GuyCarpenter Verisk™

PFAS in Europe – Assessing and Modelling an Emerging Risk

Potentially Insurable Losses in Germany, France, and Belgium

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Executive Summary

Emerging risks are a key concern for (re)insurance carriers. From a casualty (re)insurance perspective, emerging liability risks can be defined as new or unforeseen events or trends that could have significant, systemic impacts on liability (re)insurance portfolios. Per- and polyfluoroalkyl substances, known as "PFAS," are currently under specific scrutiny as an emerging liability risk in multiple regions. PFAS, also described as "forever chemicals," are a group of synthetic chemicals that have generated significant concerns related to their potential impacts on human health and the environment.

In the United States, PFAS-related litigation has led to more than $18 billion in settlements to date. Most of this litigation has focused on seeking compensation for costs and alleged harms related to PFAS environmental contamination of drinking water and soil, rather than alternative PFAS exposure pathways, such as occupational exposure or consumer exposure through products. The US litigation is ongoing. Verisk Liability Analytics anticipates that the current $18 billion in settlements could grow to between $120 billion and $165 billion in total potentially insurable liability losses, as the full extent of contamination of US drinking water systems is discovered and sparks litigation to recoup the associated remediation costs.[1]

In recent years, PFAS testing in Europe has begun to reveal widespread PFAS contamination in Europe's water and soil, as well. The magnitude and extent of the PFAS contamination in Europe known to date is illustrated in the Forever Pollution Project developed by *Le Monde* and its partners.[2] Some local governments and affected residents have already sued PFAS chemical manufacturers and other companies, seeking compensation related to the environmental contamination and the health risks associated with environmental exposure. Multiple factors may drive this type of litigation to grow more widespread. For example, new EU regulations, including the updated Drinking Water Directive, will require further testing for PFAS contamination. Meanwhile, several European countries have become more litigious in recent years, and this trend may continue in light of regulatory developments such as the EU's new Product Liability Directive and Representative Actions Directive. As more PFAS-contaminated sites are found and the regulatory and legal environment continues to evolve, a potentially large PFAS liability event could develop in several European countries.

Although studies exist on the potential extent of PFAS contamination in Europe, to date there have been limited efforts to quantify the associated potential liability losses that could arise if PFAS litigation continues to grow. Verisk Liability Analytics, in partnership with Guy Carpenter, has developed a model for PFAS liability in Germany, France, and Belgium to provide the industry with an initial view and quantification of this potential liability exposure. The development of PFAS scenarios for Europe will help (re)insurance carriers better identify their exposure to this emerging risk. This model is a critical first step to better understanding the possible impact on earnings and capital and developing proper risk management approaches.

This model quantifies the total potentially insurable liability losses, defined as the total economic and non-economic damages potentially paid out in civil lawsuit settlements or awards in Germany, France, and Belgium. The estimated losses represent ultimate insurable ground-up losses, prior to application

[1] Estimate based on Verisk's Liability Analytics research. For key examples, see "PFAS Litigation Could Generate Billions in Ground-Up Losses" (Verisk Emerging Issues, April 5, 2024), https://core.verisk.com/Insights/Emerging-Issues/Articles/2024/April/Week-1/PFAS-Litigation-Could-Generate-Billions-in-Ground-Up-Losses

[2] "The Forever Pollution Project: Journalists tracking PFAS across Europe" (last updated March 2024, accessed October 1, 2024), https://foreverpollution.eu/

of any insurance terms. The model focuses on litigation arising from PFAS environmental contamination of drinking water systems and residential garden soil, as well as from claims of bodily injury from exposure to that contamination. It also identifies the industries that could potentially be held responsible for the PFAS contamination, categorized based on their relative liability exposure. This model will allow (re)insurers to simulate how the estimated losses could accumulate on their portfolios.

Our model indicates that a European PFAS environmental-related liability event in Germany, France, and Belgium could range between €10 billion and €24 billion in total potentially insurable ground-up liability losses. Our culpability analysis indicates that dozens of industries are exposed to this potential liability event, reaching far beyond the limited number of PFAS manufacturers and other companies sued so far.

The following white paper provides key background on PFAS liability risks and the relevant European regulatory and litigation environment to date, followed by an overview of our modelling approach and results. This overview includes our narrative for how this liability event could unfold, our methodology for quantifying such an event, our model outputs and high-level takeaways, and areas of potential further research.

Context

PFAS chemical concerns and liability risks

PFAS are a large category of synthetic chemicals that contain carbon-fluorine bonds.[3] Since the 1950s, PFAS have been in widespread use in thousands of industrial and consumer products, from food packaging to airplane parts.[4] More than 12,000 unique types of PFAS compounds have been developed.[5] PFAS are also present in a firefighting foam known as aqueous film-forming foam, which has been widely used by firefighters and at airports, oil refineries, and military bases.[6]

PFAS are highly useful because they are stable, durable, and resistant to water, oils, greases, other chemicals, heat, and fire.[7] However, these same properties have raised concerns related to environmental contamination, property damage, and human health. PFAS accumulate over time in the environment and in living organisms, dispersing widely through water in particular, and they have become virtually ubiquitous—PFAS compounds have been found in the environment and in human bodies in nearly every region of the world.[8]

Scientific research has raised concerns about potential long-term risks to human health even from low levels of PFAS. To date, the two types of PFAS most studied for health and environmental impacts are PFOA (also known as C-8) and PFOS. These two compounds have been linked to multiple illnesses, including kidney and testicular cancer.[9] Although many companies have phased out the use of PFOA and PFOS, known as "long-chain" or "legacy" PFAS, these PFAS are still present in the environment. Meanwhile, evidence is growing that many other types of PFAS, including the newer "short-chain" PFAS developed to replace PFOA and PFOS, may pose similar environmental and health risks.[10] While some older PFAS types are known to persist in the human body for several years, the newer "short-chain"

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[3] "Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS)," National Institute of Environmental Health Sciences, last updated September 3, 2024, https://www.niehs.nih.gov/health/topics/agents/pfc

[4] Juliane Glüge et al., "An Overview of the Uses of Per- and Polyfluoroalkyl Substances (PFAS)," *Environmental Science: Processes & Impacts*, no. 12 (December 1, 2020): 2345–73, https://doi.org/10.1039/d0em00291g; "History and Use of Per- and Polyfluoroalkyl Substances (PFAS) found in the Environment," Interstate Technology & Regulatory Council, April 2020, https://pfas-1.itrcweb.org/wp-content/uploads/2020/10/history_and_use_508_2020Aug_Final.pdf; "Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS): Frequently Asked Questions," U.S. Agency for Toxic Substances and Disease Registry, August 22, 2017, https://www.atsdr.cdc.gov/pfas/docs/pfas_fact_sheet.pdf

[5] "Increasing Our Understanding of the Health Risks from PFAS and How to Address Them," U.S. Environmental Protection Agency, last updated October 7, 2024, https://www.epa.gov/pfas/increasing-our-understanding-health-risks-pfas-and-how-address-them

[6] Phong Thai et al., "Release of Perfluoroalkyl Substances from AFFF-Impacted Concrete in a Firefighting Training Ground (FTG) under Repeated Rainfall Simulations," *Journal of Hazardous Materials Letters* 3 (November 2022): 100050, https://doi.org/10.1016/j.hazl.2022.100050

[7] Glüge et al., "An Overview of the Uses of Per- and Polyfluoroalkyl Substances (PFAS)."

[8] "PFAS and Health: Troublesome, Ubiquitous Chemicals to Be Examined at YSPH Symposium," Yale School of Medicine, December 12, 2019, https://medicine.yale.edu/news-article/pfas-and-health-troublesome-ubiquitous-chemicals-to-be-examined-at-ysph-symposium/; "Our Current Understanding of the Human Health and Environmental Risks of PFAS," U.S. Environmental Protection Agency, March 16, 2022, https://www.epa.gov/pfas/our-current-understanding-human-health-and-environmental-risks-pfas

[9] Kyle Steenland et al., "Review: Evolution of Evidence on PFOA and Health Following the Assessments of the C8 Science Panel," *Environment International* 145 (December 2020): 106125, https://doi.org/10.1016/j.envint.2020.106125

[10] Richard Brase, Elizabeth Mullin, and David Spink, "Legacy and Emerging Per- and Polyfluoroalkyl Substances: Analytical Techniques, Environmental Fate, and Health Effects," *International Journal of Molecular Sciences* 22, no. 3 (January 20, 2021): 995, https://doi.org/10.3390/ijms22030995;

"Immunotoxicity Associated with Exposure to Perfluorooctanoic Acid (PFOA) or Perfluorooctane Sulfonate (PFOS)," U.S. Department of Health and Human Services National Toxicology Program, June 4, 2021,https://ntp.niehs.nih.gov/whatwestudy/assessments/noncancer/completed/pfoa/index.html;

"History and Use of Per- and Polyfluoroalkyl Substances (PFAS);" "Newer PFAS Compound Detected for First Time in Arctic Seawater"; "Per- and Polyfluoroalkyl Substances (PFAS) in Drinking Water," American Association for the Advancement of Science, accessed October 1, 2024, https://www.aaas.org/epi-center/pfas

PFAS exit the body more quickly, but they have nonetheless raised concerns over possible long-term health impacts.[11]

PFAS litigation trends in Europe and key cases to date

The development of European PFAS litigation thus far roughly parallels the trends seen in the US, in which environmental contamination has been the main driver of litigation. Rather than occupational or product exposure, environmental remediation costs have driven the majority of the monetary settlements to date. In general, in both the US and Europe, environmental exposure will likely continue to be the greatest driver of PFAS-related lawsuits in the near future. In part, this is because there is relatively stronger scientific evidence for health risks from this exposure pathway and because it is relatively easier to trace environmental contamination to the nearby activities of potential defendant companies. Although the number of cases filed in Europe is likely to remain well below that of the US, PFAS litigation has gained momentum in Europe as contamination has been discovered in soil, drinking water, groundwater, and surface water.

Notable PFAS lawsuits are ongoing in many European countries, including Germany, France, Belgium, the Netherlands, Sweden, and Italy. Some of these actions have been criminal proceedings, such as an ongoing criminal investigation by Dutch prosecutors into chemical company Chemours and its former parent company Dupont for PFOA emissions from its facility in the city of Dordrecht.[12] However, most are civil lawsuits, and these have led to roughly €700 million in total settlements to date. These civil suits have primarily been brought against PFAS manufacturers by advocacy groups, residents living in proximity to PFAS-contaminated sites, and water utilities. In some cases, the defendants have been government agencies, water utilities themselves, or non-PFAS manufacturers—such as a compost manufacturer in Germany—whose sites and operations may have contributed to PFAS contamination.[13]

In some of the areas found to be contaminated, some residents have also sought compensation for property damage—for example, arguing that they have lost full use of their properties due to contaminated soil in their gardens.[14] In addition, some residents have filed lawsuits that allege bodily injury or violation of their personal rights due to having high levels of PFAS in their blood. To date, no European resident has sued attributing an existing illness, such as cancer, to PFAS exposure, as seen in US bodily injury lawsuits. However, residents of contaminated areas in Belgium, Sweden, and France have sought compensation simply on the basis of having high levels of PFAS in their blood, without the presence of a disease.[15]

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[11] Ying Li et al., "Determinants of Serum Half-Lives for Linear and Branched Perfluoroalkyl Substances after Long-Term High Exposure—A Study in Ronneby, Sweden," *Environment International* 163 (May 2022): 107198, https://doi.org/10.1016/j.envint.2022.107198;

Wendee Nicole, "Breaking It Down: Estimating Short-Chain PFAS Half-Lives in a Human Population," *Environmental Health Perspectives* 128, no. 11 (November 11, 2020): 114002, https://doi.org/10.1289/EHP7853; Ian Cousins et al., "The High Persistence of PFAS Is Sufficient for Their Management as a Chemical Class," *Environmental Science: Processes & Impacts*, no. 12 (December 1, 2020): 2307–12, https://doi.org/10.1039/D0EM00355G; Megan Solan et al., "Short-chain per- and polyfluoralkyl substances (PFAS) effects on oxidative stress biomarkers in human liver, kidney, muscle, and microglia cell lines," *Environmental Research*, vol. 223 (April 15, 2023): https://doi.org/10.1016/j.envres.2023.115424

[12] April Roach, "Chemours Faces Dutch Criminal Probe on Emitting Forever Chemicals," *Insurance Journal*, October 23, 2023, https://www.insurancejournal.com/news/international/2023/10/23/745215.htm

[13] Heiner Kunold, Patrick Neumann, and Wolfgang Hörter, "PFC / PFAS Umweltskandal: Zivilklage vor dem Landgericht Baden-Baden," ("PFC / PFAS environmental scandal: civil lawsuit before the Baden-Baden Regional Court"), SWR Aktuell, December 11, 2023, https://www.swr.de/swraktuell/baden-wuerttemberg/karlsruhe/pfc-umweltskandal-prozess-beginnt-landgericht-baden-baden-100.html

[14] "PFAS pollution: 3M ordered to compensate affected family," *The Brussels Times*, May 16, 2023, https://www.brusselstimes.com/506509/pfas-pollution-3m-ordered-to-compensate-affected-family

[15] Floor Eelbolde, "Actiegroep vraagt 3M schadevergoeding van 20.000 euro per buurtbewoner" ("Action group asks 3M for compensation of 20,000 euros per resident"), June 30, 2023, *De Tijd*, https://www.tijd.be/ondernemen/chemie/actiegroep-vraagt-3m-schadevergoeding-van-20-

Key examples of civil PFAS litigation (pending or settled as of October 1, 2024) in Europe include:

- **€571 million settlement between 3M and the Flemish Government:** In 2022, 3M Belgium agreed to a settlement over PFAS contamination of the soil and groundwater around its facility in Zwijndrecht. The settlement covers the costs of PFAS treatment technology to prevent further contamination from the facility itself, soil remediation in residential gardens, remediation of agricultural and recreational lands near the facility, and investment in a local construction project affected by the soil contamination.[16]
- **Local resident lawsuits against 3M in Zwijndrecht:** An individual family living near the 3M Zwijndrecht site sought blood tests after learning of the PFAS environmental contamination and found they had exceptionally high PFAS blood levels, at 100 times the blood level deemed safe in Belgium, as well as high PFAS soil levels in their garden. They sued 3M in Antwerp court, citing both of these metrics as evidence that 3M had created a "nuisance," and in May 2023, 3M was ordered to compensate the family members with €500 each and to commit to compensating them for the costs of future potential illnesses or for devaluation of their property—a decision that 3M may appeal.[17] Meanwhile, a larger collective action representing at least 1,400 residents of Zwijndrecht with similar claims against 3M is ongoing.[18]
- **City of Lyon civil action against Arkema and Daikin:** In March 2024, the Greater Lyon metropolitan area government filed a civil action against chemical companies Arkema and Daikin over PFAS environmental contamination. PFAS was found in a widespread area and is thought to potentially affect the drinking water of at least 200,000 residents.[19] The civil action seeks to establish the source of the PFAS contamination and the duration and extent of PFAS emissions from Arkema and Daikin facilities.[20]
- **Regional court ruling on PFAS contamination from Miteni plant in Veneto region of Italy**: Beginning in 2006, a series of studies found high levels of PFAS contamination in water supplies in the Veneto region of Italy, much of which was then traced back to a plant operated by a chemical company named Miteni.[21] Beginning in 2015, the Italian National Institute of Health launched health surveillance efforts in the surrounding area and found high PFAS blood levels in local residents and Miteni plant workers.[22] Miteni itself went bankrupt in 2018, but in May 2024, the Veneto regional administrative court ordered the company's current and former owners to pay for the environmental

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000-euro-per-buurtbewoner/10478070.html; Anne Devineaux, "Forever chemicals: French company poisoned environment near Lyon for decades, locals claim," *Euro News*, June 28, 2023, https://www.euronews.com/green/2023/06/28/forever-chemicals-french-company-poisoned-environment-near-lyon-for-decades-locals-claim; Sweden Supreme Court's Judgment delivered in Stockholm, December 5, 2023, Case No. T 486-23, English version, Doc. ID 272328, https://www.domstol.se/globalassets/filer/domstol/hogstadomstolen/avgoranden/engelska-oversattningar/t-486-23-eng.pdf

[16] "Agreement Reached Between the Flemish Government and 3M Belgium to Support the People of Flanders," 3M News Center, July 6, 2022, https://news.3m.com/2022-07-06-Agreement-Reached-Between-the-Flemish-Government-and-3M-Belgium-to-Support-the-People-of-Flanders

[17] "PFAS pollution: 3M ordered to compensate affected family," *The Brussels Times*; "PFAS – our intimate relation with these forever chemicals: And the case of 3M in Antwerp, Belgium," GRID-Arendal, December 22, 2023, https://storymaps.arcgis.com/stories/dc9f7d19d293402ba1c98570bedbcc37

[18] Lina El Bakkali, "1.400 burgers slepen Amerikaanse chemiebedrijf 3M voor de rechter in Antwerpen" ("1,400 citizens take American chemical company 3M to court in Antwerp"), VRT NWS, April 10, 2024, https://www.darkwater3m.be/wp-content/uploads/2024/05/20240410-Artikel-VRT-1.400-burgers-slepen-Amerikaanse-chemiebedrijf-3M-voor-de-rechter-in-Antwerpen.pdf

[19] Rosie Frost, "Lyon, Veneto and Antwerp plagued by dangerous forever chemicals, as call for an EU ban gains steam," *Euro News*, October 20, 2022, https://www.euronews.com/green/2022/10/20/rainwater-breastmilk-and-blood-contaminated-by-forever-chemicals-is-it-time-for-an-eu-ban

[20] Gaëlle Coudert, "Pollution aux PFAS : la métropole de Lyon attaque Daikin et Arkema en justice" ("PFAS pollution: Lyon metropolitan area takes Daikin and Arkema to court"), *Deklic,* March 20, 2024, https://deklic.eco/pollution-aux-pfas-la-metropole-de-lyon-attaque-daikin-et-arkema-en-justice/

[21] Federica Marsi, "Forever chemicals come under fire in Italy," *Politico*, December 3, 2020, https://www.politico.eu/article/chemicals-pfas-miteni-under-fire-in-italy/

[22] Ibid.

remediation costs, which were estimated at the time to be approximately €137 million.[23]

- **Swedish Supreme Court ruling on PFAS in blood:** PFAS was found in the drinking water of the Ronneby municipality in Sweden in 2013 and is thought to have originated from firefighting foam leaking into the groundwater from a nearby Swedish Air Force Base. Residents sued the water treatment company Miljo Teknik, which is owned by the municipality, claiming that the PFAS-contaminated drinking water served to them constituted a "defective product" under Sweden's Product Liability Act (the national implementation of the EU Product Liability Directive) and that the high PFAS levels in their blood constituted a "personal injury."[24] In a striking decision, the Swedish Supreme Court ruled in 2023 that such high PFAS blood levels did in fact constitute a personal injury in themselves, even in the absence of a proven illness. However, the court left open two key questions—whether this personal injury should entitle the plaintiffs to compensation of any kind, and if so, what that compensation should be.[25]

PFAS litigation in Europe is still in its early stages, and the above cases have the potential to set precedents for more widespread lawsuit filings and associated settlements or awards. As awareness of PFAS risks and testing for environmental contamination continue to grow in Europe, potentially costly lawsuits seeking compensation for water and soil remediation are likely to increase.

Wherever this environmental contamination is found, there is also potential for associated property damage and especially bodily injury claims to grow significantly. The full extent of potential liability for bodily injury will depend on several key factors, including:

- the level of compensation, if any, for high PFAS levels in blood that will be decided by the Swedish courts (this decision process could take time and may similarly go through appeals up to the Supreme Court);
- whether the Swedish Supreme Court ruling will influence other countries' approaches to treating PFAS blood levels as a personal injury;
- whether any European residents already diagnosed with PFAS-linked illnesses will file lawsuits attributing their illnesses to PFAS exposure; and
- how European courts will assess the alleged causal links between PFAS environmental contamination by specific companies and the illnesses of the people in affected areas. Will the courts in Europe take into account only a general causal link (a link making it possible to determine whether a substance is generally likely to cause a particular harm, such as a particular health problem) or a specific causal link (a link making it possible to determine whether a particular substance has caused harm to a particular individual)? Court standards vary by country; for example, Germany has a strict specific causal link standard under current legislation. Each country's approach could potentially evolve over time.

Regulatory and legislative activity in Europe

The manufacture, use, and import of some types of PFAS are already restricted in Europe under several regulations and directives. The Persistent Organic Pollutants (POP) Regulation includes mandatory

[23] Ibid.; "Just the start: The growing legal battle over PFAS in Europe," *ChemSec*, June 26, 2024, https://chemsec.org/just-the-start-the-growing-legal-battle-over-pfas-in-europe/

[24] Elin Hofverberg, "Sweden: Supreme Court Declares High Levels of PFAS in Blood Constitutes Personal Injury," Library of Congress, March 7, 2024, https://www.loc.gov/item/global-legal-monitor/2024-03-06/sweden-supreme-court-declares-high-levels-of-pfas-in-blood-constitutes-personal-injury/

[25] Ibid.

restrictions on the production and use of three specific PFAS compounds (PFOS, PFOA, and PFHxS).[26] The Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) regulation similarly restricts manufacturing, use, and imports of PFOA and its precursors. Some other PFAS types are currently listed as Substances of Very High Concern to be considered for potential restriction under REACH.[27] Both POP and REACH are mandatory regulations that include penalties and sanctions for noncompliance, subject to the provisions of each EU member state.[28]

In January 2023, five EU member states (Sweden, Norway, Denmark, the Netherlands, and Germany) proposed a comprehensive ban under REACH, subject to some temporary exemptions, on the manufacturing, importing, and use of approximately 10,000 PFAS substances.[29] As of October 2024, the European Chemicals Agency (ECHA) is still evaluating this proposal.[30]

European agencies have also issued directives and guidelines on maximum levels of PFAS permissible in various exposure pathways, including food, drinking water, surface water, and groundwater:

- The EU revised its Drinking Water Directive in December 2020. This directive regulates drinking water quality, and the revised version requires Member States to monitor drinking water for any PFAS and to monitor the individual levels of 20 specific PFAS types. The total limit for PFAS in drinking water under the Directive is 0.5 µg/L, while each of the 20 PFAS types of concern has an individual limit of 0.1 µg/L.[31] Member States are required to comply with the limits by January 2026.[32]
- In 2022, the European Commission (EC) issued recommendations encouraging Member States to monitor for multiple types of PFAS in a long list of at-risk food products. In January 2023, the EC set maximum levels for four types of PFAS in certain meat and seafood products.[33]

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[26] "Plan d'action ministériel sur les PFAS" ("Ministerial action plan on PFAS"), French Ministry of Ecological Transition and Territorial Cohesion, January 17, 2023, https://www.ecologie.gouv.fr/politiques-publiques/plan-daction-ministeriel-pfas; "The new POPs under the Stockholm Convention," Secretariat of the Stockholm Convention, accessed October 1, 2024, https://www.pops.int/TheConvention/ThePOPs/TheNewPOPs/tabid/2511/Default.aspx

[27] "Emerging chemical risks in Europe — 'PFAS,'" European Environment Agency, published December 12, 2019, modified May 25, 2023, https://www.eea.europa.eu/publications/emerging-chemical-risks-in-europe; "Member State Committee Support Document for Identification of Nonadecafluorodecanoic Acid (PFDA) and its Sodium and Ammonium Salts as a Substance of Very High Concern because of its Toxic For Reproduction (Article 57 C) and Persistent, Bioaccumulative, and Toxic (PBT) (Article 57 D) Properties," European Chemicals Agency, December 2, 2016, https://echa.europa.eu/documents/10162/48c9acdc-7474-b256-e8cb-b0c6c1e5f2d0

[28] "Corrigendum to Regulation (EC) No 1907/2006," Official Journal of the European Union, L 136/3, May 29, 2007, https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:136:0003:0280:en:PDF; "Regulation (EU) 2019/1021 of the European Parliament and of the Council of 20 June 2019 on persistent organic pollutants," Official Journal of the European Union, L 169/45, June 25, 2019, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R1021

[29] "ECHA publishes PFAS restriction proposal," ECHA/NR/23/04, European Chemicals Agency, February 7, 2023, https://echa.europa.eu/-/echa-publishes-pfas-restriction-proposal; Linda-Jean Cockcroft et al., "EU REACH: How to prepare for the proposed PFAS restriction," ERM, March 22, 2023, https://www.erm.com/insights/eu-reach-restrictions-how-to-prepare-for-the-proposed-pfas-restriction/. Note: The French National Assembly also approved a bill May 2024 that would ban PFASs in cosmetics, wax, textiles ("'Forever chemicals': French MPs approve PFAS product ban," *France 24*, April 4, 2024, https://www.france24.com/en/europe/20240404-forever-chemicals-french-mps-approve-pfas-product-ban). The bill ultimately did not advance due to early parliamentary elections.

[30] "Next steps for PFAS restriction proposal," European Chemicals Agency, March 13, 2024, https://echa.europa.eu/-/next-steps-for-pfas-restriction-proposal

[31] By comparison, the US EPA standard is 4 parts per trillion, or 0.004 µg/L, for PFOA and PFOS and 10 parts per trillion, or 0.01 µg/L for other specified types of PFAS ("Per- and Polyfluoroalkyl Substances (PFAS): Final PFAS National Primary Drinking Water Regulation," United States Environmental Protection Agency, last updated July 12, 2024, https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas).

[32] "European zero pollution dashboards: Treatment of drinking water to remove PFAS (Signal)," European Environment Agency, published April 16, 2024, modified October 14, 2024, https://www.eea.europa.eu/en/european-zero-pollution-dashboards/indicators/treatment-of-drinking-water-to-remove-pfas-signal; "Commission Notice: Technical guidelines regarding methods of analysis for monitoring of per- and polyfluoroalkyl substances (PFAS) in water intended for human consumption," Official Journal of the European Union, C/2024/4910, August 7, 2024, https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=OJ:C_202404910&qid=1725583741948

[33] "Commission Recommendation (EU) 2023/915 of 25 April 2023 on maximum levels for certain contaminants in food and repealing Regulation (EC) No 1881/2006," Official Journal of the European Union, L 119/103, May 5, 2023, https://eur-lex.europa.eu/legal-

- The EU also proposed revisions to its quality standards for surface water and groundwater in 2022, adding a new threshold of 4.4 ng/L for 24 specific PFAS.[34] The Member States have agreed to these proposed new PFAS standards, but as of October 2024, the revisions have not been finalized with the European Parliament.[35]

In addition to PFAS regulations, there are multiple recent developments in European regulations that aim to increase protection of European consumers' rights, which could set the stage for an increase in the frequency of PFAS-related lawsuits against private companies in Europe:

- The new EU Product Liability Directive, a draft regulatory update approved in March 2023 and expected to be implemented in the member states over the next 2-3 years, increases the scope of potential liability for defective products.
  - Among other things, the new Directive allows consumers to make claims of death or personal injury, including medically recognized damage to psychological health, from defective products; it lowers the burden of proof to show that a product is defective; and it extends the liability period from 10 to 25 years for negative health impacts that are slow to manifest.[36] This regulatory change may drive future PFAS litigation, especially given that some PFAS-related lawsuits to date have already made use of product liability theories.[37]
- The EU Representative Actions Directive, enacted in 2020, requires member states to establish procedures over the next few years that will enable consumers to bring certain types of collective actions, including lawsuits seeking compensation.[38]
  - This change could make it easier for larger numbers of consumers to seek damages from a defendant company, in the style of a US class action. This consumer-focused regulatory change may potentially be relevant for PFAS liability if plaintiffs continue to characterize contaminated water as a "defective product" that may require reimbursement and cause bodily injury. The Directive may also increase PFAS liability risks indirectly by generally contributing to the increasing European acceptance of large-scale litigation of many types.

content/EN/TXT/PDF/?uri=CELEX:32023R0915; "Commission Recommendation (EU) 2022/1431 of 24 August 2022 on the monitoring of perfluoroalkyl substances in food," Official Journal of the European Union, L 221/105, August 26, 2022, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022H1431; "PFASs: very persistent chemicals," French Agency for Food, Environmental and Occupational Health & Safety (ANSES), April 4, 2024, https://www.anses.fr/en/content/PFASs-persistent-chemicals

[34] Sara Johansson and Christine Hermann, "Toxic tide rising: time to tackle PFAS: National approaches to address PFAS in drinking water across Europe," European Environmental Bureau, October 12, 2023, https://eeb.org/wp-content/uploads/2023/10/PFAS-in-drinking-water-briefing-final-1.pdf

[35] "Surface water and groundwater: Council agrees negotiating mandate to update list of pollutants," European Council press release, June 19, 2024, https://www.consilium.europa.eu/en/press/press-releases/2024/06/19/surface-water-and-groundwater-council-agrees-negotiating-mandate-to-update-list-of-pollutants/

[36] "Defective products: revamped rules to better protect consumers from damages," European Parliament press release, March 12, 2024, https://www.europarl.europa.eu/news/en/press-room/20240308IPR18990/defective-products-revamped-rules-to-better-protect-consumers-from-damages

[37] Sweden Supreme Court Judgment, December 5, 2023, Case No. T 486-23.

[38] "Representative Actions Directive," European Commission, accessed October 1, 2024, https://commission.europa.eu/law/law-topic/consumer-protection-law/representative-actions-directive_en

Modelling approach and outcomes

Liability event narrative and key assumptions

PFAS litigation is anticipated to develop considerably in Europe and more specifically in the countries covered by this initial version of the model: Germany, France, and Belgium. The model assumes these countries will still remain far less litigious than the US, but that the frequency of PFAS-related lawsuits against companies could increase beyond the typical litigation trends seen to date. This increase could be driven by the precedents set by the initial European PFAS-related lawsuits described above in the section "PFAS litigation trends in Europe and key cases to date," as well as the PFAS-related and litigation-related regulatory changes described above in the section "Regulatory and legislative activity in Europe."

The model scope focuses primarily on soil and water contamination claims due to the growing awareness of this environmental contamination, the relative ease of attributing environmental contamination to PFAS releases from companies' sites, and the urgency of remediating the types of PFAS contamination that could affect residents' drinking water and soil. The liability event narrative assumes that as Europe implements the PFAS monitoring requirements in the EU Drinking Water Directive, more water and soil contamination will be identified. Local residents, local governments, and water utilities are then expected to sue to recoup the costs of remediating drinking water supplies and soil in residential vegetable gardens. These two types of PFAS environmental remediation have high potential to grow in scale and to motivate lawsuits, given the health risks entailed.[39]

It is also assumed that bodily injury claims related to environmental contamination will grow, encouraged by the examples of litigation so far brought by individuals with high PFAS levels in their blood, such as the family test case against 3M in Antwerp and the 2023 Swedish Supreme Court ruling.[40] The model is agnostic of the exact mechanism of PFAS exposure: PFAS may enter local residents' blood through the contaminated drinking water, contaminated vegetables from soil, and/or other similar pathways. The bodily injury lawsuits modelled include lawsuits seeking non-economic damages for health-related anxiety associated with having high PFAS levels in one's blood, as well as lawsuits seeking economic damages from plaintiffs with diagnosed cases of kidney and testicular cancers—two of the cancers with the strongest scientific links to PFAS exposure.[41]

Modelling methodology overview

Identifying sources of PFAS contamination

In the first step of modelling, we sought to identify the locations of potential sources of PFAS contamination, which could include PFAS chemical production facilities, other industrial sites that handle or have previously handled PFAS compounds, and sites that make use of PFAS-containing firefighting foam, such as airports and firefighting training sites. This exercise incorporates the sources of PFAS contamination identified in *Le Monde*'s Forever Pollution Project, which identifies the locations

[39] The model is agnostic on the specific types of PFAS expected to be found in these contaminated sites, given that virtually any type of PFAS detected may be considered an environmental and health risk based on the scientific research and liability trends to date.

[40] "PFAS pollution: 3M ordered to compensate affected family," *The Brussels Times*; Sweden Supreme Court Judgment, December 5, 2023, Case No. T 486-23.

[41] Scott Bartell and Veronica Vieira, "Critical review on PFOA, kidney cancer, and testicular cancer," *Journal of the Air & Waste Management Association*, vol. 71 no. 16 (May 24, 2021): 663-679, https://doi.org/10.1080/10962247.2021.1909668; Steenland et al., "Review: Evolution of Evidence on PFOA and Health Following the Assessments of the C8 Science Panel."

of sites that are known to be contaminated or are likely to be contaminated with PFAS, and further expands upon them based on subsequent geospatial analysis (Figure 1).

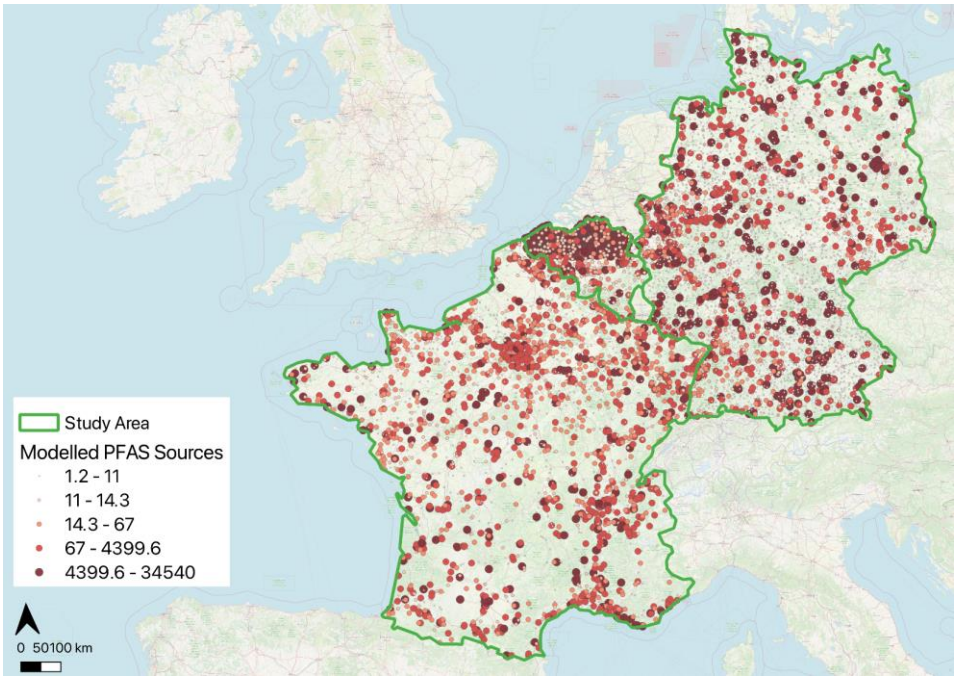

Figure 1: Modelled PFAS contamination sources, based on data from the Forever Pollution Project.

This total set of known and presumed PFAS contamination sources forms the basis for all subsequent modelling of liability losses from the three damage types considered in the model. The three damage types that plaintiffs are assumed to claim are the costs of remediating soil in residential vegetable gardens, the costs of remediating contaminated drinking water, and the costs associated with bodily injury attributed to environmental PFAS exposure. A frequency-severity modelling approach was taken to estimate total losses, by first identifying the extent of potential PFAS damage and then determining the associated costs that plaintiffs could successfully recover in lawsuit awards and settlements (defined as the "liability losses").

Estimating liability losses from soil remediation

The model assumes that owners of residential vegetable gardens within a specified radius of PFAS contamination sources will file lawsuits seeking remediation. The total soil remediation costs for residential vegetable gardens are estimated based on two primary components: the number of PFAS-contaminated residential gardens whose owners will participate in litigation, and the compensation that could be obtained to remediate and restore use to each affected garden.

First, geospatial analysis was used to estimate the count of all residential gardens within a specified radius of a PFAS contamination source. Of those total potentially contaminated residential gardens, a subset of gardens was modelled as testing positive for PFAS contamination, based on their distance from the PFAS contamination source. Of these contaminated residential gardens, only a further subset of the affected residents was assumed to be able to successfully sue for compensation; the precise numbers were determined based on research around key cultural and litigation dynamics in Europe. Finally, total soil remediation compensation for those residents who would sue successfully was estimated by applying the per-garden soil remediation costs derived from relevant settlement data.

Estimating liability losses from contaminated drinking water

The model assumes that the total potential liability losses from PFAS water contamination scales with the number of drinking water systems affected. PFAS contamination from any single source may spread widely through groundwater and surface water and thus reach multiple drinking water systems. To reflect this diffusive nature of PFAS water contamination, we applied a geospatial smoothing procedure over the individual PFAS source (previously identified based on *Le Monde*'s Forever Pollution Project) to model the relative probability of PFAS water contamination throughout each country (Figure 2). The probability of PFAS water contamination at a given location is a function of the density of PFAS sources in the vicinity and the contamination severity of those sources.

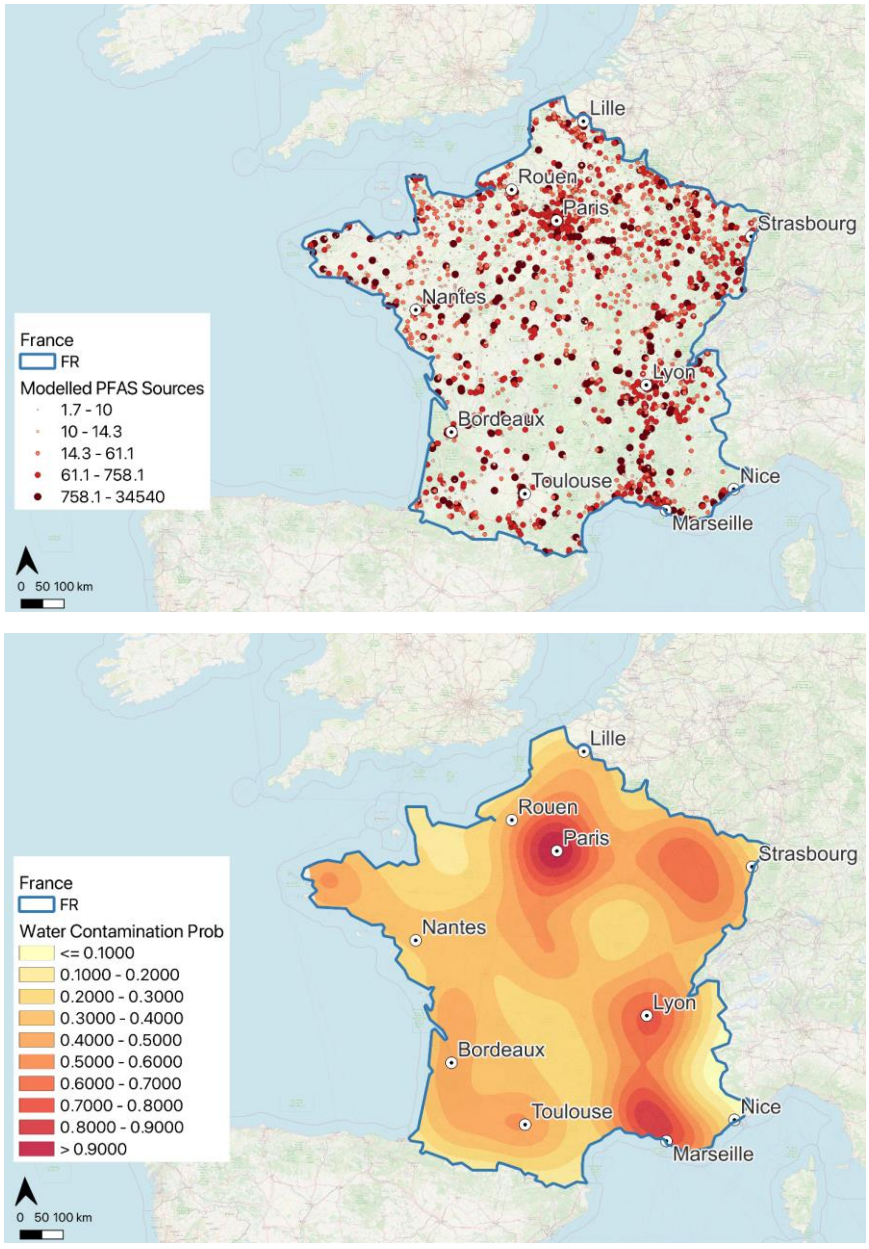

Figure 2: Upper: Individual modelled PFAS sources in France, prior to smoothing. Lower: Water system contamination probability after the application of smoothing. This figure shows France as an example; the same methodology was applied to Germany and Belgium.

We then combined these smoothed contamination probabilities with country-specific population density data to estimate the total population exposed to PFAS-contaminated drinking water per country. The size of the affected population implies the extent of water system contamination, and, therefore, the necessary remediation cost per country. Finally, as with soil remediation, the model applies adjustments reflecting litigation trends to determine the total potential compensation amounts that plaintiffs such as water utilities and local governments could plausibly recover through lawsuits.

Estimating liability losses from bodily injury claims

Scientific studies have demonstrated a correlation between elevated PFAS concentrations in blood and increased risks of specific diseases, particularly kidney and testicular cancer, and in the US, there have been successful lawsuits attributing these specific cancers to PFAS exposure.[42] Therefore, the model focuses exclusively on kidney and testicular cancer because of the relatively strong evidence linking them to PFAS exposure.

The previously estimated number of individuals exposed to PFAS-contaminated drinking water forms the basis for modelling bodily injury liability losses. From this affected population, we estimated the number of individuals diagnosed with cancer, including both existing and prospective instances of kidney and testicular cancer. Out of the total count of cancer patients, the pool of eligible plaintiffs was subsequently identified based on litigation dynamics in each country.

For eligible plaintiffs, the model separately estimates economic and non-economic damages. The modelled economic damages reflect medical treatment costs, and the modelled non-economic damages reflect compensation for mental anguish and/or pain and suffering for the cancer patients. The model also assumes that individuals with no diagnosed disease but with high PFAS levels in their blood may obtain compensation for mental anguish, including fear and anxiety over potential future health impacts. This type of claim has been successful in Europe already in relation to other health risks, such as asbestos exposure, and has the potential to succeed in relation to PFAS exposure given the litigation so far, including the recent Swedish Supreme Court case.[43]

Modelling potentially culpable industries and companies

After estimating the total potentially insurable ground-up liability losses as described in the above section ("Modelling Methodology Overview"), we determined the set of industries that could be "culpable" in this PFAS liability event. Culpability is defined as the set of industries and companies that would be sued and ultimately pay out settlements or awards. Key factors influencing an industry's PFAS liability exposure include the size of the company, the extent of its use or handling of PFAS, and its position in the supply chains that create and use PFAS compounds. For example, both in the US and in Europe, chemical manufacturers have been the first and main targets of PFAS litigation (see section "PFAS Litigation Trends in Europe and Key Cases to Date" above).

Our research into existing litigation and industry PFAS usage indicates that dozens of industries could be held responsible for PFAS environmental contamination in Germany, France, and Belgium. Our

[42] Steenland et al., "Risk assessment for PFOA and kidney cancer based on a pooled analysis of two studies," *Environment International* vol. 167 (September 2022): 107425, https://doi.org/10.1016/j.envint.2022.107425; Monireh Sadat Seyyedsalehi and Paolo Boffetta, "Per- and Poly-fluoroalkyl Substances (PFAS) Exposure and Risk of Kidney, Liver, and Testicular Cancers: A Systematic Review and Meta-Analysis," *La Medicina del Lavoro*, vol. 114 no. 5 (Oct 24, 2023): https://doi.org/10.23749/mdl.v114i5.15065; In Re: E. I. Du Pont De Nemours And Company C-8 Personal Injury Litigation, Civil Action 2:13-md-2433, Case No. 2:17-cv-998, U.S. District Court for the Southern District of Ohio Eastern Division, March 29, 2021, https://www.govinfo.gov/content/pkg/USCOURTS-ohsd-2_17-cv-00998/pdf/USCOURTS-ohsd-2_17-cv-00998-11.pdf

[43] "Anxiety From Asbestos Exposure: French Compensation Model Extended to Other Toxic Substances," Jones Day, September 18, 2019, https://www.jonesday.com/en/insights/2019/09/anxiety-from-asbestos-exposure; "DAWR-Schmerzensgeldtabelle 2019: Ausgabe 1" ("DAWR compensation table 2019: Volume 1"), German Lawyers Register, January 30, 2019, https://www.kanzlei-plattling.de/upload/formulare/Schmerzensgeldtabelle2019_Ausgabe1.pdf

model groups these industries into three categories, in order of relative liability exposure:

1. **Primary manufacturers:** the chemical companies that manufacture PFAS compounds
2. **Secondary manufacturers:** manufacturers that are not creating PFAS but are incorporating the chemicals into other products. Exposed industries include manufacturers of firefighting foam, paper, carpets, shoes, textiles, plastics and resins, electronics, foods and beverages, pesticides, and fertilizer, among others.
3. **Non-manufacturing industries:** other companies and organizations that could be held liable for allowing PFAS contamination in and around their facilities and sites, such as water utilities, wastewater treatment plants, landfills, and sites that use or store large quantities of PFAS-containing firefighting foam, such as airports.

Primary manufacturers are expected to have the greatest exposure, in line with the litigation trends in Europe so far. However, due to the large number of industries involved in the PFAS supply chain—beyond the primary PFAS manufacturers—secondary and non-manufacturing industries may end up paying out significant amounts on an aggregated basis. For example, a compost manufacturer has already been sued in Germany for contributing to PFAS contamination.[44] Our culpability research suggests that similar cases involving secondary manufacturing and non-manufacturing industries will grow.

[44] "Just the start: The growing legal battle over PFAS in Europe," *ChemSec*.

Modelling outputs and discussion

The plausible range of total potentially insurable ground-up PFAS losses for Germany, France, and Belgium is **€10 billion to €24 billion**, with country-specific modelled losses illustrated in Figure 3. For reference, as of October 2024, the actual settlement amounts in the three countries of interest are less than €600 million.

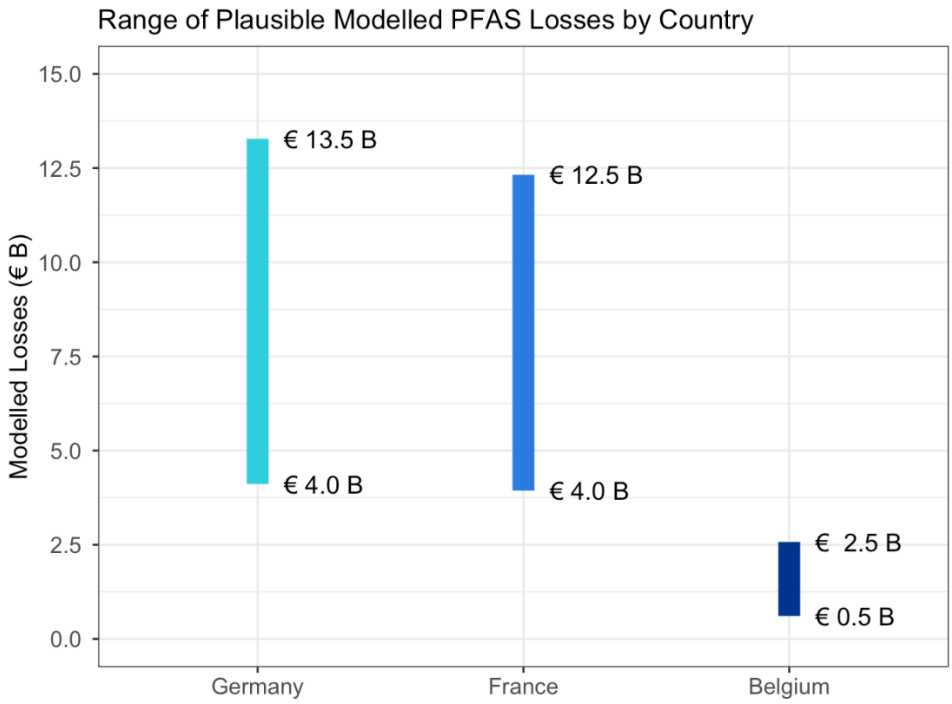

Figure 3: Plausible range of total potentially insurable ground-up PFAS losses by country for each of Germany, France, and Belgium[45] (rounded to €0.5 billion). Note that the sum of endpoints across countries does not equate to the corresponding €10 billion to €24 billion total loss range, as modelled losses are not assumed to be perfectly correlated across countries.

The variation in losses among countries is driven by the number and location of PFAS-contaminated sources and by the population density surrounding each contamination source. As a result, Germany and France are more comparable in their contributions to total losses, while the less populous Belgium is a relatively minor contributor.

[45] Belgium's lower bound of €500 million (rounded) is less than the existing €571 million settlement between 3M and the Flemish Government. However, this settlement includes loss components that are out of scope for our model.

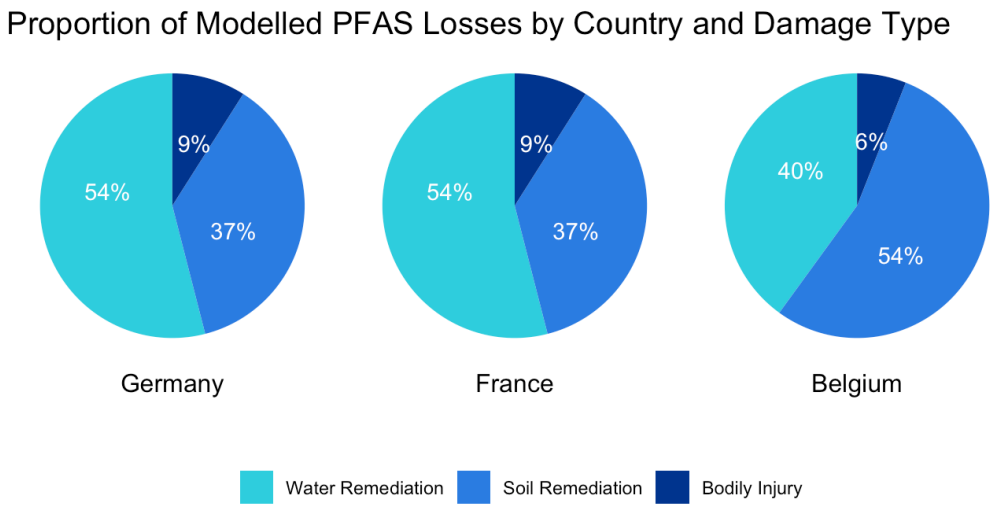

Figure 4: Proportion of modelled PFAS losses by country and damage type. The majority of modelled PFAS losses are attributed to environmental remediation.

Water system remediation is the largest component of total losses in the model, driven by the high number of people found to be potentially exposed to contaminated drinking water. This relatively larger loss is also driven by model assumptions anticipating greater awareness and more frequent PFAS testing in water systems, in part due to the requirement for each country to implement the updated EU Drinking Water Directive. Belgium deviates from this trend, with losses driven predominantly by soil remediation, rather than water system remediation (Figure 4). This may be due to data limitations, in which certain portions of the country's PFAS contamination may be underrepresented. This is discussed further in the "Limitations and Future Enhancements" section below.

Given the high costs of remediating PFAS contamination in soil, soil remediation also has significant liability loss potential. However, the final loss outputs are generally lower than the share of total losses attributed to water remediation. This is due to a combination of a lower assumed awareness of PFAS soil contamination, the limited range of PFAS soil contamination per contamination source, and a lower proportion of affected parties that are assumed to file or join lawsuits. Compared with water system claims that are effectively brought on behalf of all residents served by a given water system, residential garden soil contamination claims will likely be brought forth on a less aggregated basis. The extent of these claims will depend on which residents and municipalities voluntarily test for PFAS and choose to litigate. Collectively, these assumptions result in both a smaller modelled population exposed to PFAS soil contamination and, ultimately, fewer soil remediation claims.

Finally, bodily injury losses are a relatively low contributor to total modelled PFAS losses, despite model inputs reflecting assumptions that relevant bodily injury claims could increase in frequency. This low proportion is primarily due to the low baseline likelihood of bodily injury litigation in Europe, particularly related to chemical exposures, and the generally low compensation amounts awarded. In addition, the absence of a well-established class-action framework akin to that of the US may limit how quickly the participating plaintiff pool could grow and how easily each individual plaintiff could win bodily injury compensation. These bodily injury litigation trends are consistent across all three countries of interest. However, it is possible that these trends could change as the European regulatory and litigation landscape continues to evolve, which could meaningfully increase the potential exposure to bodily injury lawsuits, as discussed below under "Limitations and Future Enhancements."

Limitations and Future Enhancements

PFAS contamination liability in Europe is a multifaceted, highly uncertain, and potentially sprawling liability risk. Although our modelling framework and assumptions have been informed by extensive research, there are limitations to the modelling, areas where further research is required, and assumptions that may need to be updated as the litigation develops.

Data enhancements

- Our model has relied heavily on the contamination sources identified in the Forever Pollution Project by *Le Monde* to define the extent of the PFAS contamination across the countries of interest. As a result, the modelled contamination spread is subject to the extent of testing that is done by each country and captured in the Forever Pollution Project dataset. Further exploration of additional data sources and cross-checking of PFAS contamination sites are needed to ensure a comprehensive model of all known PFAS contamination locations.
- Separately, future model enhancement will leverage property exposure datasets from Verisk Extreme Events Solution (EES) to validate the estimated count of residential gardens.

Forthcoming model components

- **Culpability component:** The model will be further enhanced with the culpability component. Exposed industries have already been identified and categorized by their relative exposure; the next step of the culpability modelling will allocate specific shares of the total insurable estimated losses to industries and companies. This component of the model will allow (re)insurers to simulate how the estimated losses could accumulate on their respective portfolios.
- **Loss by accident year (LAY):** Future model enhancements will include a loss by accident year dimension. As the discovery process for PFAS in drinking water and soil continues, and with increasing awareness and legal developments related to PFAS, it is anticipated that the modelled aggregate multiyear ground-up losses will continue to materialize, and these total ground-up losses can be attributed to prospective and retrospective accident years of exposure. This modelling feature will allow (re)insurers to evaluate their portfolios from two perspectives:
  - A prospective approach, to identify potential exposure for in-force portfolios and future portfolios and to allow for underwriting actions to manage exposure to PFAS. The in-force policy conditions and certain specifics of the coverage perimeter, such as whether the policy has an accident year basis or claims-made basis, will play a critical role in (re)insurers' exposure assessment.
  - A retrospective approach, to identify exposure for historical policies. A multiyear perspective will allow (re)insurers to compare the policy conditions of past years against the modelled PFAS ground-up losses attributed to each historical policy year cohort. (Re)insurers can then compare their potential exposure to PFAS under this framework against the reserves established on their balance sheets to assess reserve risk and adequacy.

Potential scope expansions and additional loss drivers

- **Commercial property claims:** In addition to the residential soil contamination included in this model, commercial property such as agricultural land is also known to be contaminated with PFAS. There are some precedents for litigation to recoup this type of contamination, including some settlement money allocated to remediating agricultural and recreational land within the 3M Belgium settlement with the Flemish government.[46] If owners and users of contaminated property across Germany, France, and/or Belgium begin to sue in increasing numbers, the potential liability losses could be significant. The model will be expanded to cover liability losses related to contaminated agricultural soil in addition to the soil in residential gardens.
- **Bodily injury claims:** Although this model already assumes some increase in the frequency of successful PFAS-related bodily injury claims in Europe, there could still be significant room for bodily injury liability losses to grow if underlying conditions change. Influences such as social inflation, third-party litigation funding, or the increasingly plaintiff-friendly European regulatory environment — reflected in the new Representative Actions Directive and Product Liability Directive — could result in the European litigation landscape becoming significantly closer to that of the US, and PFAS-related bodily injury lawsuits could then take off at a widespread scale. Separately, scientific research into the health impacts of the many types of PFAS is still developing. If further evidence emerges strengthening the links between PFAS exposure and cancers or other serious health conditions, this could expand the scope of bodily injury litigation.
- **Regulatory changes:** The narrative underlying our model assumptions is based on the current regulatory environment in Europe, in which the updated EU Drinking Water Directive has set a limit of 0.5 µg/L (equivalent to 500 parts per trillion) for total PFAS in drinking water. This standard is far less stringent than the initial PFAS limits recently set by the US EPA, which include a limit of 4 parts per trillion for two PFAS types, PFOA and PFOS. If EU regulations or individual European country regulations were to shift to stricter standards in the future, this could drive increased remediation costs and additional liability losses.
- **Medical monitoring:** The modelled compensation does *not* include funds for medical monitoring of plaintiffs' health. Although some plaintiffs may attempt to seek such compensation related to PFAS exposure, such settlements are expected to be less likely due to a high burden of proof and low acceptance of medical monitoring compensation in the European legal landscape to date.
- **Directors and Officers (D&O) liability:** The model does *not* include the types of potential losses that might affect D&O or management liability lines, such as would arise from shareholders filing lawsuits claiming a company mismanaged its PFAS liabilities. This type of suit is possible, and PFAS contamination has the potential to pose some risk for management and professional lines. However, large management liability losses related to PFAS currently appear unlikely to materialize in Europe, in part because collective shareholder actions are generally rare in Europe to date.
- **Additional countries:** The current model includes three key European countries (Germany, France, and Belgium). However, the PFAS contamination problem extends beyond the current modelled countries, and further research is required to develop additional country-specific models.

[46] "Agreement Reached Between the Flemish Government and 3M Belgium to Support the People of Flanders," 3M News Center.

Conclusions

This white paper describes a methodology to estimate potentially insurable ground-up losses from litigation over PFAS-contaminated drinking water and soil in three key European countries: Germany, France, and Belgium. For each country, our model estimates potentially insurable liability losses for three damage types: remediation costs for contaminated drinking water systems, remediation costs for contaminated soil in residential gardens, and bodily injury claims related to kidney and testicular cancer due to environmental PFAS exposure.

Key takeaways from our research and modelling include the following:

- While European PFAS litigation is still in its infancy, with less than €600 million in actual settlements across Germany, France, and Belgium, our model indicates that a PFAS environmental-related liability event across these three countries could potentially generate ground-up losses between **€10 billion and €24 billion**, consisting of losses arising from water and soil contamination and bodily injury claims.
- Out of the total liability losses estimated in our model, more than 90% arise from claims seeking compensation for the costs of remediating soil and water, while less than 10% arise from claims of bodily injury from exposure to that environmental contamination.
- Country-specific losses are driven by the number and location of PFAS-contaminated sources and by the population density surrounding each contamination source. Estimated potential losses are between **€4 billion and €13.5 billion** for Germany and between **€4 billion and €12.5 billion** for France. Belgium's potential losses could range from **€0.5 billion to €2.5 billion**.
- Dozens of industries could be held responsible for PFAS environmental contamination. PFAS chemical manufacturers are the most highly exposed, but we anticipate that many companies across dozens of secondary manufacturing industries are also significantly exposed, including manufacturers of firefighting foam, paper, carpets, shoes, textiles, plastics and resins, electronics, foods and beverages, pesticides, and fertilizers, among other products. In addition, several non-manufacturing industries are exposed, including wastewater treatment plants, landfills, and water utilities.

We continue to monitor how litigation dynamics, developing scientific research, and growing awareness of PFAS contamination and associated health risks may further expand the scope and severity of the potential European PFAS liability event. Key possible drivers of additional losses include more widespread litigation over agricultural and commercial properties, new and stronger scientific evidence for bodily injury claims, or increasing momentum of PFAS litigation in countries outside the three covered in this model.

Our research and modelling highlight the large loss potential associated with PFAS exposure. The development of this type of model calibrated to the European environment allows (re)insurers to better assess PFAS liability for purposes of risk management and risk appetite definition. Having a developed view of the PFAS liability risk in Europe can also support opportunities for the industry to develop insurance products that may help address this risk.

The modelled losses described in this paper are ground-up losses. Each (re)insurance carrier will have to review potential insured losses based on the specific insurance policy wordings applicable in each country. It remains to be seen how coverage interpretations will respond to European PFAS litigation, and coverage gaps may result. While reinsurance in place may already provide some protection against the risk, (re)insurers should review the terms of their past and new coverages in light of the possible

liability outcomes to ensure completeness of coverage and to evaluate potential exposure for underwriting and reserving purposes. The casualty insurance industry should continue to closely monitor the development of systemic liability losses in Europe related to PFAS and manage their exposure and reinsurance coverage accordingly.

About Verisk

Verisk Extreme Event Solutions provides risk modeling solutions that make individuals, businesses, and society more resilient to extreme events. Verisk's Arium Liability Analytics product provides a framework and a platform to understand and quantify correlation of exposures to systemic and emerging events across multiple insureds, industries, lines of business, and policy years. The framework utilizes an economic map to establish how exposures (organizations and lines of business) are correlated to common causes of loss (liability footprints) through trading and commercial relationships (supply and distribution chains) as well as legal duties between industries and stakeholders. The framework allows for monitoring of liability portfolio accumulations from a wide variety of historical liability events and forward-looking stochastic scenarios and modelling of potential losses across multiple dimensions, including industry segments, divisions, lines of business (to uncover potential clash), and across years. For more information, visit https://www.verisk.com/products/arium/ or contact AriumSupport@verisk.com.

About Guy Carpenter

Guy Carpenter, a business of Marsh McLennan (NYSE: MMC), is a leading global risk advisory and reinsurance specialist and broker. Marsh McLennan is a global leader in risk, strategy and people, advising clients in 130 countries across four businesses: Marsh, Guy Carpenter, Mercer and Oliver Wyman. With annual revenue of $23 billion and more than 85,000 colleagues, Marsh McLennan helps build the confidence to thrive through the power of perspective. For more information, visit guycarp.com, or follow on LinkedIn and X.

Authors – Verisk

Eleanor Bragg
EBragg@verisk.com

Chang Cai
CCai@verisk.com

Venetia Despotaki
VDespotaki@verisk.com

Eric Gesick
EGesick@verisk.com

Eric Hang
Eric.Hang@verisk.com

Authors – Guy Carpenter

Nuala Barr
Nuala.Barr@guycarp.com

David Bassi
David.Bassi@guycarp.com

Claudia Courtin
Claudia.Courtin@guycarp.com

Philippe Gouin
Philippe.Gouin@guycarp.com

Dirk Schmehr
Dirk.Schmehr@guycarp.com

Julie Surget
Julie.Surget@guycarp.com

Eddy Vanbeneden
Eddy.Vanbeneden@guycarp.com

Verisk Boston

2 Av De Lafayette,
Fl 2,
Boston, MA 02111

AriumSupport@verisk.com

Verisk.com