than six fluorinated carbons atoms. Long-chain PFAS include PFCAs with seven or more fluorinated carbons atoms and PFSAs with six or more fluorinated carbons atoms (NC State University 2022). The Significant New Use Rules, introduced in 2002, were the first regulations surrounding long-chain PFAS in the United States. Since then, manufacturers have slightly altered PFAS chain length chemistry — transitioning from regulated long-chain PFAS to short-chain PFAS, which are structurally similar but largely unregulated (Brennan et al. 2021). Research and regulations on the occurrence and lasting effects of long-chain PFAS in environments are well documented, but disregard the potential for the substitution of short-chain variants that can be just as persistent and harmful. Studies have shown that short-chain PFAS are more widely detected, persistent, and mobile in aquatic environments, which may lead to broader human and ecosystem health risks (Li et al. 2020).

Bolstering state and federal regulations against the use of all types of PFAS throughout their full life cycle will eliminate uses of the chemicals as a class, and avoid alterations to the chemistry of the PFAS carbon chain. In this policy brief, we will discuss the negative health effects of PFAS in textiles, evaluate current policy gaps, and provide recommendations for state level regulation and federal company transparency incentives.

II. Health impacts

i. Ecosystem bioaccumulation

PFAS are characterized by their hydrophobicity, high heat capacity, and resistance to weathering. These properties make them perfect for use in water-resistant textiles; however, once released into environments, these characteristics allow them to persist and accumulate within ecosystems, thus labeling them as "forever chemicals" (Jerič et al. 2025). The release of PFAS into the environment can happen at every stage of their life cycle, including manufacturing, production, general wear and tear, and disposal at end of life (Dignes et al. 2024) (Figure 1). This increases the chance for bioaccumulation and exacerbates the negative health and ecological impacts that PFAS can exert (Nayak et al. 2023).

PFAS act as endocrine and genetic disruptors, leading to health issues among aquatic organisms that can influence the success rate of egg hatching and lead to offspring deformities (Nayak et al. 2023). PFAS most notably affects fish populations due to extreme pollution in water bodies, but the chemicals have been detected within crops and livestock as well, creating concerns for bioaccumulation up the food chain (Jha et al. 2021).

Facilities that grow crops and raise cattle nearby PFAS contamination sites have the potential to transfer these chemicals to their products. For example, a Swedish study investigating the bioaccumulation of PFAS in cattle found that the PFAS chemical group is highly transferable to dairy and meat products through water contamination (Vestergren et al. 2013). This study highlights the bioaccumulation of PFAS within the food humans consume, demonstrating their potential to persist within human bodies.

ii. Human impacts

Humans most commonly come into contact with PFAS through drinking water and food contamination, but the chemicals also have the potential to transfer through skin contact and

Figure 1: This diagram depicts a possible pathway for PFAS bioaccumulation in humans, stemming from textile industries to plates and drinking water. PFAS from the textile industry leach into the air and water, which can cause them to accumulate within crops and animals ultimately making their way into human bodies.

inhalation (Qu 2024). In fact, research has shown that PFAS can be found in the blood serum of over 98% of the US population (Dignes 2024). Once endocrine-disrupting chemicals like PFAS enter the human body, they can have adverse effects on reproductive health and increase cancer risks. For example, multiple studies have found correlations between increased levels of PFAS in blood serum and higher risks for developing kidney and testicular cancers (Shearer et al. 2020, Purdue et al. 2023). In addition, associations have been found between contaminated drinking water and the increased risk for other cancers, including endocrine, digestive, oral cavity, pharynx, skin, and respiratory system (Li et al. 2025), further emphasizing the importance for their regulation within the textile industry (Di Niso 2022, Sassano et al. 2025).

Another main concern for PFAS exposure in humans is their connection to disruptions in women's reproductive health. Studies have reported connections to PFAS exposure and polycystic ovary syndrome, endometriosis, ovarian tumors, gestational diabetes, preeclampsia, and preterm birth. There have also been suggestive studies of their connection to infertility and failed IVF success due to their confirmed presence within follicular fluid (Qu 2024). Once PFAS enter the body, they accumulate until excretion, causing higher levels of accumulation within men due to women's excretion through their menstrual cycle. In a 2014 study investigating the sex differences in elimination of PFOS, the modeled elimination half-life for men was 4.7 years, and when excluding losses from menstruation in women their elimination half-life was 3.7 years (Wong 2014). In addition, women excrete PFAS through the placenta and breast milk, resulting in contamination risk for future generations, both in utero and afterbirth (Mogensen et al. 2015).

III. Current policies

i. Federal regulations

Current federal regulations on PFAS are limited in both number and strength, and also include other toxic chemicals and waste. Without specialized laws solely focused on PFAS or federal level bans on the chemicals as a class, current regulations do not widely protect from the harmful effects of these chemicals. Current federal regulations that do govern PFAS use in the industry are summarized below in Table 1. In addition to the regulations mentioned in Table 1, the United States Environmental Protection Agency (EPA) furthers efforts through the Preliminary Effluent Guidelines Program Plan 16. This plan is an audit of the current federal regulation system that details both ongoing studies on industrial sources and discharge of PFAS along with rulemakings surrounding them. In section 6.2.3, the plan explains the EPA's continued research into textile mills specifically as point source polluters. Findings have concluded that both short and long chain PFAS are in continuous use by textile and carpet manufacturers, and that these forever chemicals are present in wastewater discharges from textile mills, affecting groundwater and surface waterways. The EPA intends to generate a national profile of textile mills through a mandatory questionnaire to assess the industry's PFAS use and wastewater management (EPA 2024).

ii. State-level bans

Federal regulations focus heavily on the manufacturing of PFAS and the cleanup of their contamination, but some states (California, New York, and Colorado) have taken these regulations a step further by banning the manufacture of textile articles and apparel that contain PFAS and the sale and distribution of contaminated products. These state bans collectively went into place on Jan 1, 2025, and will be outlined below (Rothman et al. 2024).

California's state ban on PFAS use in textiles, known as the Safer Clothes and Textiles Act, prohibits the manufacture, distribution, sale, or offer for sale of any new textile articles containing regulated PFAS within the state (California Health and Safety Code §108971, 2022). This regulation defines "regulated PFAS" as PFAS intentionally added to a product or present in a product at or above 100 ppm (CA HSC §108970(g), 2022). The current threshold of >100 ppm became effective on January 1, 2025, but is set to decrease to >50 ppm on Jan 1, 2027 (CA HSC §108970(g)(2), 2022). Under California's Safer Clothes and Textiles Act, manufacturers are responsible for providing distributors with certificates of compliance (CA HSC §108970(c), 2022). The law is regulated by California's Department of Toxic Substances Control (DTSC) (Rothman et al. 2024).

Similarly, New York's state ban on PFAS use in textiles prohibits the sale or offer for sale within the state of any new apparel containing intentionally added PFAS (N.Y. Environmental Conservation Law Chapter 43-B §37-0121, 2024). The definition of "intentionally added" within the law includes any PFAS intended to enhance the functionality of the products, but excludes any PFAS that may be present as impurities (N.Y. Environmental Conservation Law Chapter 43-B §37-0121(4)(a), 2024). This regulation prohibits both retailers and other companies.

Current Federal Regulation	Description
Toxic Substances Control Act (TSCA)	The TSCA gives the EPA the authority to require reporting, testing requirements, and restrictions relating to chemical substances and/or mixtures. The EPA is requiring that any entity manufacturing PFAS (including import) after January 1, 2011, submit information to EPA regarding PFAS uses, production volumes, byproducts, disposal, exposures, and information on environmental or health effects (Federal Register 2023).
The Resource Conservation and Recovery Act (RCRA)	The RCRA governs the disposal of solid and hazardous waste, including the management of the waste from "cradle to grave." The EPA proposed a rule to amend its regulation under the RCRA to list nine more PFOA & PFOS as hazardous constituents (Federal Register 2024). Along with this rule proposal, EPA is working to clean up PFAS pollution within the RCRA Corrective Action Program. This would give regulators the authority to require cleanup actions for waste facilities, specifically storage, treatment, and disposal facilities (EPA 2024).
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	CERCLA, also known as "Superfund", regulates two PFAS (PFOA & PFOS) as hazardous substances. EPA is taking final action on these substances under CERCLA as they present substantial danger to public health, welfare, and the environment (Federal Register 2024). The rule will ensure that polluters pay to clean up the contamination.
Safe Drinking Water Act (SDWA)	In April of 2024, EPA released the final National Primary Drinking Water Regulation with standards for six PFAS. The EPA established legally enforceable levels called Maximum Contaminant Levels (MCLs) for six PFAS. Public water systems will have three years of initial monitoring before they will be required to provide the public with information of PFAS levels in the drinking water in 2027 (EPA 2024).

Table 1: Federal regulations affecting the use of PFAS in textiles.

throughout the supply chain from intentionally contaminating their products. On Jan 1, 2027, the law will be updated to enforce both unintentional and intentional usage. This addition will require the NY Department of Environmental Conservation to update the enforceable quantitative threshold level for PFAS in new apparel as well (N.Y. Environmental Conservation Law Chapter 43-B §37-0121, 2024).

Colorado has also implemented state regulations against PFAS in the textile industry, though it is currently less expansive than those set in California or New York. Colorado's PFAS Chemicals Consumer Protection Act prohibits the sale of outdoor apparel for severe wet conditions containing intentionally added PFAS, unless the product contains a "Made with PFAS chemicals" disclosure (CO Rev Stat §25-15-601 et seq. (2024)). This went into effect on January 1, 2025, with plans to be repealed on January 1, 2028. The law defines "outdoor apparel for severe wet conditions" as products that provide protection against extreme conditions, products that are designed for outdoor sport professionals, or products not marketed for common use (CO Rev Stat § 25-15-603 (2024)). In its place, a ban on all outdoor apparel for severe wet conditions and other textile articles containing intentionally added PFAS will go into effect in 2028 (CO Rev Stat § 25-15-603 (2024), Rothman et al. 2024).

These state bans will likely influence national strategies due to the size and distribution of their industry and commerce especially for textile products (Zarghamee 2025). Manufacturers in other states will be forced to comply if they want to continue to do business within these states. Therefore, a model state law is needed to promote uniformity, guidance, and adoption of PFAS regulations in the textile industry.

IV. Gaps in current policy

i. Gaps in federal policy

Gaps in federal policy on PFAS can be accredited to industry pushback, costs, and the slow progression of research to develop alternatives. This, in combination with weak enforcement of regulations, makes gaps in current policy apparent. Federal regulations such as the Resource Conservation and Recovery Act, Comprehensive Environmental Response, Compensation, and Liability Act, and Safe Drinking Water Act, are largely limited to fixed numbers of common PFAS, instead of addressing the chemicals as a class. This weak legislation leaves room for industries to maneuver around restrictions and use unregulated PFAS variants.

Similarly, PFAS' full life cycle is not accounted for under the Toxic Substances Control Act (TSCA). The TSCA exempts small-scale businesses from PFAS reporting requirements, only regulates the manufacturing stage of PFAS within the supply chain, and supports confidentiality of production import volumes and chemical identity (Ng 2021). This limits public access to data and allows for PFAS contamination in downstream products.

The EPA faces public backlash for the lack of federal regulation on PFAS as a class. Calls for cradle to grave management of PFAS and the waste that they contaminate are heard and effective, but a full ban is challenging and slow to action due to the one trillion dollars GDP annually that is attributed to industries that rely extremely heavily on PFAS (Rajesh 2025). Examples of these industries include national security, defense, energy, and healthcare. If PFAS are individually regulated, manufacturers can unethically alter their chemistry to continue use in compliance with the law.

ii. Gaps in state policy

While recent state bans have taken the lead on regulating PFAS in the textile industry, they fall short in product coverage and enforcement. California's ban on PFAS use in textiles fails to cover single-use paper hygiene products, carpets and rugs, fabric treatments, vehicles, vessels, aircrafts, industrial use filter products, textile articles used in labs and testing, fabric used in building design or construction, US military clothing, and personal protective equipment (California Health and Safety Code 108970(h)(i), 2022). In addition, the California DTSC is not authorized to begin enforcement until July 1, 2030 (California Health and Safety Code §108971, 2022).

Similarly, timely enforcement and product inclusion fall short in New York's recent law. New York's law fails to regulate professional uniforms, personal protective equipment, and outdoor apparel for severe wet conditions until Jan 1, 2028 (N.Y. Environmental Conservation Law § 37-0121(3) 2024).

Colorado has set standards for transparency, but fails to extend their law to a full ban. The law prohibits the sale of outdoor apparel for severe wet conditions containing intentionally added PFAS, unless the product contains a "Made with PFAS chemicals" disclosure. While this will promote industrial PFAS disclosure, the chemicals will still be in use, polluting the environment and putting public health at risk.

Although flawed, these bans can serve as an outline for future California, New York, and Colorado revisions along with expanded state adoptions, addressing the core issue of regulating PFAS as a class.

V. Proposed policies and next steps

i. California, New York, and Colorado bans should serve as models for other states.

State action to address PFAS pollution from the textile industry proves to be more feasible than a federal ban. Under the current Trump Administration, the EPA withdrew a pending Biden Administration plan to set new limits on PFAS discharge into drinking water. Pulling this proposal delays establishing federal standards, but also gives polluters immunity to poison water and harm public health (Corrigan 2025). State regulators waited for federal control of this issue, but with the lack of beneficial action at the federal level, states will need to implement their own regulations.

California, New York, and Colorado PFAS bans within the textile industry serve as strong models for other states. Banning PFAS as a class stops the manufacture of slightly altered carbon chains. We recommend that other states mimic these regulations, with added focus on product coverage and enforcement strategies.

State bans in California and New York will impact national strategy due to the presence of the textile industry in both states. Companies who wish to sell any products in California or New York will need to comply with the ban, influencing their production and sale strategies company wide. This fact will also influence the spread of state bans, as the national markets are affected heavily by commerce in California and New York.

Barriers to the implementation of bans among all US states are recognized due to the potential of state government opposition. Additionally, we acknowledge that individual state bans may take longer to implement in comparison to a federal ban, and may affect interstate relations within the textile industry.

ii. Implement a company transparency federal tax credit incentive.

As these barriers are recognized, we propose a less restrictive federal solution to combat any states that don't choose to adopt the legislation. We propose the implementation of a federal tax credit on PFAS use to incentivize company transparency in the textile industry nationwide.

Under the Toxic Substance Control Act, PFAS are only regulated and reported on during production within the supply chain. Mandatory reporting on this production phase does not extend to the public, blocking consumers from accessing information about the chemicals used in the products they purchase. Creating a federal incentive to disclose the presence of any PFAS chemicals in textile products will create a market demand for transparency, and boost the production of safer materials (Federal Register 2023). As it is unrealistic for all fifty states and the US territories to create bans on PFAS as a class, federal tax credits will promote companies to regulate PFAS on their own, allowing consumers to make educated purchasing decisions and push for safer alternatives.

The federal tax credit incentive would create product disclosure requirements similar to those listed within Colorado's PFAS Chemicals Consumer Protection Act. However, the federal tax credit would be offered to companies and manufacturers as an opportunity to gain consumer trust and earn offsets on taxes (Brownstein Hyatt Farber Schreck 2022). Disclosing information about the harmful chemicals used in textile products promotes the demand for sustainable business practices and new products for consumers, along with the importance of environmental and public health.

Companies within the industry have already begun to showcase disclosure efforts, to align with their company mission. In a statement recently released by Patagonia, the company disclosed to the public that starting with their spring 2025 line, all products will be made without the intentional use of PFAS. The statement is transparent to consumers, thoroughly explaining that this change includes any intentionally added PFAS, PFCs, PFOS, and PFOAs. Although they are making this shift towards sustainability, they disclose that they cannot guarantee PFAS have not been added to their products somewhere along the supply chain. They clarify that this statement only pertains to their clothing moving forward, starting with their spring line (Patagonia 2025). This statement re-enforces the Patagonia brand as a company dedicated to integrity, justice, and environmentalism by maintaining consumer transparency.

In contrast, as of February 11, 2025, the outdoor gear company Gore Tex is facing a class action lawsuit from consumers due to their lack of transparency. The Gore-Tex company brand actively promotes environmentally friendly business and advertises their commitment to sustainability while continuing to sell products with intentionally added PFAS. W.L. Gore and associates announced they would be switching to a new durable PFAS-free waterproofing treatment, but failed to disclose this would only apply to their new line and following generations. The lawsuit against them addresses the concealment of their ongoing use of PFAS in their outdoor gear (Business Wire 2025).

These examples highlight the need for transparency among textile companies, especially those who claim to support sustainability with their products. Companies that choose to participate in this tax incentive will bolster consumer trust and advocate for safe business practices. However, it is recognized that this incentive will not be enforced and therefore companies can choose not to participate.

iii. Invest in research for alternatives to PFAS.
Given the evidence of environmental and human harms, alternatives to PFAS are needed in the textile industry. As state bans and tax incentives become common, the market for research in alternative products will expand. Entities such as the National Institute of Environmental Health Sciences (NIEHS), the EPA, and the National Science Foundation (NSF) have begun allocating money for research on replacement options for waterproofing and durability. This investment will prove to be economically beneficial, and therefore aid in eliminating these forever chemicals from the industry.

University of Leeds in association with Briston conducted a study to test non-fluorinated finishes up against traditional long and short chain PFAS finishes in outdoor apparel. The results concluded that non-fluorinated finishes perform just as well as PFAS finishes in water repellency, but fall short when repelling oils. This solution is less environmentally taxing, and survey results show outdoor gear wearers prefer comfort and water repellency over oil repellency (Hill et al. 2017). Additional research into alternative finishes include biomimicry of the hydrophobic elements of the lotus flower, along with seaweed (Glenn et al. 2021, Dignes et al. 2024). These alternatives aren't extensively studied within the textile industry, but they highlight that more research into natural implementation strategies is needed (Jerič et al. 2025).

Beneficial alternatives to PFAS are emerging in the industry, but are not yet perfect solutions. Further research and development of safer replacements will help prove PFAS are non-essential in textiles.

Additionally, this paper recognizes limitations in scientific evidence and research that restrict our proposal for cleanup of existing chemicals in the environment. Investments in technologies for PFAS cleanup such as removal by adsorption, breakdown and mineralization, and detection of PFAS using Metal Organic Frameworks (MOF), need to be researched further before conclusions can be made in that regard (FitzGerald et al. 2022).

VI. Conclusion

The bioaccumulative effects of PFAS pose significant threats to public health and the environment. Current federal and state policies lack full coverage of PFAS as a class, leading to PFAS contamination throughout the supply chain and resulting in harmful biological exposures. The need for state level regulation, federal transparency incentives, and investments in research for cleaner alternatives is timely.

The policy recommendations outlined in this paper will work in conjunction to address PFAS as a class. The adoption of state bans will eliminate the use of the chemical group and impact national strategy to shift to alternative markets. Within states who do not choose to adopt the ban, a federal tax credit incentive will influence companies to transparently label their products with a PFAS disclosure. These policy recommendations can work together to promote consumer trust and stop the environmental and public harms of PFAS contamination. As these recommendations are accepted nationally, the demand for PFAS alternatives will increase. This will further the need for investments in research and establish PFAS as non-essential in the textile industry.

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Acknowledgements

Thank you to Dr. Patrick Shirey and the University of Pittsburgh Environmental Law and Policy (GEOL 1312) class for support and advice throughout the writing and editing processes of this paper. Additionally, we would like to thank our editors, Morgan Rothschadl and Mikayla Eppert for their guidance.