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**Master's degree in
Human Rights and Multi-level Governance**

**PFAS Contamination and Structural Responsibility Gaps:
Corporate and State Failures in Preventing Human Rights
Violations and Environmental Harms**

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Introduction

Chemical pollution constitutes a fundamental element of the contemporary triple planetary crisis, alongside climate change and biodiversity loss. It represents a multidimensional and complex phenomenon which has progressively reached a global scale. Among the wide range of industrial chemicals used for multiple purposes are per- and polyfluoroalkyl substances (PFAS). Defined by having the most robust single bond in organic chemistry, these compounds have exceptional chemical stability, which prevents their degradation in natural environments or within living organisms.

Manufactured since the 1950s and broadly employed in a vast range of industrial sectors and consumer products, PFAS have progressively entered the environment and everyday life (Scheringer & Schulz, 2025).

Their unique chemical and physical features, such as resistance to heat, friction, water, oil, stains, and soil, render them economically and technologically valuable. However, the same characteristics that made them highly persistent, also made PFAS extremely harmful in terms of long-term environmental and health impacts. Exposure to these chemicals is often associated with chronic forms of toxicity, meaning that their adverse effects emerge only after prolonged periods of accumulation, complicating the assessment of harm. Consequently, the availability of scientific data has often remained partial or incomplete. Moreover, PFAS were applied within an open system of production, which led to their direct release into the environment with limited oversight. Indeed, a restrictive regulatory approach could have minimised their diffusion, instead structural weaknesses failed to anticipate and prevent the risks, enabling contamination to expand before adequate safeguards were introduced. The alarming contamination of soil and groundwater has led to their detection even in rainwater and snow, suggesting that the planetary boundary for chemical pollution may already have been exceeded (Scheringer & Schulz, 2025).

Considering these premises, understanding how PFAS contamination evolved into a global environmental and public health concern, with significant implications for the protection of human rights, becomes essential. In particular, PFAS governance failures generate conditions in which multiple interconnected rights may be compromised, including the rights to health, life, water, sanitation, information, participation in

environmental decision-making, access to remediation, and the right to a clean, healthy and sustainable environment (OHCHR, 2026)

Despite the growing scientific evidence regarding the risks associated with PFAS exposure, the production and dissemination of these substances continued silently.

The present thesis seeks to examine the governance of PFAS contamination through the lens of human rights and environmental law, with particular attention to systemic gaps in the allocation of responsibility between States and corporate actors. The research question guiding this study is: How have structural gaps in responsibility between States and corporate actors contributed to the persistence of PFAS-related environmental and human rights harm despite growing scientific knowledge?

This study argues that the persistence and expansion of PFAS contamination cannot be explained only by scientific uncertainty or regulatory delay. Rather, the underlying driving force lies in the prioritisation of economic interests linked to profit maximisation and industrial expansion over precautionary intervention. Among the enabling conditions that facilitate the persistence of PFAS contamination are structural governance failures, inadequate enforcement mechanisms and fragmented responsibility between States and corporations. Collectively, these factors facilitated the normalisation of environmental degradation and human rights violations, ultimately leaving affected communities facing the long-term consequences.

While existing literature has extensively addressed toxicological impacts of PFAS exposure, the evolution of international regulation and questions of environmental justice, this thesis expands current debates by adopting a multifaceted approach. It combines perspectives from business and human rights, environmental governance, corporate accountability and the State duty to protect. Through a comparative analysis of selected case studies, the research identifies consistent patterns of regulatory fragmentation and delay, institutional inaction, corporate influence and the deliberate suppression of scientific knowledge. Moreover, careful consideration is given to the role of civil society mobilisation in revealing contamination, producing alternative forms of awareness and demanding accountability.

Methodologically, the study adopts a qualitative and interdisciplinary approach based on the analysis of academic and scientific literature, legal instruments, institutional documents, investigative reports, and civil society submissions. It employs a comparative

analysis of case studies in Italy, the United States, Japan and India in order to underline the systemic dynamics across different multi-level regulatory contexts. Importantly, non-state sources play a central role in addressing asymmetries in knowledge and regulatory oversight.

This work is divided into four main chapters. Chapter I reconstructs the historical evolution and expansion of PFAS contamination, assesses the principal regulatory frameworks governing PFAS, and introduces the comparative case studies. Chapter II examines the allocation of responsibility between corporations and States through the framework of business and human rights, focusing on due diligence standards, corporate strategies to avoid accountability, and the State duty to protect against environmental and human rights harm. Chapter III discusses the broader implications of PFAS contamination, including human rights violations and its intergenerational harm. Finally, Chapter IV explores the role of lobbying practices in reinforcing the structural conditions that enable harm to persist over time.

Chapter I - The Global Context of PFAS Contamination

This first chapter provides the empirical, conceptual and historical foundation for the analysis of PFAS contamination as a matter of human rights concern and a severe environmental issue. It aims to contextualize chemical pollution as a global emergency, examining the international regulatory frameworks developed to address the risks and pinpointing the recurring patterns in selected case studies. Importantly, this introductory chapter contributes to the overall argument of the thesis by demonstrating how corporate strategies, systemic governance failure and regulatory gaps have enabled the capillarity of PFAS contamination across different jurisdictions.

The chapter is structured in three sections. Section 1.1 traces the historical narration of PFAS contamination, focusing on temporal discrepancies related to the scientific knowledge of their potential harm. Section 1.2 explores the international responses to PFAS contamination as well as their inconsistencies. Finally, Section 1.3 presents a comparative analysis of specific case studies on Italy, the United States, Japan, and India with the objective of detecting consistent dynamics such as regulatory delays, externalization of impacts, and fragmentation of accountability.

1.1 Historical Evolution and Expansion of PFAS Contamination

Per- and polyfluoroalkyl substances (PFAS) are a large group of thousands of manufactured synthetic chemical compounds that emerged from industrial production in the 1940s (U.S. Environmental Protection Agency [EPA], 2025a). These substances are characterized by strong carbon-fluorine bonds, which make them highly resistant to chemical transformation and environmental degradation (ECHA, n.d.). This property prevents them from breaking down either in the natural environment or within the human body, leading to their long-term and permanent accumulation. Due to their exceptional persistence in water, soils, and even living organisms, PFAS are commonly referred to as “forever chemicals” (CHEM Trust, n.d.). The industrial trajectory of PFAS began with the accidental discovery of polytetrafluoroethylene (PTFE), commercially known as Teflon, in 1938 by chemist Roy J. Plunkett at DuPont, an outcome subsequently trademarked and commercialized by the company (Udasin & Frazin, 2025). Owing to PTFE’s properties such as thermal stability, low friction, and chemical resistance, it was

rapidly employed across a wide range of industrial applications and military uses. Notably, PTFE was adopted in the Manhattan Project a secret governmental research programme implemented by the United States during World War II for the purpose of developing weapons of mass destruction. The aim was to use PTFE to contain chemically reactive materials such as uranium in the development of the atomic bomb. Afterwards, PTFE expanded into mass consumer markets, through the production of non-stick cookware, surface coatings, cosmetics, and food packaging, thereby normalizing its presence in everyday life (Udasin & Frazin, 2025).

The large-scale production of PTFE relied on the use of perfluorooctanoic acid (PFOA), also called C8. From 1951 to 2000, DuPont purchased it from an external supplier, the Minnesota Mining & Manufacturing Company (3M), which produced the chemical in its U.S. facilities (Lanzavecchia et al., 2022). Many of 3M's most profitable products were underpinned by fluorochemicals, including Scotchgard, a spray that protects leather, and aqueous film-forming foams (AFFF) used by firefighters (Lerner, 2024).

Despite the widely assumed safety of fluorochemicals, long considered to be biologically inactive, both DuPont and 3M conducted studies that already indicated the toxicity of PFAS well before this information became publicly available in the late 1990s (Gaber et al., 2023). Crucially, the article "The Devil They Knew: Chemical Documents Analysis of Industry Influence on PFAS Science" reports significant discrepancies between public knowledge and internal industry records (Gaber et al., 2023). As illustrated in Figure 1 and Figure 2, industry awareness of PFAS-related health risks substantially preceded their recognition in the public scientific domain.

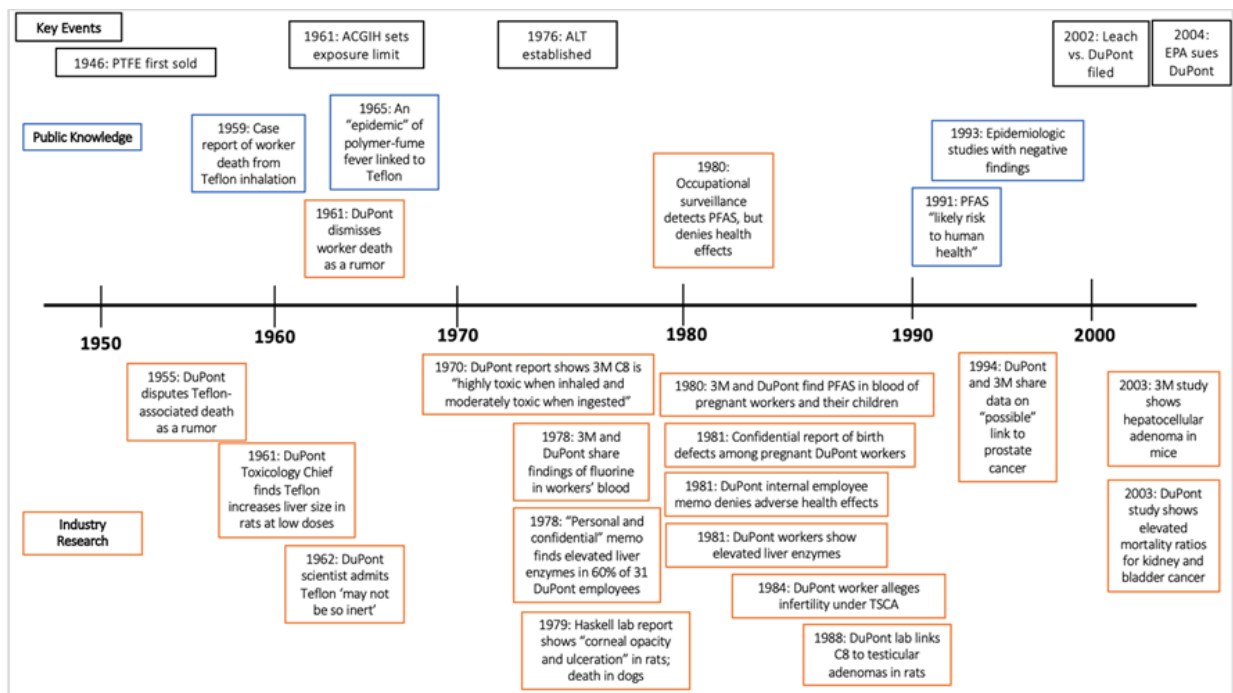


Figure 1 Timeline of public research on PFAS health effects (blue) compared to industry findings in the private domains (orange).

Source: Gaber et al., (2023).

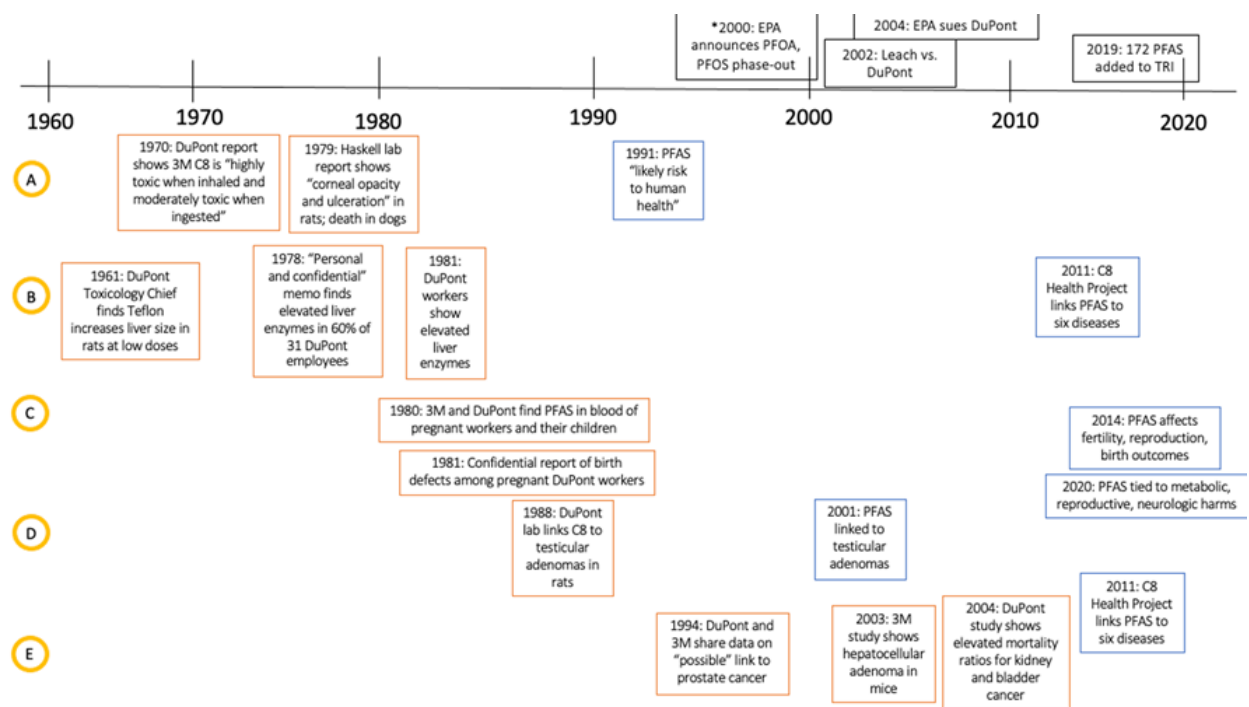


Figure 2 Extended timeline comparing industry knowledge (orange) and public scientific findings (blue).

knowledge (blue) across five key PFAS-related health effects: A= Systemic toxicity, B = Liver toxicity, C = Reproductive outcomes, D = Testicular adenomas, E = Other cancer risk.

Source: Gaber et al., (2023).

Between the 1950s and 1970s, several studies raised concerns about the potential health risks associated with PTFE exposure, such as polymer fume fever (commonly referred to as “Teflon flu”), which occurs when the material is heated to approximately 300°C. By 1962, DuPont scientists had acknowledged that Teflon “may not be so inert” when subjected to excessive heat (Gaber et al., 2023). In 1970, internal assessments by DuPont identified C8 (PFOA), supplied by 3M, as “highly toxic when inhaled and moderately toxic when ingested”; however, all these findings remained confidential. It was not until 1979 that DuPont and 3M detected PFAS in human blood. Two years later, female employees at the Washington Works plant were quietly transferred away from C8 production with little explanation. At the same time, the company reassured workers that “there is no known evidence that our employees have been exposed to C8 at levels that pose adverse health effects” (Kluger, 2023).

What actually happened diverged sharply from this constructed narrative. Results from a DuPont and 3M questionnaire revealed that two out of eight pregnancies among exposed workers resulted in babies born with birth defects, and PFAS was detected in the cord blood of one newborn (Gaber et al., 2023). These findings strongly suggest that the companies were aware that maternal exposure to PFAS could lead to the transfer of these substances to newborns through breast milk, with potential implications for congenital malformations and elevated infant mortality risks (Lanzavecchia, et al., 2022).

Consequently, the decision to reassign female employees constituted more a precautionary measure than a response to a confirmed hazard. The suppression of these unfavourable findings, specifically the questionnaire’s results which were never disclosed, further illustrates the industry’s systematic strategies to manipulate and distort scientific knowledge (Gaber et al., 2023). As Gaber et al. (2023) argues, a recurring pattern across tobacco, pharmaceutical, and chemical industries involves the deliberate delay of public awareness regarding PFAS toxicity in favour of profit maximisation. As a matter of fact, by 1980 internal research had already established that PFAS

bioaccumulate in living organisms and concentrate predominantly in human serum. At the same time, the limited commercial availability of PFOA may have hindered independent research, thereby obstructing broader scientific and regulatory progress (Gaber et al., 2023).

The year 1984 marked a crucial turning point for DuPont, as PFAS contamination had by then reached nearby community water supplies (Shapira & Zingales, 2023). Inevitably, the company was compelled to respond and considered the following options: halting C8 production, investing in abatement measures, or continuing operations as usual.

Notwithstanding the evident environmental and health risks, as well as the associated social costs, DuPont chose to double production, prioritizing economic gains while disregarding the persistent and potentially irreversible nature of PFAS pollution (Shapira & Zingales, 2023). Among the factors that incentivised the company's decision to continue polluting was its monopoly over information concerning the chemicals' dangerous effects (Shapira & Zingales, 2023). Additionally, the relative invisibility of toxic contaminants made their monitoring particularly difficult and allowed companies to evade accountability. This weakened the causal nexus between chemical exposure and its harmful impacts on people and the environment. These conditions created fertile ground for the PFAS industry to control knowledge and strategically manufacture uncertainty (Van Der Donk & Llaveró-Pasquina, 2025).

3M's practices further demonstrate this dynamic. Internal evidence exemplifies that the company downplayed the actual concentration level of PFOS found in the blood of the general public. In 1998, although 3M informed the U.S. Environmental Protection Agency (EPA) of these findings, it simultaneously specified that the detected level did not pose risks to human health or the environment. However, a significant informational discrepancy emerged: according to 3M's corporate toxicology manager, the "safe" level of PFOS was approximately 1 part per billion, whereas internal study indicated population blood concentration of roughly 30 parts per billion (Winter, 2022).

But how did substances once confined to industrial plants end up in the blood of the general population? Because of their chemical characteristics, PFAS exhibit great environmental mobility and persistence. The routes of human exposure are multiple, including drinking water, inhalation of air, dietary intake and, to a lesser degree, dermal absorption (Dehghani et al., 2025). Also, since PFAS bioaccumulate in animal tissues,

animal-derived foods represent a crucial exposure pathway within the food chain. Importantly, pollution is not limited to tap water; these chemical compounds infiltrate groundwater and aquifers, thereby affecting crops and vegetables (Dehghani et al., 2025). The widespread diffusion of PFAS is extremely concerning in light of their documented implications on human health. A growing body of research has revealed a positive association between prolonged PFAS exposure and several adverse outcomes, like thyroid disease and liver, kidney and testicular cancers (Van Der Donk & Llaveropasquina, 2025; Dehghani et al., 2025).

Significantly, the disproportionate impact on vulnerable populations, such as foetuses and children, is alarming due to links with foetal growth restriction and cognitive and behavioural difficulties in early development (Dehghani et al., 2025).

Yet the magnitude of contamination extended beyond humans, reaching wildlife even in remote areas as the Arctic (Lohmann et al., 2024). Through atmospheric and oceanic routes, PFAS were deposited in marine mammals, seabirds, fish and polar bears, ultimately entering the traditional diets of Indigenous communities and reflecting the global dispersion of these chemicals (Lohmann et al., 2024).

While the pollution spread largely unnoticed, years of internal suppression created the condition for mass litigation. A pivotal moment emerged in 1998, when a lawsuit against DuPont unveiled what would later prove to be only the tip of the iceberg. The Tennant family, cattle farmers located near DuPont's West Virginia plant claimed unexplained illness and the death of hundreds of their cows. They observed an unusual foam on the creek from which the animals were drinking, originating from discharges at a landfill owned by the fluorochemical manufacturer. The litigation that followed uncovered decades of concealed pollution caused by forever chemicals. Environmental lawyer Robert Bilott took on the case, which soon gained national attention, particularly when he exposed the hidden campaign to suppress scientific evidence (Pilz & Shaw, 2025).

In the aftermath of the Tennant case, a class action was filed on behalf of approximately 70,000 Parkersburg residents whose drinking water was affected by PFAS (Pilz & Shaw, 2025). DuPont agreed to fund the independent C8 Science Panel to investigate potential links between PFOA and human health risks. In 2011, the panel concluded that there was a probable association with six diseases (Brunswick, 2022). The litigation led to more

than 3,500 individual lawsuits and ultimately, the legal proceedings initiated in 1998, culminated in a \$671 million settlement in 2017 (Pilz & Shaw, 2025).

At this point, the spotlight turned on PFAS manufacturers. In May 2000, following a voluntary negotiation agreement with EPA, 3M announced it would phase out the production of certain per- and polyfluoroalkyl substances and develop safer alternatives (Lanzavecchia et al., 2022). But PFAS are called “forever chemicals” for a reason: once released into the environment, they persist. Consequently, although production was progressively reduced, the contamination from past emission continues to affect ecosystems and human health. By 2005, the EPA’s Guidelines for Carcinogen Risk Assessment (USEPA), affirmed that there was “suggestive evidence of carcinogenic potential” for PFOA (Donohue et al., 2016). From this moment forward, the EPA intensified its engagement with industry through voluntary initiatives. In 2006, the Agency launched the PFOA Stewardship Program: eight major PFAS manufacturers, including DuPont and 3M, committed to achieving a 95% reduction in facility emission and product content of PFOA and related chemicals by 2010, with the goal of working toward their eventual elimination (EPA, 2025b).

For instance, in 2009 DuPont in response to regulatory and legal pressure, substituted PFOA with the chemical compound HFPO-DA¹ known by the trade name GenX. The introduction of GenX was intended to replicate the performance properties of Teflon, notably its non-stick and low-friction characteristics. However, emerging scholarship framed this shift as an instance of regrettable substitution, where hazardous chemicals are replaced with related compounds whose long-term safety remains uncertain (Cordner et al., 2025). Although GenX was labelled by DuPont as “a more sustainable solution that includes a new processing aid with a favourable toxicological profile and very rapid bioelimination”, subsequent studies have called its potential toxicity into question. Evidence has not only indicated possible carcinogenic effects associated with GenX but has also suggested that the company knowingly released the compound into air and water. In the meantime, DuPont spun off into Chemours Company in 2015, thereby transferring liability for past contamination, while production of GenX continued at the Fayetteville

¹ HFPO-DA (hexafluoropropylene oxide dimer acid) is a short-chain PFAS which was historically considered a safer alternative to long-chain compounds. However, current scientific debates increasingly question this assumption, as a growing body of literature suggests potential risks to human health and the environment (Lendewig et al., 2025).

Works facility in North Carolina. The replacement of PFOA in the Teflon production process did not eliminate the underlying risks; rather, contamination persisted under new chemical formulations. Elevated concentrations of GenX were detected in the Cape Fear River, a primary source of drinking water for Wilmington (Cordner et al., 2025).

Taken together, these dynamics exposed a systemic pattern in which the overarching goal was the pursuit of profit through the strategic manufacture of uncertainty, often at the expense of social and environmental well-being (Cordner et al., 2025).

The entrenched industrial practices documented above proved the global scale of contamination that followed. PFAS ubiquity is evident from their planetary diffusion, which extends far beyond the original sites of industrial production. In 2023, an investigation by the Forever Pollution Project identified nearly 23,000 sites across Europe contaminated by these forever chemicals (The Forever Pollution Project, 2023).

The report “The cost of PFAS pollution for our society” (European Commission, 2026) emphasized the massive monetary impacts of PFAS contamination. It estimates that if current levels of PFAS pollution in Europe continue without stronger regulatory intervention, the societal costs could reach €400 billion by 2050, considering only four types of PFAS. Preventing PFAS releases at the source by 2040 could reduce these costs by about €110 billion, while treating contaminated water alone would exceed €1 trillion. Similar conclusions are reported in preliminary research indicating that preventing PFAS emission at the source would be significantly less costly and more effective than remediation strategies after contamination occurs (Ling et al., 2026).

In addition, the Global South faces a disproportionate risk. Given that the regulations in the Global North have gradually tightened, industrial production is increasingly likely to concentrate in countries with weaker environmental oversight and more limited public awareness of PFAS risks. Significantly, elevated levels of PFAS have been documented even in countries such as Japan, China, and South Korea, and in several Asian regions including India, Bangladesh, Vietnam, Singapore, Thailand, Malaysia underlying the global reach of this contamination (Van Der Donk & Llaverio-Pasquina, 2025; Podder et al., 2021)

Overall, these considerations set the stage for the following section, which examines the regulatory responses and governance frameworks addressing PFAS contamination.

1.2 Regulatory Framework

PFAS regulation has evolved significantly worldwide following the recognition of their adverse impacts. Nevertheless, the delayed acknowledgment of their risks, combined with the long-standing assumption of their safety, continues to impose substantial burdens on both humans and the surrounding ecosystems. This section covers the key regulatory milestones concerning PFAS, with particular focus on the United States and the European Union, while also providing a general overview of the Asia-Pacific context. This geographical choice reflects the transnational scope of the case studies selected for the thesis and enables a broader examination of regulatory responses across different jurisdictions.

Decades after the initial development of PFAS, the United States founded the Environmental Protection Agency (EPA) in 1970 with the aim of addressing the growing public concern over environmental deterioration, thereby centralising federal environmental responsibilities (EPA, 2025c).

Six years after its establishment, a pivotal legislative milestone was reached with the adoption of the Toxic Substances Control Act (TSCA), designed to regulate the manufacture, processing and distribution of chemical substances. TSCA granted the EPA authority to review existing chemicals through risk evaluation, and, where necessary, to restrict or eliminate unreasonable risks. For new chemicals entering the market, the Act requires a preliminary review prior to commercial introduction to assess their safety (Earthjustice, 2026).

Building on this, in 2024, the EPA implemented the National Primary Drinking Water Regulation (NPDWR) under the Safe Drinking Water Act (SDWA) to address the risks posed by PFAS in drinking water. This regulation establishes legally enforceable standards for six PFAS compounds, aiming to protect public health from their effects (Dobrzyńska et al., 2025). While the NPDWR represents a nationwide measure, the US regulatory system remains fragmented, lacking a comprehensive federal strategy to address PFAS contamination and relying on a mosaic of state-level regulations (Lendewig et al., 2025).

Critical analyses have stressed the structural limitations of the U.S. regulatory framework. In particular, the EPA developed an inventory of 62,000 industrial chemicals already in use at that time under the TSCA, which were effectively grandfathered into the market

and presumed safe by default (Krimsky, 2017). A central limitation of the original TSCA framework, before its 2016 revision, concerned the allocation of the burden of proof for chemical safety. Under this structure, the responsibility fell primarily on the EPA to demonstrate that a chemical posed an unreasonable risk. Moreover, before a substance could enter into the market, chemical manufacturers were required to notify the EPA by submitting a premanufacture notice (PMN). However, because PMNs often contained limited health and safety data, the EPA frequently lacked sufficient evidence to restrict or prevent market entry, allowing many substances to enter commerce in the absence of adequate toxicological information (Krimsky, 2017).

While the 2016 reform of TSCA strengthened EPA's authority and chemical oversight, Richter et al. (2021) emphasized that the U.S. regulatory framework has functioned as a system characterized by institutionalized ignorance. Among the factors that fostered these structural weaknesses were the information and timing gaps, the lack of independent evaluation of chemical substitutions, and the heavy reliance on industry-generated data. Within this configuration, ignorance was actively produced and maintained by the very architecture of the regulatory process. As the authors further note, this dynamic mirrors the phenomenon of "regulatory capture", in which regulated industries exert influence over the agencies tasked with regulating them. A key pathway of this influence is the "revolving door", whereby personnel move from regulatory agencies to industry jobs and vice versa. This circulation creates favourable conditions for bypassing regulation, driven by personal networks and consolidated institutional knowledge. A critical issue of this process is its embeddedness in the U.S. regulatory system, specifically visible in environmental governance, including the Trump administration's approach to the EPA (Richter et al., 2021). A concrete illustration of these dynamics can be found in the case of the Tennant family in West Virginia, where the process to hold DuPont accountable was significantly delayed. Subsequent investigations revealed that individuals involved in the regulatory response later transitioned into professional roles linked to DuPont, as well as several attorneys working on C8-related cases for the company eventually became regulators in the EPA (MacLean, 2025).

Altogether, in the PFAS case, these elements undermined the production of impact-oriented scientific knowledge, facilitated selective ignorance, and enabled the global expansion of PFAS (Richter et al., 2021). Hence, at the root of this silent and widespread

expansion lies the cumulative effect of both regulatory shortcomings that structurally favoured the chemical industry and the strategic (in)action of manufacturers (Dosunmu et al., 2025).

Before examining specific regulatory frameworks, it is necessary to highlight the key challenges that complicate effective PFAS governance, including the lack of harmonised standards, inconsistencies in PFAS definitions, and persistent economic and industrial resistance (Yu et al., 2025). In this regard, Yu et al. (2025), in their assessment of the regulatory status of PFAS under the TSCA, found that 36.3% of PFAS are classified as substances of Unknown or Variable composition, Complex reaction products, or Biological materials (UVCB), many of which are identified as persistent, bioaccumulative, and toxic. This high level of ambiguity underscores the need for a coordinated global response (Yu et al., 2025).

Against this backdrop and, beyond the U.S. regulatory context, a crucial step in the international arena was the adoption of the Stockholm Convention on Persistent Organic Pollutants (POPs) in 2001, which entered into force in 2004. The global treaty was signed by 152 countries and currently counts 186 Parties, reflecting widespread commitments to addressing persistent chemical pollutants. As of 2026, only selected PFAS subgroups, most notably PFOA, PFHxS and long-chain PFCAs, are listed in Annex A of the Convention, requiring Parties to implement measures aimed at eliminating their production and use. PFOS, by contrast, remains subject to restriction under Annex B, reflecting a partial approach that allows for continued use in specific applications².

This selective regulation underscores the challenge of addressing an entire chemical class composed of thousands of variants (Häubi & Turuban, 2025). Additionally, a major limitation in the enforcement of the Stockholm Convention lies in its implementation architecture, which is based on National Implementation Plans (NIPs). According to Article 7, Parties are required to develop these plans in order to outline how the obligations under the Convention will be fulfilled at the domestic level (Secretariat of the Stockholm Convention, n.d.). However, because this mechanism relies on national regulatory capacity and political willingness, its effectiveness may vary across

² Stockholm Convention on Persistent Organic Pollutants (adopted 22 May 2001, entered into force 17 May 2004) 2256 UNTS 119.

jurisdictions, potentially resulting in uneven levels of protection and gaps in environmental and human rights accountability.

At the European level, the regulatory landscape has increasingly shifted toward group-based restrictions on PFAS, rather than the regulation of individual substances (Yu et al., 2025). The Regulation on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), which entered into force in 2007, aims to ensure the protection of human health and the environment against chemical pollutants³. Under REACH, companies bear the primary responsibility for identifying and managing the risks associated with the substances they use and must submit relevant safety information to the European Chemicals Agency (ECHA). The Regulation also dedicates Article 33 to strengthening consumer protection, by establishing the right to know whether products contain Substances of Very High Concern (SVHC)⁴.

In parallel, the European Union implements the obligations of the Stockholm Convention through the EU Regulation on Persistent Organic Pollutants (POPs Regulation 2019/1021)⁵ which bans or restricts the use and production of the substances listed under the Convention.

More recently, in 2020, the European Commission adopted The Chemical Strategy for Sustainability: Towards a Toxic-Free Environment, a central pillar of the European Green Deal that aims to implement the Zero Pollution ambition for 2030, including actions intended to progressively phase out PFAS across the European Union. Additionally, the Strategy embraces a group-based approach to regulating PFAS as a chemical class, with the objective of preventing the cycle of “regrettable substitution”, where banned substances are replaced with structurally similar compounds, whose risks remain insufficiently understood (ECHA, n.d.).

Another important step forward was the 2023 proposal for a universal restriction on PFAS, submitted by the authorities of Denmark, Germany, the Netherlands, Norway, and

³ Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) [2006] OJ L396/1.

⁴ Regulation (EC) No 1907/2006, art 33.

⁵ Regulation (EU) 2019/1021 on Persistent Organic Pollutants, which implements the obligations of the Stockholm Convention within EU law. The Regulation has been subsequently amended to incorporate additional substances listed under the Convention, including PFOA and its salts and related compounds (Commission Delegated Regulation (EU) 2020/784) and PFHxS, its salts and related compounds (Commission Delegated Regulation (EU) 2023/866).

Sweden. The initiative aims to introduce a grouping approach limiting the manufacture, use, and placing on the market of PFAS, representing one of the most ambitious regulatory initiatives to move towards a PFAS-free economy within the EU. As of the time of writing, however, the proposal remains under evaluation by ECHA's scientific committee (RAC and SEAC) (ECHA, n.d.).

Outside the United States and the European Union, regulatory responses have also emerged across the Asia-Pacific region, with countries such as China, Japan, South Korea, Australia and New Zealand progressively adopting measures to restrict PFAS (Dobrzyńska et al., 2025).

At the regional level, the Asia-Pacific Economic Cooperation (APEC) plays a crucial role in promoting collaboration on chemical governance, and environmental protection while supporting member economies in tackling PFAS. Still, regulating PFAS remains challenging due to disparities among economies and differences in regulatory capacities. Even so, APEC initiatives such as the Chemical Dialogue aim to foster the exchange of information and best practices, and harmonize standards across the region (Yu et al., 2025). The goal of this section was to provide an overview of the global regulatory responses to an already widespread chemical contamination, characterized by delayed intervention and persistence dependence on industrial knowledge production. Despite the progressive strengthening of oversight mechanisms, significant gaps continue to enable the circulation of PFAS across jurisdictions, carrying implications for the protection of human rights. The next paragraph will present concrete case studies, illustrating how apparently local incidents progressively escalated into a planetary emergency.

1.3 Case Analysis: Recurring Dynamics

The intent of this section is to critically analyse the sequence of events in Trissino (Vicenza), Japan, and India with the objective of uncovering the common thread linking these cases to DuPont and 3M and exposing recurring dynamics behind PFAS contamination. These countries were selected because they exemplify different stages and contexts of the widespread diffusion of PFAS across continents.

In the 1960s, in the Vicenza region, the prominent Marzotto family, long associated with the textile industry, established a laboratory dedicated to the chemical experimentation of synthetic materials, known as Ri. Mar.

It was here that some of the first stain-resistant, oil and water repellent treatments were studied, technologies that had been introduced to Italy through U.S. military research. Initially, the Marzotto industrial model promoted a close relationship with the local community, presenting itself as an enterprise aligned with the welfare of the surrounding population. However, as industrial production intensified, this relationship gradually weakened (Peruffo, 2022).

In the decades that followed, multiple incidents involving the release of hazardous products were documented, beginning in 1966. The leaked substance belonged to the family of perfluoroalkyl compounds (PFAS), chemicals used in the manufacture of fluoropolymers such as Teflon, commercialised by DuPont and historically produced by 3M. It is worth noting that by the 1970s, both companies had already detected PFAS in human blood and in foetuses, yet production continued unimpeded. During this period, Ri.Mar. and 3M became global leaders, collectively manufacturing up to twelve tons of PFAS per year (Peruffo, 2022).

As the environmental impact became increasingly apparent, several local wells were closed due to contamination and Ri.Mar. was brought to trial. However, according to the court's judgment⁶, the lack of sufficient evidence regarding the dangers of these chemicals in drinking water led to the dismissal of the case, and Conte Marzotto was ultimately discharged (Peruffo, 2022).

In the meantime, Ri.Mar evolved into the joint venture Miteni, which would later become one of the most environmentally hazardous industrial sites in the region due to its PFAS-related activities. In 2009, the company was sold to the investment fund International Chemical Investors Group (ICIG) for the symbolic price of one euro. The contaminated area extends over 180 km², exposing 400,000 residents to PFAS contaminated water. Yet it was not until 2013 that public authorities officially declared a PFAS emergency (Lanzavecchia et al., 2022).

However, the public recognition of the urgency of the issue was not sufficient to halt production. In fact, the company received authorisation from the Veneto Region to manufacture GenX (Lanzavecchia et al., 2022).

From 2016 onwards, civil society became aware that the population had been chronically exposed to toxic contamination and soon began to mobilise. Thousands of people

⁶ Pretore di Vicenza, Judgement No. 416, 14 April 1979

participated in protests, and grassroots movements such as Mamme No PFAS emerged, bringing together ordinary mothers from the affected areas. As shown in Figure 3, large scale demonstrations took place in 2017 due to the inadequacy of institutional responses.



Figure 3 Protest organised by “Mamme No PFAS” movement in Lonigo (Italy), 2017, with approximately 11,000 participants.

Source: Mamme No PFAS, (n.d.).

Their mobilization was largely driven by the shock of discovering the health impacts of chemical exposure on their children (Menegatto et al., 2022). In response to the inaction of institutions, they began gathering information, learning about PFAS contamination, and raising public awareness on the issue. By doing so, they contributed to the production and spread of knowledge beyond institutional and scientific arenas (Menegatto & Zamperini, 2024).

In 2017, environmental lawyer Robert Bilott, known for his legal action against DuPont in the U.S., visited Italy, drawing attention to the interconnection between the practices of the American company and those of Miteni. Evidence suggested that both were aware of the dangers of PFAS. As public scrutiny increased and investigations progressed, Miteni's reputation deteriorated significantly after being accused of environmental crimes. In 2018, the company ultimately declared bankruptcy (Lanzavecchia et al., 2022). The trial that followed must be understood within the context of environmental justice.

In 2025, the Vicenza Court convicted eleven managers of former Miteni for serious environmental offences, intentional water poisoning, and deliberate environmental disasters, amounting to 141 years of imprisonment. The Court issued a landmark ruling, finding that the company knowingly continued its operations for decades despite awareness of the harmful effects of PFAS. While production had already begun in the late 1960s, the regional environmental protection agency (ARPAV) first discovered contamination in 2013 across an area affecting 350,000 residents. As a result of this long and complex judicial process, more than 300 civil parties received substantial compensation (Human Rights Center, 2025b).

Furthermore, in separate labour proceedings, the Court established for the first time a causal connection between a worker's death and exposure to PFAS. The victim was a former employee of Miteni, where he worked from 1978 to 1992. He died in 2014 from renal pelvis cancer, a disease attributed to long-term exposure to PFOA and PFOS (Human Rights Center, 2025a). This temporal gap between prolonged accumulation of PFAS and manifestation of disease signals the chronic nature of PFAS toxicity, which often hinders causal attribution and recognition of harm.

From a human rights perspective, this case law demonstrates how environmental contamination can translate into violations of fundamental rights, notably the right to work in safe and healthy conditions, especially when interpreted in light of Article 1 of the Italian Constitution, which frames the Republic as founded on labour (Human Rights Center, 2025a).

The attribution of criminal responsibility, together with the first court recognition of a connection between PFAS exposure and occupational disease, represents a significant advancement in the evolution of environmental law and corporate accountability in Italy.

Subsequent scientific research further confirmed the severity of the contamination. A study conducted by Biggeri et al. (2024), published in *Environmental Health*, constitutes one of the first documented analyses of the two main pathways of groundwater and food contamination in the so-called “Red Area” of the Veneto region.

The research reported a significant association between PFAS exposure and increased mortality from cardiovascular diseases and cancers in the affected municipalities. In particular, it estimated 3,890 excess deaths between 1985 and 2018 compared to the expected rates (Biggeri et al. 2024).

Greater vulnerability is observed among individuals exposed at younger ages, pointing to an unequal distribution of harm across generations (Biggeri et al. 2024). These results suggest that the human rights implications of PFAS contamination extend to serious threats to the right to life and health, reinforcing the responsibility of states to protect affected populations from irreversible environmental harm. This is particularly significant in light of the established findings of corporate responsibility for the contamination.

The Trissino case illustrates how a local incident escalated into an international issue, demonstrating the key role of civil society mobilisation in challenging corporate practices and pushing regulatory and institutional responses.

Unlike Italy, where PFAS contamination originated from industrial production, the case of Japan centres around military activity.

The relevance of contamination in Japan is closely linked to the presence of 78 U.S. military facilities, which have been identified as potential sources of contamination in Okinawa, where no industries manufacturing PFAS are present, as well as in mainland Japan. As previously noted, AFFF (aqueous film forming foam), a firefighting agent produced by 3M, contains PFAS. Although the Japanese government has affirmed that it possesses large stocks of AFFF within its Self-Defense Forces, the results of this study reveal that three main pathways of contamination were linked to firefighter training activities, accidental leaks of AFFF, and the disposal of AFFF on military bases (Mitchell, 2020). Moreover, the peculiar nature of Japan-U.S. relations stems from bilateral agreements, such as the Japan-US Status of Forces Agreement (SOFA), which grants the U.S. military a high degree of regulatory autonomy, including control over access to installations and limitations on local inspections. The revision of SOFA has therefore become a contested issue among civil society groups and local governments, due to the

lack of environmental accountability and the asymmetric nature of the agreement in favour of the U.S. (Akiko, 2024).

Okinawa alone hosts 31 U.S. military facilities, many of which are located near drinking water sources. The first public announcement of elevated levels of PFOS in water near the bases, came in 2016. In 2019, both PFOA and PFOS were detected in the residents' blood, at levels respectively more than double and four times the national average (Mitchell, 2020).

A recurring feature of PFAS contamination cases is the systemic lack of transparency surrounding environmental information. In Japan, several investigations (Mori, 2022; Mitchell, 2020) relied on requests filed under the Freedom of Information Act (FOIA), which allows the public to request access to government records. These investigations revealed years of unreported data on military contamination in Okinawa and mainland Japan (Mitchell, 2020).

Another important common element is the instrumental role of local environmental activism. In Japan, a network of environmental experts and local media helped inform and educate the public through a variety of strategies, including the tactical use of FOIA requests, engagement with public institutions, the dissemination of scientific knowledge, and the spread of information through local mass media (Mori, 2022).

The Japanese case highlights how bilateral agreements can obscure environmental accountability. This practice, as the political scientist Shinji Kawana describes, is a form of “security blocking”, meaning a political strategy used to suppress information about U.S. military operations from public scrutiny (Mori, 2022).

While the recent Indian case differs in context, focusing on the reallocation of industrial production rather than military activity, it similarly illustrates how PFAS contamination can spread under conditions of limited oversight. This example reflects the growing trend discussed in the first section of this thesis: the transfer of polluting industrial infrastructure from Global North to the Global South, where environmental regulation is often weaker. Critics have labelled this phenomenon as “pollution colonialism” where major polluters remain the least affected by the harm they generate, whereas environmental costs are externalised to countries of the Global South where labour costs are significantly lower (Sharma, 2025; NewsGram, 2025).

From an environmental justice perspective, this dynamic reflects broader postcolonial patterns of unequal ecological exchange, through which environmental risks and pollution are disproportionately displaced onto already vulnerable populations (Li et al., 2025).

Several investigative reports have uncovered a concealed connection between the former Italian company Miteni and Laxmi Organic Chemicals, an Indian corporation located in Lote Parshuram, south of Mumbai (IJ4EU, 2025).

After Miteni's collapse, Laxmi Organic acquired the company's assets in 2019, as well as its plant machinery, technical documentation, REACH registrations and patents. The acquisition also entailed the transfer of technical expertise and production know-how developed at the Trissino facility, enabling the Indian company to replicate the chemical processes previously carried out in Italy. Consequently, the aim was not only to continue the production of fluorochemicals but also to inherit part of Miteni's market share by leveraging its established industrial capabilities (Liva et al., 2025).

The equipment was dismantled, shipped to India, installed at the company's industrial site, where production started in 2025 (Phadke, 2025).

In preparation for production, Laxmi Organic relied on Miteni's existing commercial relations and began sending chemical samples to several multinational companies, including Chemours and DuPont. (Liva et al., 2025).

Moreover, PFAS contamination primarily affects industrial regions, placing a disproportionate burden on nearby communities, especially those whose livelihoods and diets depend on local fisheries (Gautam et al., 2025).

More broadly, the Lote Parshuram industrial district has long been affected by environmental degradation. Several incidents have already been reported, raising concerns about the company's compliance with environmental discharge standards. During frequent power cuts, the wastewater treatment plant cannot function properly, and industrial effluents may be discharged directly into water streams (Liva et al., 2025).

This situation, together with the absence of specific regulations addressing PFAS in India, further indicates the urgency to establish regulatory limits and monitoring programs (Gautam et al., 2025).

As stated in the beginning of this section, the ultimate objective was to reveal the recurring patterns that characterise PFAS contamination. These dynamics help to delineate the common thread linking DuPont, 3M, Trissino, Japan and India.

In all cases, contamination is identified relatively earlier through scientific knowledge. However, such detection often remains confined to corporate actors, whose power allows them to manipulate and obscure information, preventing the public from becoming aware of the risks.

Despite emerging evidence of harm, production generally continues because of its profitability, allowing contamination to persist and expands over time and space. As a result, institutional responses tend to be inadequate and fragmented, while corporate actors are able to evade accountability mechanisms.

Meanwhile, as the impacts accumulate, civil society groups, activists and research begin to investigate and mobilise. Through these efforts, a local environmental issue may become a public political problem, eventually leading to regulatory intervention.

But regulatory pressure may also contribute to the geographical reallocation of hazardous production elsewhere, thereby reproducing the vicious cycle.

The recurrence of similar dynamics across different continents illustrates how environmental harm can remain largely invisible for extended periods of time. For this reason, PFAS pollution has often been interpreted as a form of slow and destructive violence (Tola & Boscolo, 2025).

In this sense, the notion of slow violence developed by Rob Nixon refers to the environmental threats that unfold gradually, whose lethal effects are often underestimated and remain largely unnoticed. This inevitably aggravates the vulnerability of both people and ecosystems (Nixon, 2011).

These dynamics prompt essential questions concerning the obligations of corporations and states under international human rights law, which will be addressed in Chapter II.

Chapter II - Responsibility for PFAS Contamination

The endurance of harm caused by PFAS contamination, despite growing scientific knowledge, coupled with delayed institutional responses and limited public awareness, creates significant challenges in attributing responsibility. The intent of this second chapter is to contribute to answering the research question by delving into the structural conditions of responsibility that enable such harm to persist over time.

This section therefore examines the extent to which corporate actors and states can be held accountable for such long-term environmental and health impacts. It begins by contextualizing the international framework on business and human rights, as well as its limitations and strategies corporations may use to evade accountability. The discussion, then, will turn on state duties and failures in protecting public health and the environment.

2.1 Corporate Responsibility

2.1.1 International Standards and Due Diligence Framework

The issue of corporate responsibility has long been debated within international law. One of the earliest attempts to address this question was the United Nations Global Compact (UNGC), launched in 1999 as a voluntary international initiative on corporate sustainability aimed at promoting responsible business practices. Participating companies commit to aligning their operations with the Ten Principles relating to human rights, labour, the environment and anti-corruption (UN Global Compact Network Italia, n.d.). Nevertheless, despite its ambitious scope, the UNGC lacks binding enforcement mechanisms, which limit its effectiveness. As a matter of fact, its soft law nature combined with the vagueness of its provisions, leads scholars to describe it as more of a “guide dog” rather than a “watchdog” (Joseph & Kyriakakis, 2023).

Moreover, it increases the risk of “blue washing”, a deceptive practice in which corporations present themselves as aligned with United Nations values without introducing substantive changes (Macchi, 2022).

In response to the limitations of voluntary initiatives, a more far-reaching attempt to define corporate accountability emerged with the “UN Norms on the Responsibilities of

Transnational Corporations and Other Business Enterprises with Regard to Human Rights”. The Norms constitute a code of conduct based on international human rights standards, drafted by a working group of the United Nations Sub-Commission on the Promotion and Protection of Human Rights and adopted in 2003. They represent an important milestone, as their scope goes beyond pure voluntarism by including mechanisms of implementation (Macchi, 2022) and pointing towards more binding forms of regulation (Joseph & Kyriakakis, 2023).

The Norms affirmed that corporations have the obligation to promote, secure the fulfilment of, and to ensure respect for human rights within their sphere of influence and activities⁷. However, they encountered strong opposition from companies, business organizations and several governments, due to concerns over the duplication of pre-existing agreements, the potential discouragement of investment, and the allocation of responsibilities to corporations that were traditionally considered to belong to states (Osorio, 2004).

The failure of the Norms to design a comprehensive “non-voluntary” framework and a binding code of conduct, left greater space for further developments.

In light of the need for an international framework to govern corporate responsibility, the Special Representative of the Secretary General on business and human rights (SRSG) appointed Professor John G. Ruggie to elaborate a structured approach clarifying the roles and duties of businesses in respecting human rights. This resulted in the UN Guiding Principles on Business and Human Rights (UNGPs), formally endorsed by the UN Human Rights Council in 2011.

The emergence of the UNGPs needs to be viewed through the lens of what Ruggie referred to as the “governance gap” in the context of globalisation. These gaps arise from the inconsistencies between the influences of economic forces and the ability of societies to address their negative impacts. As a result, companies operate in a tolerant environment where they can engage in harmful practices without being subject to adequate oversight, or sanctioning (Ruggie, 2008, para.3).

The UNGPs indeed seek to address these gaps and are built around a tripartite articulation that follows the “Protect, Respect, and Remedy” Framework: the state duty to protect

⁷ Sub-Commission on the Promotion and Protection of Human Rights 2003, Section A - General Obligations.

human rights, the corporate responsibility to respect human rights, and the need for access to effective remedies for victims of business-related abuses (Macchi, 2022).

Although constituting a soft law instrument, the foundational principles of the second pillar imply that corporations bear a responsibility to respect human rights and “do no harm”, independently of state duties.

Additionally, Guiding Principle 13 clarifies the scope of this responsibility, specifying that companies may cause or contribute to adverse human rights impacts through their own activities or omissions, and as well as through their business relationship with other entities (OHCHR, 2011). In this context, “contribution” refers to situations in which corporate behaviour increases the risk of harm, although it is not sufficient in itself to cause it. In cases of direct contribution, a causal link to the negative impacts can be established, and companies are therefore expected to cooperate in their remediation (Macchi, 2022).

This responsibility can be fulfilled through effective human rights due diligence (HRDD) processes aimed at identifying, preventing and mitigating human rights impacts (OHCHR, 2011). An initial step is conducting a human rights impact assessment (HRIA) both at the operational level and across the value chain. The results should be integrated into internal actions and policies, giving particular attention to vulnerable populations such as women, indigenous peoples, children, and persons with disabilities. The activities implemented in response to HRIA, should be tracked in order to monitor their effectiveness, and their outcomes communicated and reported externally, as a measure of transparency (McCorquodale, 2024).

Crucially, the rationale under Pillar II is rooted in what has been defined as the basic expectation that society holds of business conduct. While under the first pillar states’ responsibilities are grounded in legal obligations under international human rights law, corporate behaviour is instead linked to their social licence to operate, namely a non-legal concept. Failure to meet these expectations, may negatively affect companies’ reputation (Ruggie, 2008).

The reliance on the notion of social expectations as a foundation of the responsibility to respect has been widely discussed in literature. As argued by Macchi (2022), the approach adopted by Ruggie risks reducing international human rights law to a mere benchmark for acceptable corporate behaviour. In this sense, given the inherently variable and

evolving nature of social expectations, the normative strength of the corporate responsibility to respect is weakened. Moreover, companies may be incentivised to respect human rights, as this aligns with their economic interests, for instance by enhancing their reputation and competitive position (Deva, 2012). However, as Deva (2012) emphasises, such a justification downgrades human rights to mere instruments of profit maximisation, thereby undermining their intrinsic normative value. This dynamic becomes particularly problematic when respecting human rights conflicts with profit-making, allowing harmful practices to persist.

This critique is further reinforced by Deva, who underlines that adherence to human rights norms should not be conceived as a strategic choice, but rather as a “non-negotiable condition of doing business”. From this perspective, the idea of implementing the “profit with principles” justification requires a structural rethinking of the role of business in society, ultimately contributing to the overall objective of humanizing business (Deva, 2012). In this regard, companies should prioritise the common good over the exclusive pursuit of shareholder profit and integrate the interests of a broader range of stakeholders. Furthermore, measures such as conducting mandatory human rights due diligence and the disclosure of non-financial information would strengthen corporate accountability. These represent some of the transformative changes identified by the author, which are necessary to address corporate irresponsibility and prevent the persistence of human rights harm (Deva, 2012).

In this framework, the Organisation for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises were originally adopted in 1976 and revised in 2011 to align with the UNGPs. They constitute a series of recommendations for multinational enterprises; therefore, they have a non-binding nature. They are supported by an implementation mechanism, the National Contact Points for Responsible Business Conduct (NCPs) through which human rights complaints can be brought against businesses acting inconsistently with the OECD guidelines (Ruggie & Nelson, 2015).

The 2023 revision of the OECD Guidelines tackles pressing global challenges, including climate change and the environmental impacts of business activities. As underlined by Macchi (2022), the responsibility to respect should be understood in a comprehensive manner. Given that environmental harm has increasingly been recognised in jurisprudence as a human rights violation, corporate responsibility cannot be confined to

international human rights law but must encompass international environmental law and climate law.

In fact, Chapter VI of the OECD Guidelines explicitly addresses environmental protection and outlines key elements of environmental due diligence. These include the adoption of climate related policies, the assessment of risks, the implementation of mitigation measures, the monitoring of outcomes, the communication of information on the process, and cooperation in remediation (OECD, 2023).

However, the effectiveness of these non-binding instruments remains constrained by their self-regulatory and voluntary nature. This creates a gap between formal commitments and actual corporate practices, enabling companies to publicly adopt principles of social responsibility whilst perpetuating harmful activities (Greenpeace & SOMO, 2018).

The move towards binding regulation of corporate conduct at the European level is reflected in the adoption of the Corporate Sustainability Due Diligence Directive⁸, which establishes obligations for companies to address adverse human rights and environmental impacts in their operations and across their value chains. Mieszkowska (2024) identifies several potential unwanted consequences of the Directive. Among these, the most directly relevant for this study is the possible withdrawal of EU businesses from suppliers or jurisdictions perceived as too “high-risk”, a strategy that may lead to ended contracts, job losses, or the reallocation of supply chains to territories with less stringent regulations.

Recent developments further exemplify the difficulties of reconciling European Union competitiveness and corporate economic interests with the urgent need to foster sustainable development. In 2026, the EU Council adopted a simplification package aimed at lightening sustainability reporting, increasing the threshold for large companies, and limiting the “trickle-down effect” of due diligence requirements on smaller companies (Council of the European Union, 2026).

Beyond regional efforts, the United Nations Human Rights Council adopted in 2014 Resolution 26/9⁹ and found an open-ended intergovernmental working group on transnational corporations and other business enterprises with respect to human rights. The mandate of the OEIWG is “to elaborate an international legally binding instrument

⁸ Directive (EU) 2024/1760 of the European Parliament and of the Council of 13 June 2024 on corporate sustainability due diligence and amending Directive (EU) 2019/1937 and Regulation (EU) 2023/2859 (CSDDD)

⁹ Full text available at: <https://documents.un.org/doc/undoc/gen/g14/082/52/pdf/g1408252.pdf>

to regulate, in international human rights law, the activities of transnational corporations and other business enterprises”. The initiative was conceived to meet the shortcomings and growing dissatisfaction with soft law principles. However, as highlighted by the author Zamfir (2018) of the European Parliament Briefing, the complexity of the subject and the broad scope of the instrument may slow down the negotiations. In fact, as of 2026, the sessions are still ongoing.

Despite the progressive development of international and regional frameworks, the continued occurrence of environmental harm and human rights violations highlights the need to move past normative commitments and critically examine their practical implementation, as well as the ways in which companies respond to these standards.

2.1.2 Corporate Practices and Strategies to Avoid Accountability

Having set the baseline of the most relevant international instruments, this section critically analyses the gap between normative expectations and actual business practices, as enriched by the case of PFAS.

Importantly, a joint allegation letter issued under the Special Procedures of the United Nations Human Rights Council and addressed to DuPont raised serious human rights concerns related to PFAS contamination (OHCHR, 2023). The communication was supported by the Special Rapporteur on the implications for human rights of the environmentally sound management and disposal of hazardous substances and wastes; Working Group on the issue of human rights and transnational corporations and other business enterprises; Special Rapporteur on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment; Special Rapporteur on the right to food and Special Rapporteur on the human rights to safe drinking water and sanitation¹⁰ (OHCHR, 2023).

The experts drew attention to alleged human rights violations and abuses affecting the communities living along the Cape Fear River in North Carolina, due to their prolonged exposure to PFAS emissions released from Fayetteville Works facility operated by Chemours. Over several decades, hazardous wastewater containing PFAS was discharged into the river, resulting in contamination levels in fish samples that significantly exceeded

¹⁰ Full text available at: <https://spcommreports.ohchr.org/TMResultsBase/DownloadPublicCommunicationFile?gId=28410>

safety standards identified by EPA. A large proportion of local residents were found to have PFAS present in their bodies, long after the facility ceased releasing certain substances.

Beyond local impacts, the contamination of the Cape Fear River which flows into the Atlantic Ocean underscores the extensive and transboundary nature of PFAS pollution (OHCHR, 2023).

Moreover, the complexity of corporate restructuring is represented by the reorganisation of DuPont's business operations. In 2015, the company spun off its "Performance Chemicals" into a new entity, Chemours, to which parts of environmental liabilities and legal claims were transferred. This was followed in 2017 by a merger between DuPont and Dow Chemical Company, resulting in the formation of DowDuPont, which was subsequently split into three separate entities. This sequence of mergers and acquisitions has made it considerably more difficult to attribute environmental liability and to ensure effective remediation for victims (OHCHR, 2023).

These concerns are also echoed in recent legal action brought by the State of Connecticut against major chemical manufacturers, including DuPont, Chemours, 3M and Corteva (State of Connecticut, 2024). According to the complaint¹¹, this series of corporate operations may be interpreted as part of an orchestrated and coordinated strategy aimed at hindering or delaying creditors' claims regarding environmental and human health harms. However, the specific details and dynamics of these alleged strategies remain largely unavailable to the public, which further complicates the assessment of corporate intent (State of Connecticut, 2024).

In response to these allegations, the companies involved submitted replies to the Special Procedures Communication. For instance, Chemours asserted the favourable toxicological profile of GenX, claiming that it does not bioaccumulate (Chemours, 2023). This position, however, contrasts with existing literature, which has characterised GenX as a clear case of "regrettable substitution" (Cordner et al., 2025). The manufacturer also underlined the distinctive properties of fluoropolymers, highlighting their versatility and utility across a wide range of industrial applications, as well as their importance for the green transition (Chemours, 2023).

¹¹ Full text available at: https://portal.ct.gov/-/media/AG/Press_Releases/2024/Binder1.pdf

Additionally, Chemours specified that it had never manufactured PFOS or PFOA at the Fayetteville Works facility and therefore argued that any detection of these substances could not be attributed to its activities, but rather to DuPont as the previous operator (Chemours, 2023). By distinguishing between different chemical compounds and emphasising the historical succession of operators, the company effectively narrowed the scope of its potential liability.

On the other hand, DuPont de Nemours denied ownership of the Fayetteville Works site and clarified that a subsidiary merely operates as a tenant at that plant but, without involvement in the production of PFAS chemicals in question. Furthermore, DuPont de Nemours stressed the distinction between its current corporate structure and its predecessor, E.I. du Pont de Nemours and Company, which had historically owned the site (DuPont de Nemours, Inc., 2023).

A consistent pattern emerges from these responses. Through the combined use of corporate restructuring narratives and technical argumentation, both companies appear to distance themselves from liability while simultaneously fragmenting responsibility across entities and over time.

These dynamics are also reflected in literature. Baker et al. (2020) analyse the practice of spinning off environmental liabilities, which implies their transfer to distinct and often undercapitalised entities. This process may enable parent companies to separate themselves from legal and financial responsibility, particularly when the spun-off company lacks the resources to address long-term environmental claims. As the authors observed, the drivers that may facilitate this behaviour are economic incentives, reputational considerations and information asymmetries, which together might contribute to the externalisation of environmental harm.

Apart from legal fragmentation, corporations may also rely on financial strategies such as bankruptcy. In the case of Miteni, the 2025 judgment of the Corte d'Assise di Vicenza included charges of fraudulent bankruptcy (Fazzini, 2025), a bankruptcy-related criminal offence under Italian law referring to acts such as the concealment or dissipation of assets to the detriment of creditors (Regio Decreto 16 marzo 1942, n. 267, art. 216). At this point, the insolvency of the company raises critical questions about who bears the responsibility for remediation and for repairing the damages caused to human health and the environment.

Drawing on the analysis of Miteni's official report conducted by Lanzavecchia et al. (2022), it can be argued that certain corporate decisions were rationally oriented towards profit maximisation, with production sustained as long as it remained economically viable, while the burden of future compensation was left to third parties.

This interpretation was supported by trade unions, such as CGIL and Flictem Vicenza, which underlined that the company's declaration of insolvency shifted the costs of irreversible harm onto workers, local communities and surrounding territory (Centin, 2018).

At the same time, this strategy appears to stand in contrast with the "polluter pays" principle, first articulated by the Organisation for Economic Co-operation and Development (OECD) in 1972 and later enshrined in Article 191(2) of the Treaty on the Functioning of the European Union (TFUE).

At the core of this principle lies the idea that those responsible for pollution should bear the costs associated with prevention, control, and remediation. Its objective is to discourage environmentally harmful practices by internalising these costs, rather than allowing them to be externalised onto society (European Court of Auditors, 2021).

Overall, the interaction between these corporate practices and the limitation of existing international framework helps to explain how environmental harm and associated human rights violations may continue despite growing scientific knowledge, by complicating the attribution of responsibility and weakening enforcement mechanisms.

2.2 State Responsibility

As anticipated at the outset of this chapter, this section deals with the State duty to protect against human rights abuses and environmental harm in the context of business operations, with particular attention to its articulation in the PFAS case and its practical implications.

To begin with, the right to a healthy environment is closely interconnected with the enjoyment of a range of fundamental human rights, such as the rights to life, health, food, water, sanitation, and development. Indeed, the environment has been considered functional to the enjoyment of human rights (Martin-Ortega et al., 2022).

The growing international recognition of environmental protection as a human rights concern underscores the urgent need for both states and businesses to take preventive and regulatory actions (UNDP et al., 2023).

Historically, the 1972 United Nations Conference on the Human Environment in Stockholm marked a foundational moment in the development of the relationship between environmental protection and human well-being. Principle 1 of the Stockholm Declaration affirmed that humans have “the fundamental right to freedom, equality and adequate conditions of life, in an environment of a quality that permits a life of dignity and well-being”¹².

This linkage has since evolved through national constitutions, regional systems, and global frameworks, and was further reinforced by the Rio Declaration on Environment and Development, which states that human beings “are entitled to a healthy and productive life in harmony with nature” (United Nations, 1992), leading to its formal recognition by the Human Rights Council in 2021 and the United Nations General Assembly in 2022 (UNDP et al., 2023).

As of 2025, around 85% of UN Member States recognise the right to a healthy environment in their constitutions, legislations or regional treaties (Boyd, 2025). This right is generally understood as encompassing both substantive and procedural dimensions. A comprehensive explanation is provided by Dávila (2025), who adopts a human rights-based approach grounded in the interdependence of all human rights. The substantive dimension is based on the principle that individuals should be able to enjoy their human rights without interference arising from environmental degradation. In this regard, the Inter-American Court of Human Rights has acknowledged that States have positive obligations to adopt legislative, regulatory, and monitoring measures, in relation to environmental harm caused by private actors (Dávila, 2025).

The procedural dimension, by contrast, includes rights to information, public participation, and access to justice in environmental matters.

In this regard, individuals should be able to obtain information not only about general environmental conditions, but also about specific instances of pollution and exposure to toxic substances which may adversely affect their health. To this end, environmental and social impact assessment (ESIAs) constitute an important tool for both States and

¹² Full text available at: https://www.ipcc.ch/apps/nj-lite/srex/nj-lite_download.php?id=6471

businesses, as they facilitate the disclosure of relevant information and support informed public engagement (Dávila, 2025).

Additionally, the right to participation enables impacted communities to take part in the decision-making processes concerning environmental issues. Finally, the right of access to justice ensures that, in case of environmental harm or human rights violations, individuals can seek judicial and other forms of remedy, including guarantees of non-repetition, aimed at preventing the recurrence of such violations (Dávila, 2025).

These rights are accompanied by corresponding States obligations, which have been clarified through the Framework Principles on Human Rights and the Environment developed by UN Special Rapporteur John H. Knox. Drawing from international treaties, binding decisions, and authoritative statements of human rights bodies, these principles categorised State duties across three dimensions: procedural, substantive, and specific obligations towards persons in vulnerable situations (Boyd, 2024).

Within this framework, the right to a clean, healthy and sustainable environment is operationalised through a set of standards derived from both international environmental and human rights law, guiding State conduct. In particular, under the due diligence obligation, requiring states to take adequate measures to prevent environmental harm caused by private actors, the duties of prevention and the precautionary principle assume a central role (Dávila, 2025).

The obligation of prevention entails that States establish an effective system of regulation, oversight, and monitoring that avoids activities that may cause environmental harm and lead to related human rights violations (Dávila, 2025).

Complementing this duty, the precautionary principle centres on the need for anticipatory action in situations of potential environmental risk. It requires that the burden of proof be placed on those responsible for environmentally dangerous activities, and that affected communities be meaningfully involved in decision-making processes. Its relevance lies precisely in its application to contexts of scientific uncertainty, where risks to human health and the environment are not yet fully established, but where the potential for serious harm justifies intervention (Dávila, 2025).

These obligations are further specified in the context of business-related human rights harm through the UN Guiding Principles. Under Pillar I, States are the primary duty-bearers under international law and are required to fulfil this duty through concrete

measures, including appropriate regulation, legislation, and effective enforcement (United Nations, 2015). With respect to implementation, international human rights treaty bodies have clarified that States must supervise business activities, prohibit harmful conduct, and investigate and sanction abuses when they occur (Macchi, 2022).

Having outlined the normative framework governing the State duty to protect, it is interesting to examine how these obligations have been implemented in practice in response to PFAS contamination.

In reaction to the slowness of Italian institutions, Greenpeace conducted in 2025 an independent investigation to verify the state of drinking water quality in 235 municipalities. The results show the presence of 58 PFAS molecules in aqueduct networks, raising concerns about the risks to human health. The urgency for further studies and increased public awareness appears to be linked to the inadequacy of the regulatory system. PFAS contamination in Italy is counted among the most serious in Europe, and despite its origins dating back in the 1990s, it is still not mandatory to systematically monitor the presence of these “forever chemicals” in drinking water (Greenpeace Italia, 2025).

However, the recent Directive (EU) 2020/2184¹³ on the quality of water intended for human consumption pursues the objective of establishing the requirements for safe and clean drinking water. The Directive explicitly refers to the precautionary principle, requiring Member States to protect human health.

But this normative development has been at the centre of significant critique. Based on the latest scientific evidence, the parameters established at the European level do not seem to be sufficient to properly safeguard human health. According to the European Food Safety Authority (EFSA), the safe threshold for PFAS exposure should be considerably lower than those currently set by the EU Directive (Greenpeace Italia, 2025). As a matter of fact, a comparison with standards adopted in other nations underlines these discrepancies. Notably, 41% of the samples collected by Greenpeace exceeded Danish parameters for safe water consumption, while 22% surpassed reference values in the United States. Therefore, this mismatch may have crucial implications for the protection of public health. Figure 4 represents the extent of PFAS contamination in the Italian

¹³ Full text available at: <https://eur-lex.europa.eu/eli/dir/2020/2184/oj/eng>

municipalities monitored, showing that 79% of the analysed samples contained PFAS (Greenpeace Italia, 2025).

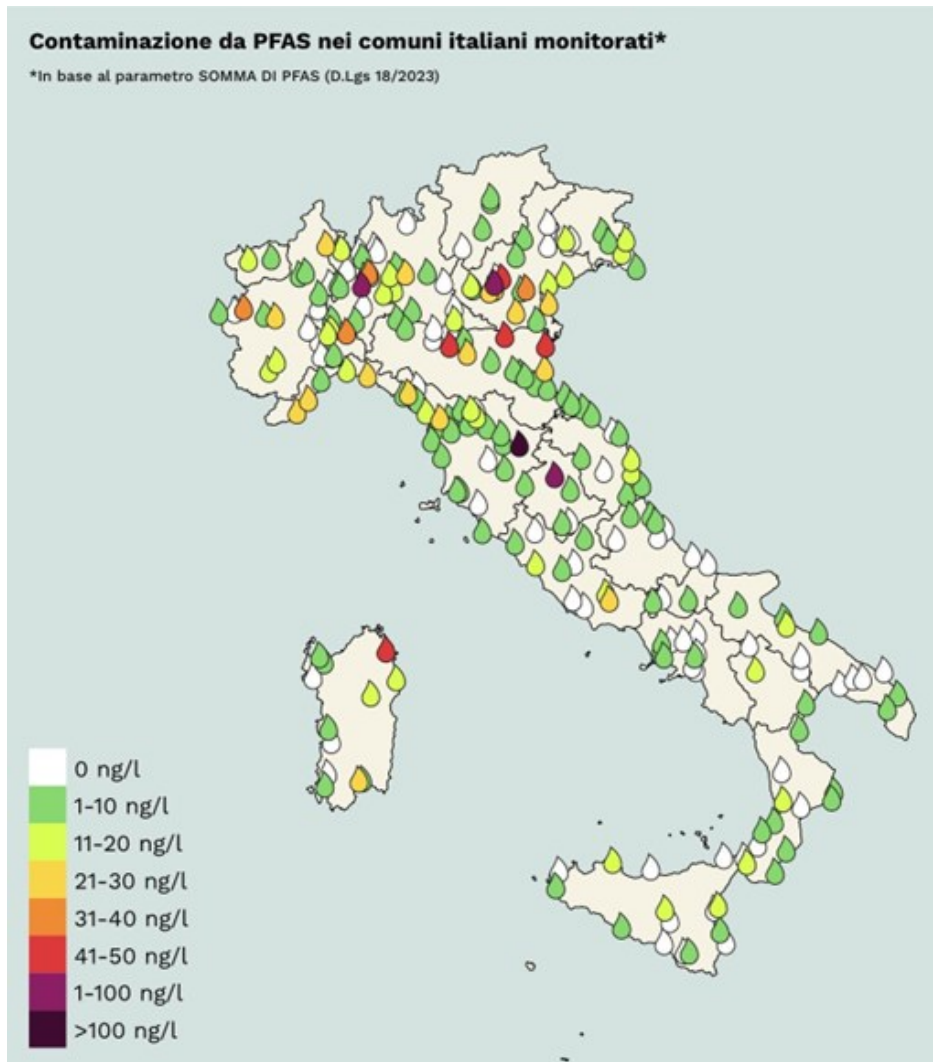


Figure 4 PFAS contamination levels in Italian municipalities.

Source: Greenpeace Italia, (2025).

These challenges are not limited to the national level. At the regional level, the Veneto authorities suspended for seven years the epidemiological research initially scheduled for 2017 and 2018. The study was intended to assess the impacts of PFAS contamination in Padova, Verona, and Vicenza, but was thereafter delayed due to concerns related to its high costs, raising questions about the value attributed to public health (Carollo, 2023). As reported by Mamme No PFAS, the epidemiological study was ultimately implemented

after nearly a decade of delay, stressing the detrimental and long-term consequences of institutional inaction. Another critical aspect was the limited involvement of civil society in the research process, despite the fact that local communities had long campaigned for the recognition and acknowledgment of the issue (Mamme No PFAS, 2025).

Notwithstanding the regulatory progress, the costs of contamination, including filtration systems, environmental remediation and the disposal of contaminated sludge, still fall on citizens rather than being borne by polluting companies. For this reason, the polluter pays principle appears to be reversed, as private actors retain the benefits derived from PFAS production, while negative externalities are transferred to affected communities (Mamme No PFAS, 2026).

In view of the need for timely action, the current Italian government led by Giorgia Meloni has been subject to criticism from civil society actors following the decision to postpone by six months the implementation of the European Directive¹⁴, originally expected in January 2026. This decision reflects concerns regarding the urgency of the situation and the tension between public health protection and administrative or technical constraints faced by competent authorities. Moreover, Italy does not figure among the countries supporting a comprehensive ban on PFAS at the European level (Vez, 2026).

As far as the origin of PFAS governance failure in the United States is concerned, it is useful to analyse how the State of West Virginia responded to PFAS contamination. As previously noted, regulatory responses in the United States have been often remarked as slow and fragmented. Among the contributing factors are corporate resistance, reputational management strategies, the suppression of whistleblowers, and limitations on regulatory oversight, as well as the framing of scientific evidence as “junk science” (Renfrew & Pearson, 2021). From this perspective, it has been argued that the regulatory system itself favoured the protection of industry-produced knowledge, thereby limiting its accessibility from the public. As a result, scientific progress merely remained unseen, and chemical regulation experienced significant delays. Consequently, exposed communities became those responsible for demonstrating harm and mobilising attention to PFAS toxicity. On the other hand, public authorities may excessively rely on industry

¹⁴ Directive (EU) 2020/2184 of the European Parliament and of the Council of 16 December 2020 on the quality of water intended for human consumption (recast) <https://eur-lex.europa.eu/eli/dir/2020/2184/oj?eliuri=eli%3A2020%3A2184%3Aoj&locale=it>

expertise, which could shift responsibility onto individual behaviour rather than systemic exposure. The temporal mismatch between the acknowledgment of the contamination and its remediation is a period of time frequently characterised by uncertainty and contested scientific knowledge (Renfrew & Pearson, 2021).

In this context, the adoption by the state of West Virginia of the PFAS Protection Act¹⁵ in 2023 marked a significant, albeit delayed, regulatory development aimed at addressing PFAS contamination in drinking water. This achievement occurred 22 years after lawyer Robert Bilott discovered the health implications of PFOA exposure. Due to the relevant delay Bilott underlined how this law was supposed to be an initial step that needed to be implemented decades ago. Moreover, even where regulatory frameworks have been established, implementation remains incomplete: required action plans to identify and address PFAS contamination have not been fully developed, and the legislative oversight commission on water resources has been repealed. Additionally, the lack of funding and political barriers were mentioned among the reasons for delays, reflecting the risk of politicising environmental protection and public health, leaving them vulnerable to institutional instability. (Tony, 2025a). Evidence further confirms the persistence of structural weakness in drinking water governance, as in 2024 West Virginia recorded the highest rate of health-based drinking water violations in the United States, largely because of exceedances of contaminant substances (Tony, 2025b). Figure 5 uses a glass of water to illustrate the correlation between PFAS concentration levels (PFOA and PFOS) in drinking water and the corresponding long-term health risks.

¹⁵ House Bill 3189, full text available at: https://www.wvlegislature.gov/Bill_Status/bills_text.cfm?billdoc=hb3189%20intr.htm&yr=2023&sesstyp e=RS&i=3189

PFAS in Drinking Water

What are the risks?

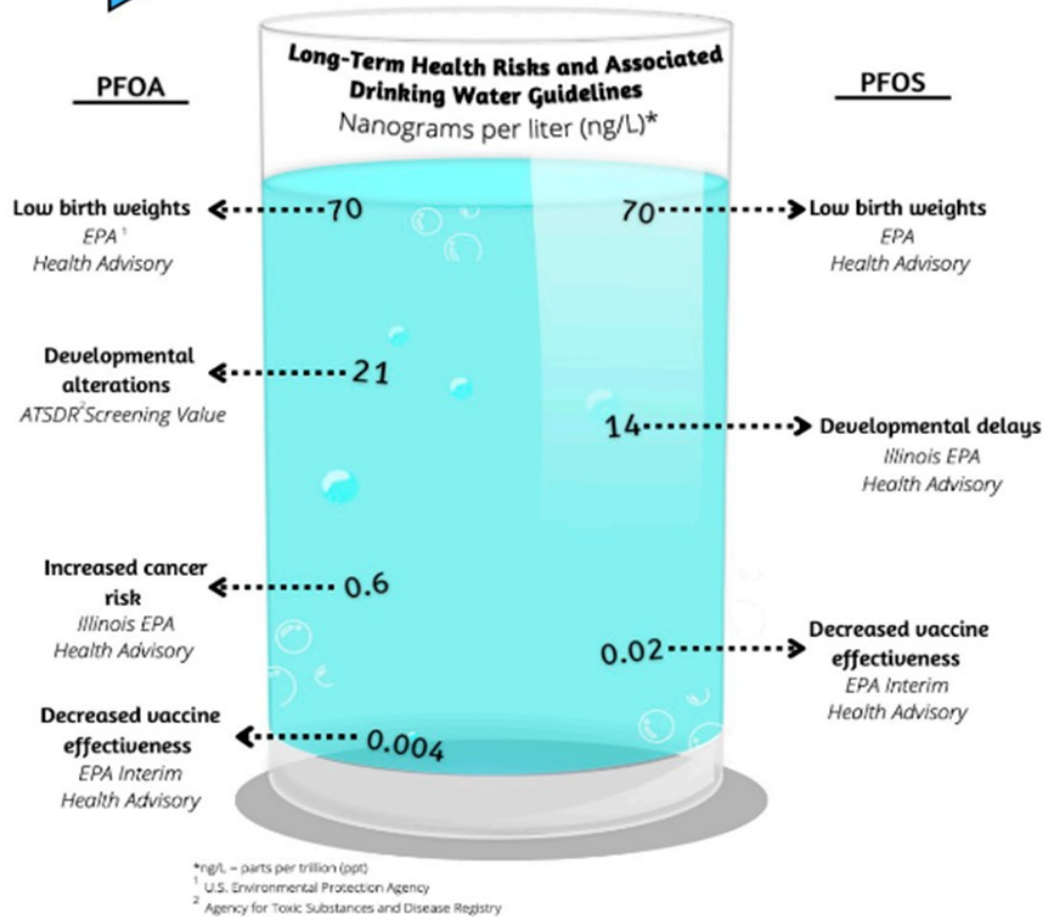


Figure 5 Illustration of PFAS contamination in drinking water.

Source: Bergdorf-Smith (2024), adapted from Illinois Department of Public Health.

Note: PFOA and PFOS are two common types of PFAS found in drinking water. Additionally, nanograms per liter (ng/L) and parts per trillion (ppt) are equivalent units.

Beyond Italy and the United States, similar challenges emerge in other jurisdictions, particularly in the Japanese context. In Okinawa, PFAS contamination has been linked to U.S. military bases, raising complex issues of jurisdiction and accountability. Recent civil society submissions to the Office of the High Commissioner for Human Rights have expressed concern regarding the opaque nature of arrangements adopted within the Japan-

U.S. Joint Committee, operating under the U.S.-Japan Status of Forces Agreement. Efforts by Okinawa Prefecture to access facilities where PFAS was detected date back to 2016; however, these requests have been denied by U.S. military authorities on the grounds that specific criteria were not met (Okinawa Liaison Committee to Protect Citizens' Lives from PFAS Contamination, n.d.).

Notably, the report underlines how the Government of Japan and its Ministry of Defence have passively accepted these refusals, questioning its ability to effectively exercise its sovereign duty to safeguard its citizens. The prolonged absence of remedial action, despite the involvement of U.S. authorities, has placed a substantial burden on Okinawa residents. This has been further exacerbated by the limited response of both local and national governments, prompting civil society actors to organise autonomous initiatives, like the conduct of blood testing (Okinawa Liaison Committee to Protect Citizens' Lives from PFAS Contamination, n.d.).

Moreover, in January 2026, the Okinawa Prefectural Government (OPG) reported PFOS concentrations exceeding national safety thresholds in areas surrounding US military bases. The OPG explicitly attributes primary responsibility for protecting the health of its citizens to the Government of Japan, as the provider of facilities for U.S. forces. Accordingly, it calls for independent investigative actions, enhanced cooperation between Japan and the United States to facilitate access to military areas, reform of the structural asymmetries embedded in the Status of Forces Agreement (SOFA) and greater transparency discussions between Japanese and U.S. governments (Okinawa Prefectural Government, 2026).

While the Japanese case concerns limited governmental intervention and jurisdictional asymmetries, comparable trends emerge in the context of transnational reallocation of industrial production.

In the Indian case, the issue of State responsibility becomes relevant when tracking the afterlife of Italy's Miteni chemical plant. According to an investigation supported by Journalismfund Europe, a member of the Maharashtra Legislative Assembly publicly denounced the Ratnagiri facility for manufacturing PFAS, while the Industries Minister reportedly downplayed the accusation labelling it as a "political exaggeration". At the same time, the company did not contest the findings, whereas local mobilisation demands cessation of operations at the facility, warning that the region is at risk of turning into a

repository for dangerous industries moved out of Europe (Journalismfund Europe, 2026a).

Indian authorities acknowledged their awareness of the transfer of machinery and PFAS production. Nevertheless, environmental authorisation for the activity was granted in accordance with existing regulatory frameworks. Despite the absence of specific restrictions on PFAS in India and the mounting international scientific consensus regarding their toxicological impacts, industrial and economic development appears to prevail over precautionary considerations and long-term environmental protection (Journalismfund Europe, 2026b).

As Deva (2012) argues, corporations are often able to violate human rights because of the far-reaching economic, political, social, and informational power they possess. States frequently welcome corporate influence, not merely tolerating it, but also enabling it through licenses, contracts, outsourcing and the privatization of public functions. In the context of PFAS contamination, this relationship underlines the mutually reinforcing dynamic between corporate behaviour and state inaction, through which environmental degradation and human rights harm become structurally embedded within governance system. It must also be acknowledged that corporate lobbying exerts a substantial influence on regulatory processes, frequently opposing to measures aimed at restricting or banning these substances. This issue will be addressed in the final chapter as a key obstacle to the identification of effective solutions.

The following chapter, instead, will delve deeper into human rights violations in the case of PFAS contamination and its intergenerational dimension.

Chapter III - The Persistence of Harm: Human Rights Violations and Intergenerational Injustice

The previous chapters explored the historical development of PFAS contamination, the evolution of regulatory responses, and the accountability deficits that facilitated the pervasive dissemination of these chemicals. Building on this foundation, the present chapter adopts a human rights-based approach (HRBA), a normative framework grounded in international human rights standards aimed at advancing and protecting human rights. Within this lens, corresponding obligations are attributed to duty-bearers, with the objective of ensuring the effective realization of the rights of right-holders (United Nations Sustainable Development Group, n.d.). Applied to PFAS contamination, this perspective enables the consequent environmental degradation to be understood as a human rights threat that disproportionately affects vulnerable groups, persists across generations, and manifests as a form of injustice.

This chapter is organised into two sections. The first one prioritizes the human rights implications related to the case studies, whereas the second one addresses the intergenerational dimension of PFAS exposure.

3.1 From Environmental Contamination to Human Rights Violations

The implications of PFAS environmental contamination extend across multiple dimensions of human life, encompassing physical, psychological, emotional and socio-economic spheres (Onencan et al., 2024). As the authors observe, studies grounded in victimology often focus predominantly on the economic consequences of corporate crimes, while overlooking broader dynamics of marginalisation, disempowerment, and structural inequalities affecting vulnerable groups, particularly along class and gender lines. For this reason, adopting a human rights perspective becomes essential in order to illuminate the lived experiences of individuals and communities affected by PFAS contamination.

According to Onencan et al. (2024), victims of PFAS contamination experience five main phases of adaptation.

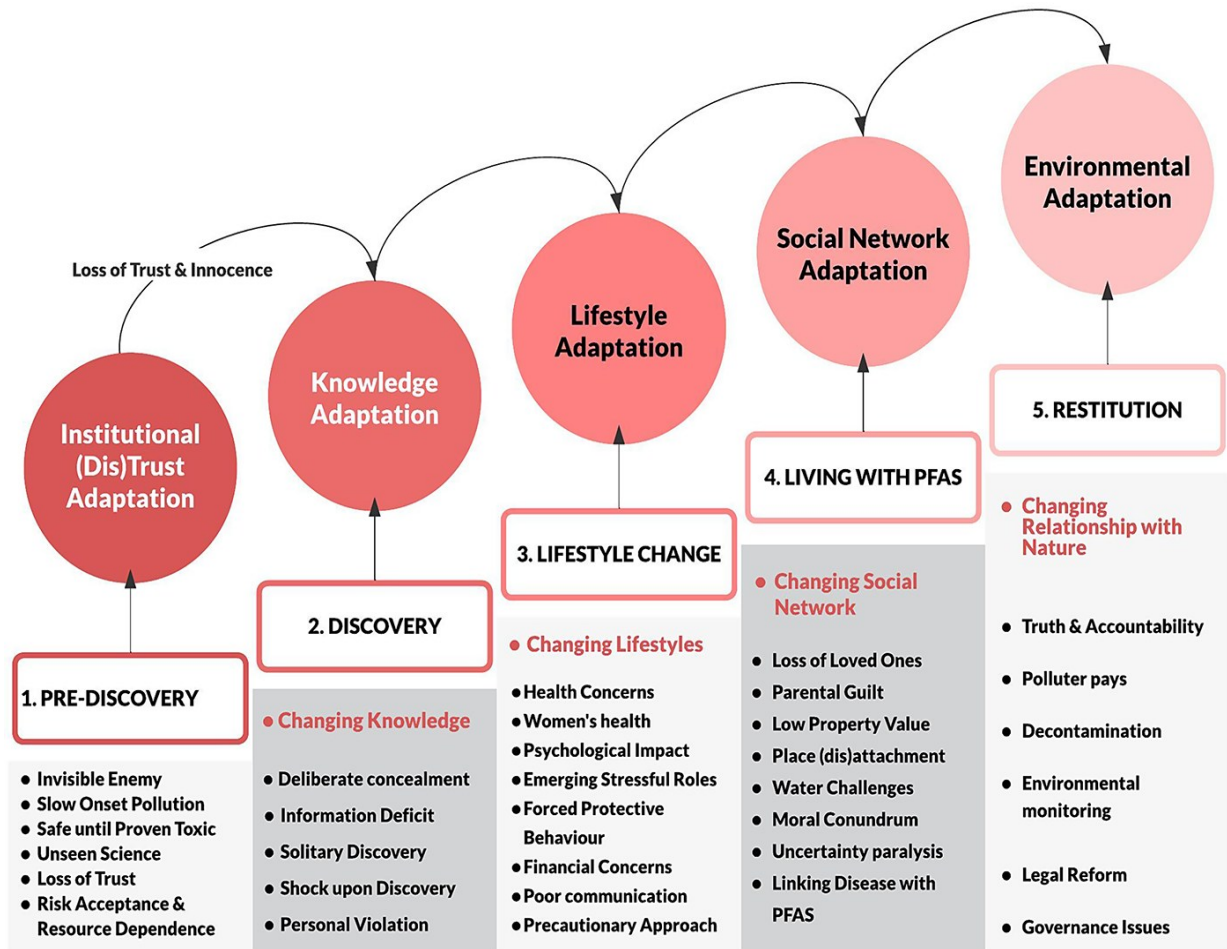


Figure 6. Visual representation of the five PFAS adaptation phases.

Source: Onencan et al., (2024).

Figure 6 exemplifies this conceptual framework by retracing the different stages and narratives characterising life in a contaminated environment: “pre-discovery”, “discovery”, “lifestyle change”, “living with PFAS” and seeking “restitution”. Affected communities spent years in the initial phase, entirely unaware of this invisible contamination surrounding them. In this sense, it can be considered as a form of “unseen science”, where crucial information is intentionally obscured, generating loss of trust in public institutions, feelings of betrayal linked to corporate misconduct, and growing social scepticism.

The “discovery” phase marks a significant turning point, forcing individuals to adapt their lifestyle to the consequences of the contamination. Yet the impacts associated with PFAS exposure are not distributed equally. Due to the longevity and bioaccumulative nature of these substances, certain groups experience disproportionate forms of vulnerability. In

particular, studies suggest the pivotal need for gender-specific PFAS research, given the intergenerational implications and the tendency of exposed women to consider pregnancy “as a medically monitored state” (Onencan et al., 2024). Moreover, “living with PFAS” contamination entails continuous confrontation with health risks, changes in consumer habits, and socio-economic disadvantages linked to declining property values.

The final phase identified by the authors is characterized by the reactive mobilisation of community seeking recognition, remediation, and accountability for the damages suffered (Onencan et al., 2024).

PFAS contamination also reflects broader patterns of environmental injustice. Those already living in precarious socio-economic conditions often experience forms of multidimensional poverty, in which the interconnected effects of the triple planetary crisis, exponentially deteriorate existing inequalities. This becomes particularly relevant in areas of toxic exposure, commonly referred to as “sacrifice zones”, which remain at the forefront of bearing the extreme consequences of industrial contamination (Dávila, 2025).

Unlike traditional dynamics of environmental injustice, where polluting activities are typically located in already marginalised areas, the PFAS case seems to disrupt this logic. The study conducted by Van Der Donk & Llaveró-Pasquina (2025), explains that the historical perception of PFAS as harmless, echoed in the “safe until proven dangerous” paradigm, meant that their distribution did not initially follow patterns of socio-spatial zoning and segregation. As a result, the combination of delayed recognition, environmental persistence, and declining property values has produced a “pollution trap”, where affected populations become locked into contaminated environments.

Going beyond the above social-legal framing, PFAS contamination gives rise to multi-layered forms of harm that interfere with the effective enjoyment of fundamental human rights.

The impossibility of separating human wellbeing from environmental and ecosystem integrity is further reinforced by the “One Health” approach, according to which the cross-cutting impacts of PFAS simultaneously affect human, animal, and environmental health. For instance, shared exposure pathways like contaminated food and water consumption, as well as maternal transmission, produce alike outcomes across species, ranging from reproductive and development disorders to immunological and carcinogenic

effects (Souza et al., 2026).

While the previous chapter examined state responsibility through the right to a healthy environment and related principles, this section shifts the focus to the individual dimension of human rights protection by analysing the right to health as a central entry point for understanding the implications of PFAS contamination on affected populations. Figure 7 provides a conceptual map summarising the interconnectedness of human rights dimensions involved in PFAS contamination and how these are simultaneously and potentially violated. The figure is intended to support the reader in navigating this section.

INTERDEPENDENCE OF HUMAN RIGHTS IN PFAS CONTAMINATION

PFAS exposure through water, food, environment and products generates multiple, mutually reinforcing human rights violations.



PFAS contamination creates a web of interdependent rights violations.
When one right is undermined, others are weakened, and the full enjoyment of human dignity is compromised.

Figure 7. Interdependence of human rights in PFAS contamination.

Source: Author's elaboration.

The right to the enjoyment of the highest attainable standard of physical and mental health was first recognised in the 1946 Constitution of the World Health Organization (WHO), and it is now widely acknowledged by States as a fundamental human right (Office of the United Nations High Commissioner for Human Rights [OHCHR] & World Health Organization [WHO], 2008). The WHO conceptualized health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”. However, as clarified by General Comment No. 14 of the Committee on Economic, Social and Cultural Rights (2000), the right to health under Article 12 of the ICESCR is neither limited to this definition nor confined to access to healthcare alone. On the contrary, it encompasses the broader socio-economic conditions necessary for individuals to live a healthy life.

These determinants include access to safe drinking water and adequate sanitation, safe food, adequate nutrition and housing, healthy working and environmental conditions, as well as health-related education and information and gender equality (OHCHR & WHO, 2008). Given the interdependent and indivisible nature of human rights, the enjoyment of the right to health contributes to the effective realisation of multiple other rights, while its violation may simultaneously compromise their protection (OHCHR & WHO, 2008).

A core component of the right to health is the principle of non-discrimination and equality, which prohibits any distinction, exclusion or restriction that undermines or impairs the equal enjoyment of human rights. As accentuated by the OHCHR and WHO, discrimination can cause structural forms of marginalization that in turn generate and reinforce drivers of health inequalities. Moreover, as underscored by the literature (Dávila, 2025), intersecting types of disadvantages result in cumulative vulnerability for specific groups. Crucially, this principle imposes on States not only a negative obligation to refrain from implementing discriminatory practices, but also a positive duty to adopt targeted measures of protection. For this reason, the examination set out below positions the right to health within its interaction with other human rights rather than treating it in isolation.

When it comes to PFAS contamination, empirical evidence further supports that chemical pollution in drinking water is not socially neutral. The research carried out by Liddie et al. (2023), shed light on the significant correlation between sociodemographic factors and PFAS exposure in U.S. communities. Notably, water systems where PFAS contamination was detected were more likely to serve higher proportions of socioeconomically disadvantaged populations, like Hispanic/Latino and non-Hispanic Black residents. These findings signal how historical patterns of racial and socio-economic segregation have contributed to the uneven spatial distribution of environmental pollution, particularly through the concentration of PFAS-related sources near airports, landfills, and military installations.

These dynamics are also present in military contexts. The Report of the Special Rapporteur, Marcos Orellana (2025) explicitly links toxic exposure deriving from military activities to human rights violations. Specifically, the use of PFAS-containing firefighting foams on U.S. territory and within American military bases abroad, including in Okinawa, has been associated with violations of women's reproductive rights, and serious impacts on human health, such as cancers and birth defects. This gendered dimension is also captured within General Comment No 14 of the CESCR, which requires the adoption of a gender-sensitive approach to health policies, acknowledging the role of social, cultural and biological factors in shaping health outcomes. More broadly, this brings attention to the imperative need to integrate human rights considerations into the regulation of military operations, particularly when addressing forms of chronic harm (Orellana, 2025).

The Okinawa case has been described in civil society submissions to the OHCHR as an expression of environmental racism stemming from colonial power relations. In view of this, the region is identified as a “sacrifice zone” shaped by the enduring presence of U.S. military installations and the externalisation of environmental and social costs onto local populations. Furthermore, access to safe drinking water not only constitutes a basic environmental and health necessity, but also acquires a significant cultural dimension, particularly when considered in relation to the indigenous Ryukyuan people of Okinawa (Matsuda, 2026).

The Okinawa Prefectural Government (2026) further maintains the idea that the presence of PFAS can destabilize cultural practices, insofar as rivers constitute sites of spiritual

significance and spaces of cultural transmission for local communities. As a matter of fact, Goya (2026), frames the pollution of ritual sites connected to ancestral customs of spirituality and harvest as an interference with cultural traditions protected under Article 11 of United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP). Also, the Committee elaborates on this view, by remarking that the deprivation of Indigenous Communities of the enjoyment of their traditional environment, entails a damaging effect on their health (CESCR, 2000).

In this regard, General Comment No. 15 of the CESCR recognises the right to water under Articles 11 and 12 of the ICESCR as a prerequisite for living in dignity, given that it encompasses a broad range of purposes including food production, hygiene, adequate livelihoods, and cultural practices. The Committee identifies availability, quality, and accessibility as core elements necessary for the effective enjoyment of this right. Accordingly, water must be sufficient for personal and domestic use, free from substances that may threaten human health, physically and economically accessible, and accompanied by access to information concerning water-related issues. In this context, States are required to protect from interference by third parties, including corporations, and to adopt measures aimed at preventing the contamination of water resources.

Closely connected to the right to water is the right to seek and receive information, protected under Article 19 of the ICCPR. The relevance of this right lies in its role in enabling individuals to make informed decisions regarding their health and to take preventive action against environmental and health risks. Among the violations identified in General Comment No. 14 of the CESCR is the “deliberate withholding or misrepresentation of information vital to health protection or treatment”. These standards are further reflected in Principle 10 of the Rio Declaration, which affirms that environmental matters should be addressed through public participation and access to environmental information (United Nations Environment Programme, 2023).

One emerging element from the PFAS case studies analysed in this thesis is that both manufacturers and the States in which production occurred responded, albeit in a limited manner, only once the harm became publicly known, while for decades PFAS emissions remained largely unmonitored. In the Veneto region, for instance, following the visit of the Special Rapporteur in 2021, authorities were found to have provided insufficiently

transparent information, with residents becoming aware of the contamination through social media rather than institutional channels (Crivellari, n.d.).

Moreover, the aftermath of the discovery is still characterised by the absence of a specific national law regulating the production, use, and discharge of PFAS in Italy. Remedial measures, as the installation of carbon filters appear not enough to mitigate the diffuse nature of the contamination, where agricultural irrigation continues to rely on potentially contaminated water sources (Mamme No PFAS, n.d).

Paradoxically, prior to the recognition of PFAS contamination and its harmful effects, attention tended to concentrate primarily on substances added during agricultural production and farming practices. By contrast, less consideration was devoted to the quality and origin of water sources and to the contaminants they might contain throughout supply chains until reaching the final product (Brunswick, 2022). This implies that the population still bears living costs, despite the obligation of States to ensure the right to remedy as grounded in several international human rights instruments, including Article 13 of the European Convention on Human Rights (ECHR), Article 2 of the ICCPR, Article 8 of the Universal Declaration of Human Rights, and the 2005 UN Basic Principles and Guidelines on the Right to a Remedy and Reparations.

The safeguarding of the right to health also embraces institutional responses concerning remediation measures necessary to preserve community wellbeing. In civil society's opinion, the refusal of Japanese authorities to finance the replacement of high-performance filtration systems allocates the burden of ensuring adequate health protection on the affected populations. Scientific data indicate elevated levels of PFAS in residents' blood, evidencing a violation of bodily integrity in the absence of informed consent from affected individuals (Matsuda, 2026).

As supported by the "One health" approach, the bioaccumulation of PFAS in the human body also derives from their concentration within aquatic and terrestrial food chains, as well as from contact with packaging containing PFAS compounds (European Commission, n.d.). Food of animal origin represents a significant pathway of exposure to PFAS, due to the tendency of these substances to accumulate in protein-rich products and to transfer through contaminated soil, water, and feed sources (European Commission, n.d.). In order to get an overview of the interdependence of water systems, livestock production and food safety it is useful to take into account data provided by Water

Footprint Network. The production of one kilogram of beef requires approximately 15,000 litres of water globally, illustrating the extent to which contamination of water resources may spread throughout food production chains (Water Footprint Network, n.d.). In this context, cattle exposed to contaminated water and feed may accumulate PFAS in meat and dairy products subsequently consumed by humans. These dynamics may hamper the effective enjoyment of the right to adequate food recognised under Article 11 of the ICESCR, particularly due to contamination of essential dietary products.

The implications of PFAS bioaccumulation become significant when considering reproductive health. In Italy, these aspects have been articulated by grassroots movements such as “Mamme No PFAS”, which gave visibility to the transmission of harm across generations. General Comment No 14 explicitly recognises that Article 12.2 (a) of the ICESCR includes measures aimed at improving maternal and child health, covering access to sexual and reproductive health services, prenatal and postnatal care, and conditions supporting the healthy development of the child.

The accumulation of regulatory gaps, delayed responses, and corporate lobbying against a comprehensive ban of these hazardous substances may allow contamination to reach a level capable of threatening human survival, ultimately undermining the protection of the right to life. The right to life is enshrined in Article 6 of the ICCPR. General Comment No. 36 specifies an extensive interpretation of this provision, covering not only intentional deprivation of life, but also foreseeable threats arising from degradation of the environment, and the deprivation of land and resources of Indigenous People. States, therefore, have both a duty to respect and ensure the right to life, as its effective enjoyment depends also on proactive measures taken by them.

PFAS harm is not confined either geographically or temporally. Extending the analysis of its systemic effects across environmental and social dimensions, the Indian case embodies its spatial persistence. The transnational reallocation of toxic industrial infrastructure intended for the production of these chemical compounds, portrays how PFAS contamination travels across borders. While judicial proceedings in Italy ended with a notable criminal sentence of Miteni’s corporate executives, a re-establishment of the same production activities in Lote, Maharashtra took place. This continuity raises critical concerns regarding regulatory asymmetries between jurisdictions, the possibility of anticipatory corporate restructuring, and the limited awareness of affected local

communities. This spatial displacement occurs in a context in which, although judicial accountability may be established in Italy, environmental harm and related human rights violations can nonetheless be reproduced in other jurisdictions. As a result, human rights protection becomes territorially constrained in practice, with affected communities experiencing similar or even more severe patterns of harm (Liva, 2026).

This spatial externalisation of harm anticipates a broader pattern of persistence that is not only geographic, but also temporal, opening the research to the intergenerational dimension of PFAS exposure.

3.2 Intergenerational Injustice

The theoretical background underpinning this section is the field of intergenerational climate justice, which seeks to articulate ethical duties toward the future and to reconcile present needs without compromising those of future generations (Bessant, et al., 2025).

Consistent with the “One health” approach (Souza et al., 2026), legal scholar Edith Brown Weiss proposes a relational conception of generations based on a shared connection to the Earth. She further emphasises the cross-cutting nature of intergenerational obligations, claiming that breaches committed by one generation impose corresponding duties of restoration for the others (Bessant, et al., 2025).

The intergenerational aspect of PFAS exposure derives from their non-degradable, highly mobile, and lasting nature in ecosystems and living organisms. These “forever chemicals” remain in the human body over time, leading to cumulative and potentially irreversible harm. Hence, future generations are burdened with a toxic legacy that could have been prevented or mitigated through the reduction of these enduring environmental and health impacts.

Understanding the cascading effects of present actions and inactions across generations highlights our responsibility towards the world to come. Embracing this perspective, the Declaration on Future Generations, contained in Annex II of the UN General Assembly’s Pact for the future (2024) is rooted in the recognition of the interconnectedness between past, present, and future, placing the interests and well-being of future generations at the centre of decision-making processes. Among its guiding principles are the right of sustainable development and the prevention of the transmission of injustice across generations.

With the goal of conceiving the rights of those who do not exist yet, but will come into being, the Maastricht Principles were adopted in 2023, stating that key international human rights instruments are not bound by temporal limits, extending their protection to both present and future generations (Basson et al., 2025).

As further discussed in the commentary and scholarly analysis (Basson et al., 2025; & Dávila, 2025), the Principles frame each generation as a trustee of the Earth for future ones. This entails the duty to ensure the sustainable use of resources, and to prevent foreseeable harm to those who will inherit environmental conditions shaped by present decisions.

While the Maastricht Principles adopt a forward-looking interpretation of human rights obligations, intergenerational concerns are already embedded within international legally binding treaties, most notably in the Convention of the Rights of the Child (CRC)¹⁶. Adopted in 1989, the CRC constitutes a landmark achievement and a global commitment, as it is the most widely ratified human rights treaty. It develops the full spectrum of civil, political, economic, social and cultural rights of children and defines obligations on States to fulfil their basic needs. Article 3 elaborates the doctrine of the “best interest of the child”, requiring that this consideration be a primary factor in all decisions affecting children, particularly when such measures are taken on their behalf (Save the Children UK, 2025).

Moreover, General Comment No. 26 (2023), notes that the environment in which children live fundamentally affects their growth, while also stressing that they may be disproportionately vulnerable to environmental degradation and exposure to dangerous substances. In this vein, Article 24 safeguards the right to the highest attainable standard of health, which can be disregarded by both past and ongoing industrial activities generating persistent environmental contamination.

The advocacy work of the Child Rights International Network (CRIN) is documented in its 2024 report on children’s rights and hazardous chemicals in the European Union. Although existing regulatory frameworks are intended to provide prevention and protection, their limitations have resulted in persistent gaps and potential rights infringements (Child Rights International Network, 2024).

¹⁶ Full text available at: <https://www.ohchr.org/en/instruments-mechanisms/instruments/convention-rights-child>

Special Rapporteur Baskut Tuncak (2018), has asserted that more than 200 chemical compounds have been detected in newborns, raising serious concerns on their inability to exercise the right to development. This also has implications for the right to be heard and for the notion of consent in human rights terms. While this right presupposes the capacity to express views on matters affecting one's life, exposure to pollutants occurs prior to the formation of such opinions. As a result, children may find themselves in a situation of disempowerment, where structural inaction by States and institutions may additionally weaken their ability to be heard. On this matter, since exposure continues incessantly before and after birth, children are susceptible to what has been described as a "toxic trespass" in their environment. Medical literature has characterised the cumulative health burden as a "silent pandemic" of disease driven by toxic pollution (United Nations Human Rights Council, 2016).

It is in this setting that PFAS contamination is situated. An up-to-date study has identified associations between higher levels of PFAS in mothers and adverse health outcomes, such as risk of low birth weight, elevated infant mortality, developmental and neurological complications, partly due to these substances' ability to cross the placenta barrier and circulate through umbilical cord blood. This evidence underscores the necessity of precautionary measures and regulatory actions aimed at protecting children from being born already "pre-polluted" by harmful chemicals (Perkins, 2026).

The implications of these intergenerational consequences became visible when factoring the claims advanced by civil society organizations in Okinawa. Fears have been expressed regarding elevated rates of low-birth-weight infants in areas surrounding U.S. military bases. Additionally, premature exposure may create continued medical intervention throughout childhood and later stages of life (All Okinawa Council for Human Rights, n.d.).

Beyond physical health effects, testimonies also reveal how incertitude and anxiety of prenatal exposure often place an uneven burden on mothers, who may blame themselves for the possible consequences of PFAS contamination on their children. In response, a preventive measure could be adopting prenatal and postnatal PFAS screening benefiting from broader institutional support, with the goal of sharing responsibility (Machida, 2026).

What is worth reflecting on is the fact that, despite scientific consensus on the negative health implications and years of mobilisation of affected communities, the first blood concentration survey in Japan addressed to pregnant and postpartum women, eventually was previewed in 2026 (Machida, 2026). Unfortunately, this delayed response signals how questions of intergenerational transmission remain insufficiently integrated into environmental and health governance frameworks.

The attempt to internationalise local experience of environmental harm is reflected by a testimony of a mother raising two children in Okinawa, submitted as part of an individual contribution to the preparation of the thematic report on PFAS and human rights. According to her, the extensive presence of U.S. military bases on the island is perceived as conflicting with the principle of the “best interests of the child” under Article 3 of the CRC. In this account, concerns are raised that geopolitical and strategic considerations are often prioritised over the protection of children’s rights. Despite numerous appeals to both the Japanese and United States governments and the exhaustion of domestic remedies, affected communities continue to seek international support, framing their claim within international human rights law. Indeed, Article 31 on the right to rest and play seems constrained as environmental contamination and associated insecurity limit children’s ability to engage safely in everyday activities (Yonashiro, 2026).

Having established the theoretical bridge from environmental pollution to the multiple human rights violations caused by PFAS contamination, the analysis now turns to the research question of this thesis. It does so by critically examining the role of corporate influence, including lobbying practices that often run counter to effective environmental and human rights protection.

Chapter IV - Discussion Towards Possible Solutions: Lobbying, Alternatives and the Future of PFAS Governance

This final chapter aims to provide an overall picture of PFAS contamination, reflecting on the obstacles that concretely slow down chemical regulation. It begins from the premise that these substances are present in a wide variety of products essential to everyday life, from industrial applications to the most intimate consumer goods, and identifies the corresponding industrial sectors, recognising multi-sectoral lobbying as the main cause of delay in PFAS restrictions. It then examines possible solutions, including the alternatives already available, the essential-use concept and its limitations, and transparency measures such as labelling. Finally, it offers a concrete example of a European country that has challenged the paralysis caused by industrial lobbying, albeit in a limited way.

The research question guiding this thesis sought to trace the structural gaps in responsibility between States and corporate actors that enabled both the production of PFAS and the persistence of their global diffusion. The patterns emerging across the case studies of the United States, Italy, Japan, and India reveal an entangled skein of dynamics characterised by delayed recognition of harmful impacts, fragmented accountability mechanisms, profit maximisation, and the externalisation of environmental and health costs onto affected populations.

However, addressing these dimensions also requires acknowledging a factor that actively obstructs the path towards effective remediation and prevention: the influence exercised through multi-sector lobbying practices. While scientific evidence concerning PFAS-related harms has progressively expanded, regulatory responses have frequently remained slower than the speed at which contamination spreads.

Consequently, understanding how lobbying shapes regulatory processes become essential not only for explaining the persistence of PFAS contamination, but also for identifying possible solutions capable of reducing present harms and preventing their transmission across future generations.

First and foremost, it is necessary to map the main applications of PFAS in order to track down the multitude of industrial sectors involved in their production, use, and commercialisation. The detailed work conducted by Glüge et al., (2020) demonstrates the

comprehensive, yet not exhaustive, overview of PFAS uses, and their scale of applications, documenting more than 200 use categories and subcategories across approximately 1400 individual PFAS substances.

Within this extensive research, several industrial and consumer sectors emerge as particularly relevant for the purposes of this thesis: food production, cookware, electronic devices, medical utensils, personal care products, textile, pesticides, plastic, mining, energy, oil and gas and pharmaceuticals. This limited list already demonstrates the broad integration of PFAS in essential domains of production and consumption (Glüge et al., 2020).

A key aspect to consider is the expensive nature of PFAS manufacture and substitution, which is closely linked to their unique characteristics, and their functional advantages in industrial applications. Their versatility often makes them difficult to replace in specific contexts, as they are employed to compensate for performances that alternative substances cannot easily replicate. The properties identified by the authors include:

ability to lower the aqueous surface tension, high hydrophobicity, high oleophobicity, non-flammability, high capacity to dissolve gases, high stability, extremely low reactivity, high dielectric breakdown strength, good heat conductivity, low refractive index, low dielectric constant, ability to generate strong acids, operation at a wide temperature range, low volatility in vacuum, and impenetrability to radiation.

(Glüge et al., 2020, p. 9).

At the institutional level, PFAS are also framed as “enablers” of the future of European Industrial competitiveness, in strategic and interdependent sectors such as aerospace, defence, green energy and clean technology, and semiconductor. In addition, the report assesses potential scenarios for substitution across these sectors, highlighting important differences in feasibility (Richards, White, & Stenning, 2025).

For instance, in the aerospace context the reliance on fluoropolymers is primarily justified on safety and performance reasons, making the identification of viable alternatives challenging and leading to low expectations. By contrast, in sectors such as defence and green energy and clean technology, the potential for substitution appears more variable. The semiconductor industry, however, is identified as heavily dependent on PFAS use,

showing reliance that constrains the prospect of technological change (Richards, White, & Stenning, 2025). Consequently, these findings give an idea of what could be the tendency in near future of possible substitutions in strategic domains of the European market, suggesting a scenario with limited possibilities of substitution.

Moreover, Richards, White, and Stenning (2025) draw an important distinction between PFAS as a broad chemical class and fluoropolymers as a specific subgroup. The authors argue that fluoropolymers have not been sufficiently researched, and that existing studies do not conclusively demonstrate their harmful effects on human health. However, the absence of evidence of harm does not constitute evidence of safety, nor does it exclude the possibility of significant environmental damage across the lifecycle of these substances. As a matter of fact, CHEM Trust (2025) offers a critical assessment of industry narratives that characterise fluoropolymers as non-bioaccumulative and of low concern. The most significant risks arise during the manufacturing processes, generating dangerous waste with extreme persistence in the environment. Furthermore, when Teflon is subject to incineration, it can produce highly toxic products such as greenhouse gases with high global warming potential. Therefore, chemical lobbying benefits from these partial representations of evidence, strategically ignoring the full production and disposal lifecycle, a dynamic that will be examined in detail in the following section.

Paradoxically, PFAS are also widely present in the green transition sector, particularly in green hydrogen production, heat pumps, solar cells, wind turbines, electric vehicles, and semiconductors. This raises a fundamental question: how can an energy transition truly be considered green if it relies on components that permanently pollute the environment and accumulate in living organisms (CHEM Trust, 2025)?

However, according to CHEM Trust (2025), PFAS-free alternatives are already emerging across all these sectors, challenging the industry's lobbying claim that these substances are irreplaceable.

As demonstrated in the previous chapter, PFAS contamination gives rise to multiple human rights violations. Yet, the proximity of these chemicals to individuals is far more visible in daily consumption. The alarming findings of a 2024 report entitled “Toxic harvest: The rise of forever pesticides in fruit and vegetables”, revealed that between 2011 and 2021, the proportion of European fruit and vegetables contaminated with PFAS increased by 220% and 247% respectively.

Particularly concerning is the so-called “cocktail risk”, referring to the detection of up to four distinct PFAS pesticides within a single sample of strawberries or grapes grown in the EU. Among EU-imported products, those originating from Costa Rica (41%), India (38%), and South Africa (28%) recorded the highest contamination rates, further underscoring the transnational dimension of this issue (Pesticide Action Network Europe, 2024).

Unlike PFAS contamination deriving from industrial accidents, the introduction of PFAS in pesticides represents an intentional and direct source of pollution. With the aim of making them last longer, these substances are deliberately sprayed on agricultural crops, contaminating food, soil and water. According to PAN Europe and Générations Futures (2023), this source of PFAS exposure is significantly underestimated, leading authors to describe Europe’s crops as a form of toxic harvest. Furthermore, the vast and simultaneous use of multiple PFAS pesticides, a phenomenon defined as “cocktail effects”, often escapes adequate risk assessment, amplifying their toxicity on human health and the environment. The use of PFAS pesticides is not an isolated European issue, since the Environmental Working Group (2025) calculated that every year, an average of 2.5 million pounds of pesticides with “forever chemicals” were applied on California fields (Environmental Working Group, 2025).

PFAS pervasiveness in everyday life gives insights on how many industrial sectors are dependent on these substances. Apart from the well-known example of cookware, where PFAS prevents food sticking on the pan (Glüge et al., 2020), many other applications often go unnoticed by consumers. For instance, PFAS have been detected in contact lenses, waterproof clothing, dental floss, shampoo, beauty products, cell phones, wall paints, and food packaging (Kluger, 2023; Guardian Staff, 2025).

A closer examination of the gender dimension reveals the possible presence of PFAS in menstrual hygiene products. Although research on this subject remains limited, the European Union PERIOD project specifically investigated whether dermal contact with menstrual products may contribute to PFAS exposure (European Commission, 2025a). Building on this concern, Wicks et al., (2025) found intentional use of PFAS in 33% of period underwear and 25% of reusable pads tested, indicating a largely unregulated exposure pathway. For this purpose, while no federal regulation exists in the United States, several states, such as California, Maine, Vermont, Colorado, and New York, have

adopted bans on PFAS in menstrual products (Safer States, 2026).

Even though this overview is necessarily limited, it demonstrates the ubiquity of PFAS in every dimension of daily life, from the industrial domain to the most intimate consumer uses. This deep-rooted integration is far from accidental, reflecting decades of industrial profits protected by lobbying practices.

The debate surrounding substitution and progressive elimination has intensified following the proposal advanced by five European countries for a universal restriction of PFAS under REACH. According to Johansson and Pettersson (2025), opposition from industrial stakeholders grew strongly against the proposal, seriously affecting its implementation. The authors also warn that failure to adopt restrictions could contribute to the continued PFAS accumulation, potentially reaching 4.4 million tonnes being released into the environment in the next thirty years (Johansson & Pettersson, 2025).

The related costs in terms of health in Europe alone amount to €52-84 billion annually, while the global social expenses approximately reach €16 trillion per year (CHEM Trust, 2025).

Industrial actors have already penetrated the highest level of the European Commission, exercising active influence on its decision-making processes. Indeed, the issue has become deeply politicised (Corporate Europe Observatory, 2025). Among the most active corporate lobbyists is Chemours (a Dupont spin-off), which organised direct meetings with Commission officials, recording more high-level contacts than any other group. This stands in stark contrast with the Commission's intention to balance meetings between NGO and private sector (Corporate Europe Observatory, 2025).

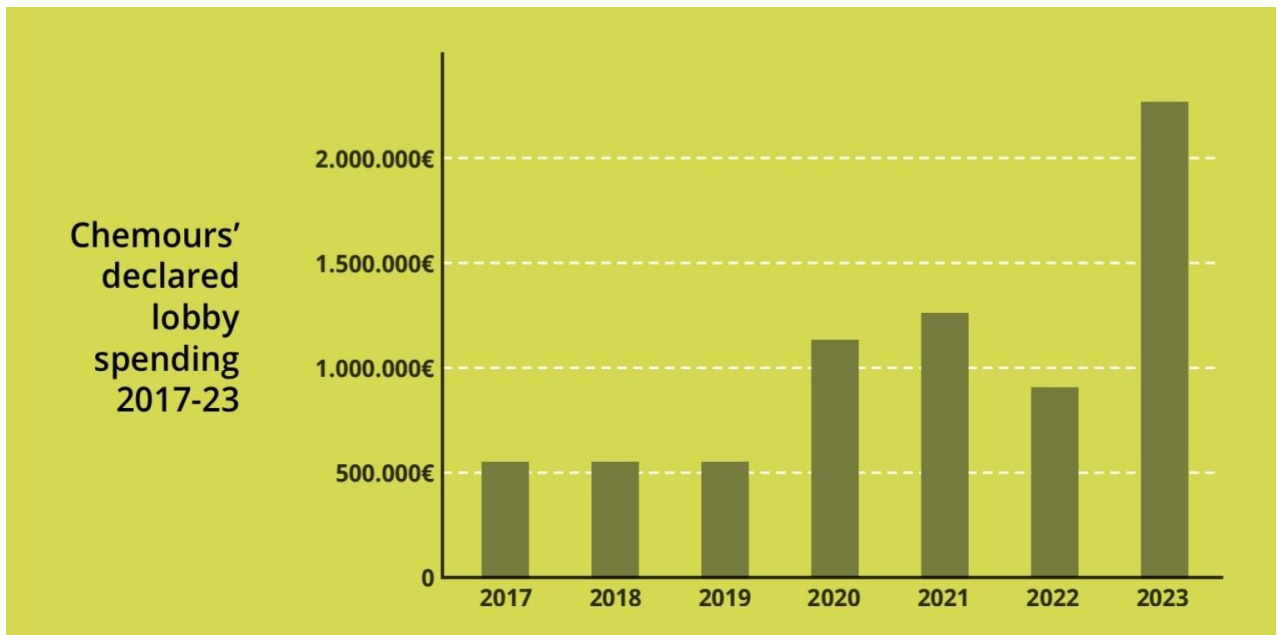


Figure 8. Chemours declared EU lobbying expenditure, 2017–2023.

Source: LobbyFacts, cited in Corporate Europe Observatory (2025, p. 26).

As illustrated in Figure 8. Chemours' declared EU lobbying investments increased remarkably between 2017 and 2023, with a sharp rise following the submission of the universal PFAS proposal in 2023.

According to documents collected by Corporate Europe Observatory (2025), the Commission itself advised PFAS manufacturers on how to develop their claims, even before having evaluated the relevant scientific findings.

Beyond direct lobbying, the second typical strategy adopted by Chemours is activating other industrial actors and supply chain partners, spreading information on its campaigns in favour of PFAS. The company simultaneously pushed for a voluntary self-regulating approach as an alternative to a universal ban, campaigning for the exclusion of fluoropolymers under the framework of "responsible manufacturing". This was further reinforced through the support of lawyers tasked with identifying legal flaws in the restriction proposal (Corporate Europe Observatory, 2025).

Industrial actors such as Plastics Europe also mobilised to advocate for exclusion of fluoropolymers from the comprehensive ban, emphasising the potential economic costs of the restriction on the European economy (Corporate Europe Observatory, 2025; Johansson & Pettersson, 2025). On the other hand, investigations conducted by the Forever Lobbying Project severely questioned the validity of the evidence used to support

some of these claims, developing a “stress test” methodology to assess industry argumentation. Specifically, several recurring patterns emerge in industry assertions. The first is the presumption of safety of fluoropolymers such as Teflon, despite their classification as PFAS. However, the foundation of this claim relies predominately on research produced by either employees or consultants of 3M, Chemours and DuPont. The intent indeed is to generate doubt and delay. In combination with this perspective, industry actors rely on the concept of technical indispensability. Thus, Forever Lobbying Project investigations demonstrated that two-thirds of the 134 cases analysed showed links to potential alternatives (Johansson & Pettersson, 2025).

Furthermore, it also emphasizes that industry had nearly fifty years to invest in safer developments, rather than continuing harmful production. Finally, a reinforcing narrative concerns the industry warnings of dramatic economic damage and wave of unemployment triggered by PFAS restrictions. While economic consequences are undeniable, these must be weighed against healthcare costs that systematically disappear from industrial reports, portraying restrictions as economically devastating while systematically omitting the costs of inaction (Johansson & Pettersson, 2025).

Beyond Chemours, the lobbying campaign involves a broad coalition of industrial actors, primarily driven by the chemical sector through trade associations such as CEFIC and Plastics Europe. All industries that employ PFAS in their production processes or final products actively support this campaign. Among the most active ones is the battery sector, represented by RECHARGE, which sought the complete exclusion of batteries from the ban proposal. Moreover, they also justify it by pointing out that PFAS in batteries cannot be replaced and that their absence would compromise the achievement of the Green Deal’s climate goals (Corporate Europe Observatory, 2025).

However, as highlighted by Dr Shubhi Sharma of CHEM Trust, cited in Corporate Europe Observatory (2025), climate change and PFAS pollution are intrinsically interconnected, addressing one, while exacerbating the other represents a fundamental contradiction. Similarly, the other sectors that exercise a strong influence are the medical technology and pharmaceutical together with the semiconductors, vehicles, and defence industry. Collectively, the largest PFAS producers recorded an average increase of 34% in declared EU lobbying expenditure in 2024 (Corporate Europe Observatory, 2025).

The investigative work of civil society organizations revealed a systematic and intentional

lack of transparency and accountability of the permanent representations in Brussels. Almost half of the representations, 13 out of 28, did not reply to repeated requests for information about PFAS lobbying, whereas of the other 15, 6 did not have records and the other 9 had information. For instance, Sweden was subject to heavy lobbying, probably because of being among the member states that initiated the proposal. These tendencies were considered by the authors as preliminary signs of corporate capture (Corporate Europe Observatory, 2025).

A striking case of institutionalised corporate capture is the previously cited report of Richards, White & Stenning (2025) on PFAS as enablers of EU competitiveness. According to ChemSec (2026) the authors of the report belong to an independent consultancy firm Risk and Policy Analysts (RPA), which appeared to rely on past research for the UK government and on 3M's own data on chemicals' effects on human health. Moreover, the premise that the six fluoropolymers represent the quasi totality of all fluoropolymers used in Europe is data corroborated by the Fluoropolymer Products Group of CEFIC, which constitutes one of the major industrial lobbyists in Europe. The presumption of their safety cannot be assessed solely on the final products, but rather it must be considered within the broad production process, whereby decades of industrial emissions have generated irreversible global contamination. Therefore, benefits on human health and the environment, indeed exist on their restrictions, leading to inconclusive estimates based on the assumption of null financial benefits. Even the title of the study, which categorizes PFAS as the drivers of European Union competitiveness already alludes to industrial dependency rather than to any commitment to finding safer alternatives (ChemSec, 2026).

Additionally, the Forever Lobbying Project's investigation draws a clear pattern of orchestrated lobbying occurring in tobacco, fossil fuels and chemical industries that has reached the highest level of EU institutions. In April 2024, the President of the EU Commission Ursula von der Leyen stated in an official letter that "PFAS are currently needed for critical applications for the green and digital transitions and for the EU's strategic autonomy, e.g. in semiconductors, electrolyzers, fuel cells, batteries and in components for many sectors, including defence, aerospace and medicine" (Calatayud et al., 2025). The language adopted closely mirrors the framing used by both industry lobbyists and Richards, White & Stenning (2025), exemplifying what Kwak, (2014)

defines as “cultural capture”: a phenomenon whereby industries shape policy outcomes through mechanisms of group identity, status and relationship networks, leading institutional actors to unconsciously internalise the perspectives of those they regulate, without the need for direct financial incentives or explicit corruption.

In August 2025, a further demonstration of industrial influence emerged with the recent modification of the EU PFAS restriction proposal by ECHA. The initial draft had received 5,600 replies during the public consultation, with the dossier submitters recommending a comprehensive ban covering all PFAS uses. Despite this, ECHA decided to exclude eight categories of PFAS applications, including printing, sealing, machinery, explosives, military uses, technical textiles, broader industrial uses, and certain medical uses (ChemSec, 2025b), and to allow PFAS production and exports to third countries indefinitely, creating a significant export loophole. This dynamic of pollution displacement mirrors the one examined in the first chapter of this thesis, whereby health harms are externalised to countries with weaker regulatory protections, echoing the reallocation of Miteni’s production to India (ChemSec, 2025a). A further concern relates to the magnitude of these exclusions: sealing alone is expected to employ 1.3 million tonnes of PFAS over the next 30 years. This approach effectively favours those industries that omitted information during the public consultation, while disadvantaging the companies that had invested in PFAS-free alternatives (ChemSec, 2025b).

The updated proposal also undermines the prospects of effective regulation through the wide presence of derogations particularly the 86 exemptions currently under consideration, some without any time limit, thereby permitting unstoppable pollution (ChemSec, 2025a).

Against this background, a recurring obstacle in the substitution process lies in identifying safer alternatives capable of preserving the original functionality of PFAS. In some cases, this leads to “regrettable substitution”. The case of GenX, however, illustrates an even more serious dynamic: introduced to replace PFOA, it proved so harmful that Cordner et al. (2025) framed it as “detrimental” rather than regrettable. This entails a certain degree of awareness of the dangerous effects, meaning the replacement was neither accidental nor unintentional.

Despite these challenges, the argument that PFAS are irreplaceable is increasingly contradicted by evidence. A notable example is the ChemSec Marketplace, which serves

as a worldwide platform enabling businesses to discover safer alternatives to harmful chemicals, while solution providers can promote their offerings. Importantly, it also displayed solutions for consumers enabling a more responsible purchasing experience (ChemSec, n.d.).

This availability is further confirmed by scientific research by Figuière et al. (2025) in the context of the EU-funded ZeroPM project which developed a database of 325 PFAS applications across 18 use categories, finding 530 PFAS-free alternatives.

The authors concluded that technically feasible substitutes are already available for 40 applications, while for 83 applications no alternatives could yet be identified, highlighting the areas where further research should be prioritised.

Important limitations in potential alternatives are underlined by the study of Cheng et al. (2025), which shows how some of them are already being widely used globally, without adequate knowledge or assessment of their impacts on ecosystems. As illustrated in Figure 9, the circulation of PFAS alternatives across air, soil, water, sediments and living organisms occurs without robust evidence regarding their pollution footprint. This suggests that considerable uncertainty remains in the research field, and that history risks repeating itself.

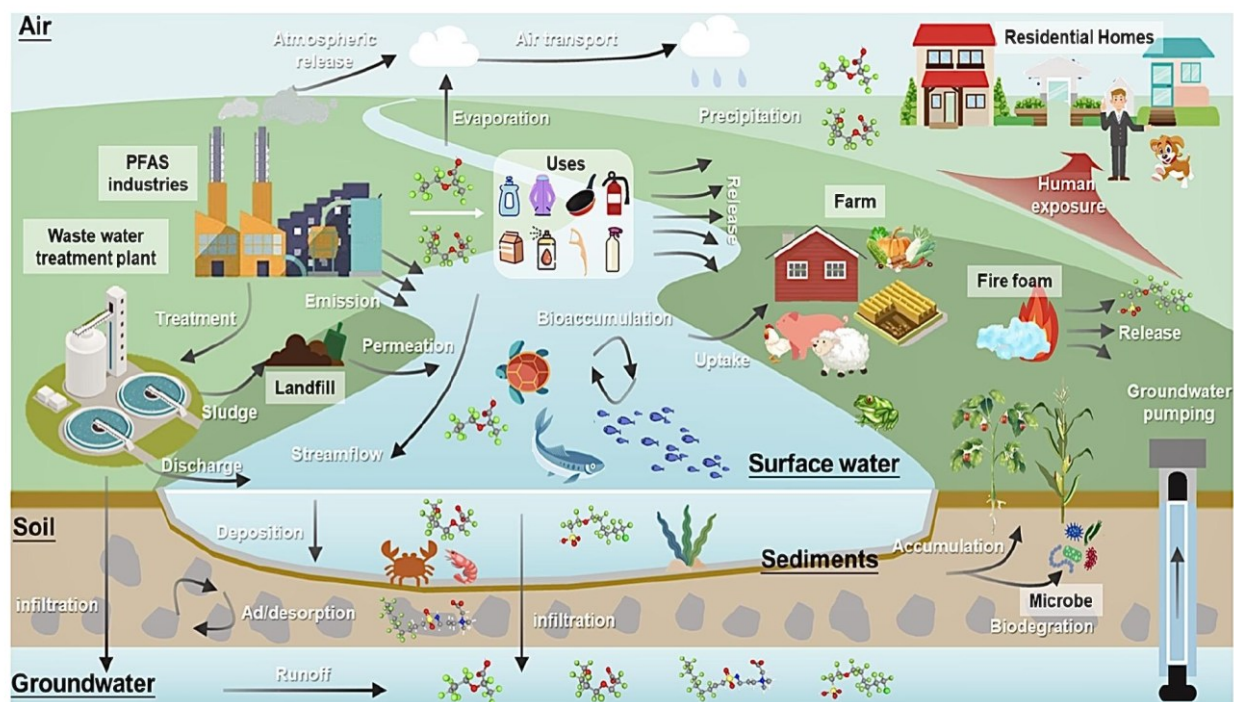


Figure 9. Migration and accumulation of PFAS alternatives in the natural environment.
Source: Cheng et al., (2025).

It is worth noting that the contamination pathways in Figure 9, although referring to PFAS alternatives, essentially mirror those of traditional PFAS, circulating through air, water, soil, and living organisms in the same way. From this perspective, safer alternatives may be as pervasive as the substances they are meant to replace.

A major structural constraint is grounded in the slowness of the regulatory system, where evaluating the safety of a single substance can take between seven to nine years (Bisschop, 2026). Furthermore, the approach behind the universal PFAS restriction reflects what Bisschop (2026) described as a “rule-exception design”, in which broad exceptions constitute a legitimate form of pollution. This is powered by the entire PFAS’ story which has been flawed from the very beginning; indeed, it started with a chronic knowledge asymmetry between industries and regulators, that allows the perpetuation of harm over time.

A different position, instead, is offered by the essential-use concept, introduced by the Montreal Protocol in 1987 to implement the phase-out of ozone layer substances, for which the European Commission developed guidance criteria within chemical regulation in 2024 (Figuière et al., 2025). The framework is centred on two questions: whether a substance serves a vital societal or safety function, and whether there exist available replacements. According to Figuière et al. (2025), this approach enables evaluating PFAS applications for which suitable alternatives can be identified. Of the 40 applications for which suitable alternatives are available, roughly 28 (approximately 10% of the total uses documented in the database) can be considered non-essential, as safer alternatives are already on the market and no exemption from regulation would be justified.

Two practical examples where there are no alternatives, but where the functions provided by PFAS are not critical for society are bicycle chain lubricants and anti-fog sprays. These two cases do not fulfil the criteria of necessity and therefore can be considered non-essential. This reasoning helps shift the focus toward regulating applications that are genuinely indispensable, rather than on uses that could be simply abandoned (Figuière et al., 2025).

Nevertheless, the essential-use approach is not without shortcomings. Apart from the

general external pressure exercised by lobbying, which purposely manufactures doubt and uncertainty, one of the main difficulties concerns the definition of what constitutes “essential for society”. Suffill et al. (2024) argue for the significance of integrating social and behavioural science into this assessment, allowing the concept to encompass both experts’ and non-experts’ perspectives, as well as the variation in how “essentiality” is rated across time and geography. Likewise, the presence of vulnerable groups and equity considerations should be taken into account. Not surprisingly, economic factors are identified as one of the largest barriers to the essential-use approach, since the industrial notion of essentiality is primarily driven by profit margins.

In a context where lobbying continues to delay regulatory actions, where decision-making processes remain slow, and where available alternatives may carry environmental and health risks, product labelling may constitute a minimal yet meaningful measure. By clearly indicating the presence of PFAS in consumer goods, labelling would enable individuals to make informed and conscious purchasing decisions. This warning strategy has long been applied in various sectors such as tobacco, alcohol, and plastic, and has proved effective in spurring behavioural change that could gradually push the market towards safer solutions (Suffill et al., 2024).

The study by Rodgers et al., (2022) explored how some product labels, specifically those most used by adolescents and children, lacked a clear list of added chemicals such as PFAS, and analysed whether consumers could rely on other information to identify PFAS-free products.

The results found that the presence of “green” and “nontoxic” assurances did not automatically indicate the absence of PFAS. These labels therefore offer no reliable guarantee of safety, since such certifications usually do not assess PFAS or are based on higher thresholds for individual PFAS than those detected in this study. As a result, consumers are deprived of the information needed to make safe and informed choices. Even more concerning, since the products targeted in this research were intended for children and young individuals, it reinforces the intergenerational dimension of harm discussed in the previous chapter (Rodgers et al., 2022).

At the European level, some regulatory steps towards greater transparency are being implemented with the Packaging and Packaging Waste Regulation (PPWR)¹⁷, which

¹⁷ Regulation (EU) 2025/40 of the European Parliament and of the Council of 19 December 2024 on

entered into force in February 2025 and applies from August 2026. It is designed to manage and harmonise packaging waste and recycling while reducing resource consumption. It also targets the disposal of “forever chemicals” in food packaging and aims to make labelling clearer. In the United States, by contrast, measures can be observed mainly at the state level, rather than through a unified federal regulation, and these provisions remain largely sectorial (Zoch, 2025).

Despite this recent development, according to an up-to-date article by Cozzarini (2026), more than a hundred businesses pressed to postpone the application of the PPWR by petitioning President von der Leyen. Even such measures, therefore, have not escaped lobbying dynamics: companies such as Coca-Cola, Heineken, McDonald’s, Kraft Heinz and Mondelez are among the main proponents of the last-minute postponement request. This occurs to the detriment of all the other private actors that had already invested in compliance and sustainability, supported by NGOs and scientific institutions advocating adherence to the 12 August deadline. If this were to happen, the episode would reveal a fundamental tension: the companies that proactively embrace healthier change would be penalised, whereas those that continue to pollute and resist change would effectively be rewarded. This demonstrates that even transparency measures remain vulnerable to the influence of economic interests, and that consumers are ultimately the ones who pay the price.

A more encouraging perspective is offered by France, which has emerged among the first EU countries to implement national actions with the intent of constraining PFAS. On 27 February 2025, France enacted Law 2025-188 which bans the manufacturing, export, import, sale, or free distribution of PFAS- containing cosmetics, clothing textiles, shoes, and waxing products. By January 2030, the ban will be comprehensively extended to all textile products, although exemptions are provided for essential uses and other specific categories. A practical implementation of the “polluter pays” principle is introduced through a tax of €100 per 100 grams of PFAS emitted into water annually, applied to industrial facilities exceeding that threshold. This is combined with the State’s duty to monitor PFAS in drinking water and to exercise sanitary controls, thereby reinforcing the preventive dimension of environmental protection (King & Spalding, 2025).

packaging and packaging waste, amending Regulation (EU) 2019/1020 and Directive (EU) 2019/904, and repealing Directive 94/62/EC

Of particular relevance is the exclusion of cookware containing PFAS which, although originally included in the draft, was removed as a consequence of intense lobbying of Groupe SEB, the producer of Tefal frying pans. According to the environmental law organisation ClientEarth, this exclusion represents one of the law's "undeniable shortcomings", particularly because safer alternatives for cookware already exist and are commercially available (Zainzinger, 2025).

In conclusion, to answer the research question of this thesis, this chapter has shown that the persistence of PFAS contamination stems from multiple interconnected factors. Having identified the key systemic gaps in responsibility between States and corporate actors, a crucial element emerges in the multiplicity of sectoral lobbying that actively obstructs institutional progress, spreading doubt, partial truths, and even false information. Crucially, lobbying does not operate in a vacuum: it exploits the very structural gaps in responsibility examined throughout this thesis. This inevitably results in a paralysis of the regulatory system, which ultimately serves the endless pursuit of profit.

Conclusion

In conclusion, the interdisciplinary approach adopted in this thesis has contributed to unmasking the complex dynamics at the roots of PFAS contamination. Every chapter was intended to add a layer to the research question underpinning the work: *How have structural gaps in responsibility between States and corporate actors contributed to the persistence of PFAS-related environmental and human rights harm despite growing scientific knowledge?* The permanence of “forever chemicals” and their related impacts is systematically reproduced by information asymmetries, fragmentation of accountability, and regulatory capture. Scientific knowledge existed from the very beginning: it was the intentionally generated ignorance documented by Richter et al. (2021), together with the corporate awareness revealed in the timeline reconstructed by Gaber et al. (2023) that concealed the risks and allowed harmful production to continue unchallenged.

Despite being a contamination that spread on a planetary scale, the hotspots were identified in the United States, where PFAS were first manufactured; in Italy where production continued; in Japan, where PFAS were employed in American military bases; and in India as a living proof site of contamination exportation driven by tightening regulatory action elsewhere.

The common thread of these case studies is the reproduction of the same patterns across continents. The sequence indeed appears identical: discovery, suppression of information, uncontrolled diffusion, mobilisation of civil society, delayed institutional response, and externalisation of harm. The enabling conditions that permitted the fragmentation of responsibility were corporate strategies, such as restructuring, bankruptcy, and delocalization; institutional derogations (ECHA); and opaque bilateral agreements (SOFA). These elements hinder the allocation of responsibility, crucially shifting the costs onto affected populations. Moreover, lobbying acted as a connective tissue underlying the above mentioned conditions that allowed the persistence of PFAS, exploiting the gaps, a dynamic clearly displayed in the phenomenon of “cultural capture”. Consequently, human rights violations, intergenerational forms of injustice, and environmental deterioration constitute the inevitable outcomes of these foreseeable decisions.

Overall, the interpretative key is offered by Bisschop (2026), who portrays PFAS contamination as a “state-facilitated corporate crime”, being the result of intersecting economic and social interests of both states and corporations.

However, far from adopting a pessimistic view, this thesis acknowledges the following landmark developments: the Miteni case law, the European proposal for a universal ban, the several instruments available such as the ChemSec Marketplace and the “essential-use” concept, and the French law. Altogether, despite not representing decisive solutions, these at least contributed to addressing the issue. A more contradictory aspect, which deserves attention, is the paradox of the green transition’s reliance on PFAS. Therefore, the question of a just transition remains far from resolved.

Some signs of change may be identified in the Clean Industrial Deal, presented by the European Commission in February 2025. The objective of this strategy is to establish a process of decarbonisation while enhancing industrial competitiveness, treating the two not as opposing forces but as two sides of the same coin. Among its innovative aspects are accelerated state aid measures for achieving green goals, and boosted investments in clean technologies (European Commission, 2025b).

While the critical relationship between competitiveness and sustainability is not new within EU policies, the Clean Industrial Deal places this linkage at the centre of Europe’s industrial strategy, raising the question of how to reconcile industrial competitiveness with environmental sustainability. Whether this shift will prove capable of addressing PFAS dependence of certain sectors deserves further attention beyond the scope of this thesis.

A further reflection of this work is the vital role played by civil society, which has effectively acted as an epistemic community in the circulation of knowledge on PFAS. These communities were at the heart of environmental activism and subsequent revolutions, helping in holding governments and businesses accountable (Menegatto & Zamperini, 2024). It is worth noting that in both cases, first in the United States and then in Vicenza, ordinary citizens were those who first detected and denounced the harm they were suffering. In both contexts, the truth emerged thanks to grassroots movements. This led to a bottom-up production of awareness which in turn activated independent science, whose findings proved fundamental in breaking the silence and forcing the issue onto the regulatory agenda.

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