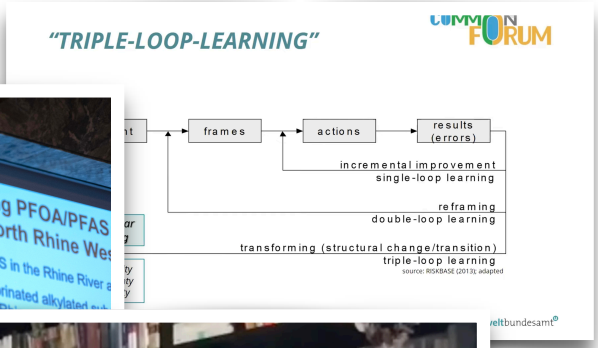
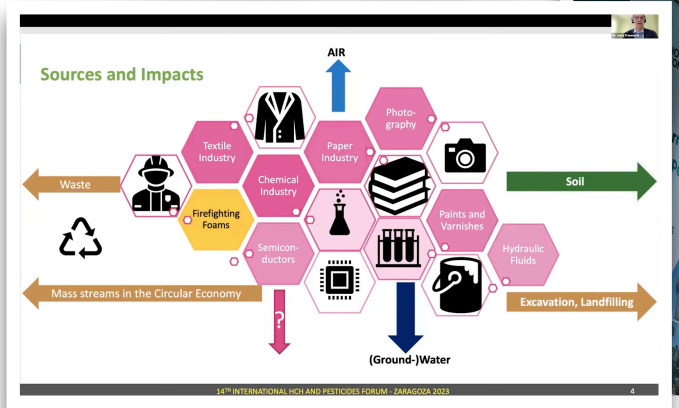
Block 12

EMERGING POLLUTANTS. PFAS SESSION





REVEALED: THE MASSIVE CONTAMINATION OF EUROPE BY PFAS 'FOREVER CHEMICALS'

By Stéphane Horel
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https://www.lemonde.fr/en/les-decodeurs/article/2023/02/23/revealed-the-massive-contamination-of-europe-by-pfas-forever-chemicals_6016906_8.html

PFAS are toxic and virtually indestructible chemicals used in a wide range of objects, from anti-stick pans to medical implants. 'Le Monde' has uncovered the existence of thousands of contaminated sites.

It is a picture-perfect lake, a little piece of Scandinavian paradise in all its charm. The water is clear, there are rare species of birds, and here and there islets bristle with vigorous conifers. For decades, however, Lake Tyrifjorden in Norway has been brewing a disastrous potion of invisible, harmful and probably irreversible pollution. The chemical ingredients that contaminate its waters belong to a family of ultra-toxic substances with names so complex that acronyms have replaced them: per- and polyfluoroalkyl compounds, or PFAS.
Since the late 1940s, these chemicals with unique properties have been used to mass-produce the non-stick, stain-resistant and waterproofing treatments that coat our everyday utensils and textiles, and much more. Teflon, Scotchgard (the popular textile waterproofing agent) and Gore-Tex are made using them. Myriads of objects contain them: carpets, guitar strings, electric vehicle batteries, paints, acne treatments, kebab and fry wrappers, electrical circuit sheathing in airplanes, hip prostheses, and dental floss.
Harmful to health, PFAS could be composed of several thousands or even several million compounds – no one knows. What they have in common is an indestructible chain of carbon and fluorine atoms brought to the world by 20th-century chemistry, which are the source of both PFAS' properties but also their persistence in the environment. They are indestructible in nature, and able to travel very long distances, far from the area where they were emitted. They have been dubbed "forever chemicals."

Mapping the forever pollution

For nearly a year, *Le Monde* worked with journalists from 17 media partners to try to measure the extent of this contamination in Europe. According to our conservative estimate, based on thousands of environmental samples, there are more than 17,000 sites in Europe contaminated at levels that require the attention of public authorities (above 10 nanograms per liter). The experts we interviewed estimated that in more than 2,100 "hotspots," the contamination reaches levels considered hazardous to health (more than 100 nanograms per liter).

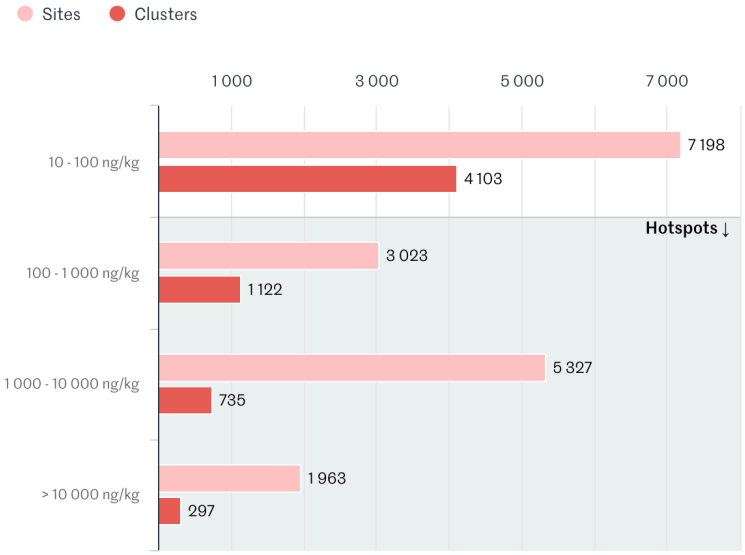

FIGURE 1. SITES AND CLUSTERS IDENTIFIED BASED ON THEIR MAXIMUM PFAS CONCENTRATION.
Source: Forever Pollution Project

Some of these are in the vicinity of the 20 PFAS production plants that we were able to locate – the list and mapping of these industrial sites had never been established.

Our investigation reveals the locations of nearly 21,500 sites suspected of being contaminated by past or present industrial activity across Europe, as well as more than 230 factories identified as PFAS users. In an unprecedented experiment of peer-reviewed journalism, the Forever Pollution Project draws on the methodologies of leading experts to publish, for the first time in Europe, an interactive map of PFAS contamination across the continent. The project's objective is to provide a tool of public interest – something that was unavailable to date – to communities affected or likely to be affected by this pollution, to researchers, to civil society and to public authorities.

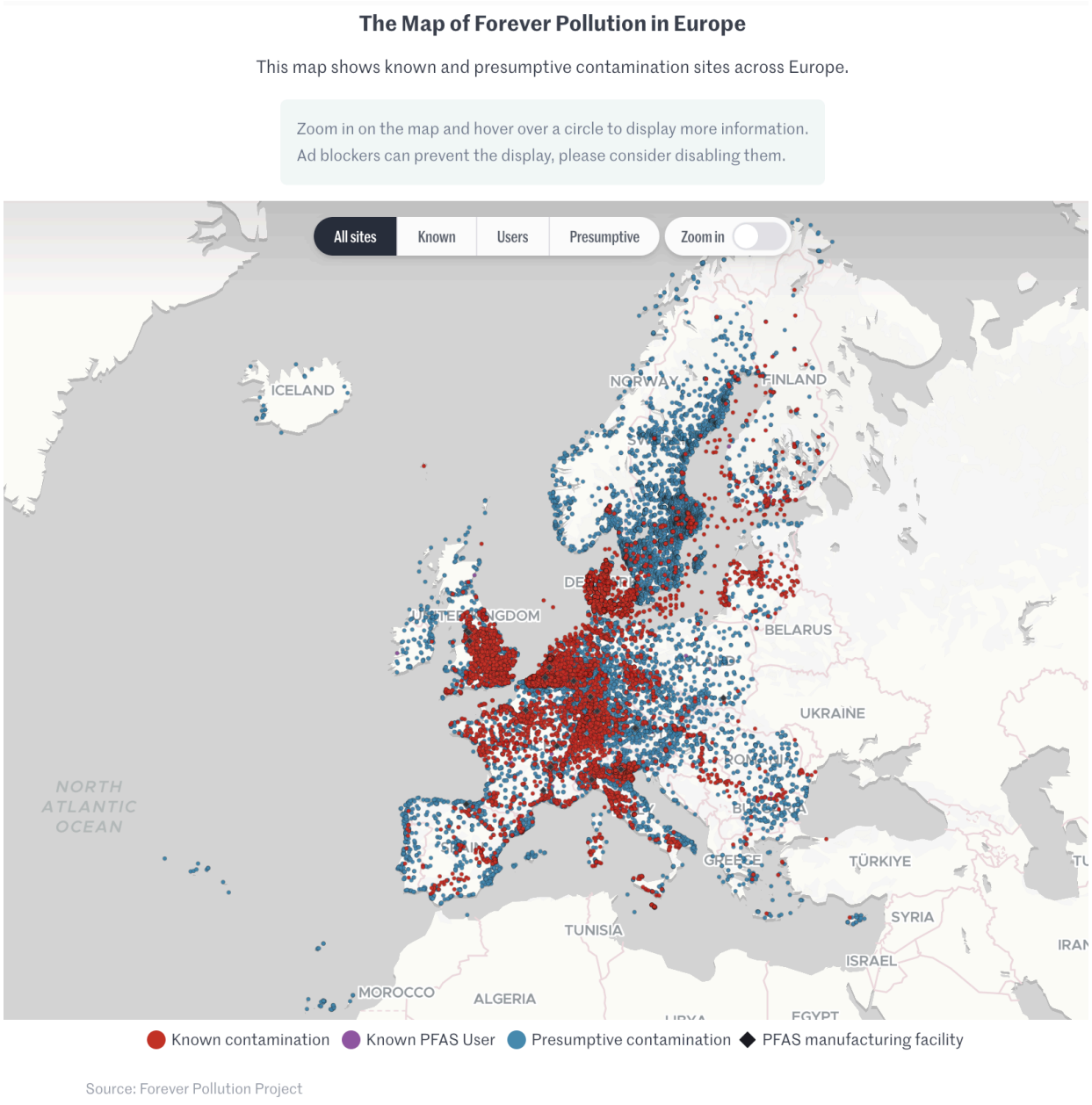

FIGURE 2. ALL PFAS CONTAMINATION SITES ACROSS EUROPE
For more detailed information see original Le Monde article https://www.lemonde.fr/en/les-decodeurs/article/2023/02/23/revealed-the-massive-contamination-of-europe-by-pfas-forever-chemicals_6016906_8.html

From the beautiful Blue Danube to Lake Orestiada (Greece), from the Bilina River (Czech Republic) to the Guadalquivir Basin (Spain), PFAS are detected in water, air, and rain; otters and codfish; boiled eggs and teenagers. Collected by scientific teams and environmental agencies, the tens of thousands of data points we have assembled show that few places are now spared by this ubiquitous contamination that is still largely unknown to the public – not even the most intimate places, like our bodies. Biomonitoring studies show that these unwanted components permeate our blood.

PFAS gained notoriety with Todd Haynes's 2019 film Dark Waters, in which Mark Ruffalo plays

American lawyer Rob Bilott. The real Rob Bilott discovered the first evidence of this environmental crime in the vicinity of the plant where the DuPont chemical group manufactured its Teflon, in Parkersburg, West Virginia. This was in 1998. But while the United States has come to grips with the extent of PFAS contamination in the years since, the scandal has not crossed the Atlantic.
However, unbeknownst to us, the poison of the century has also contaminated all of Europe.

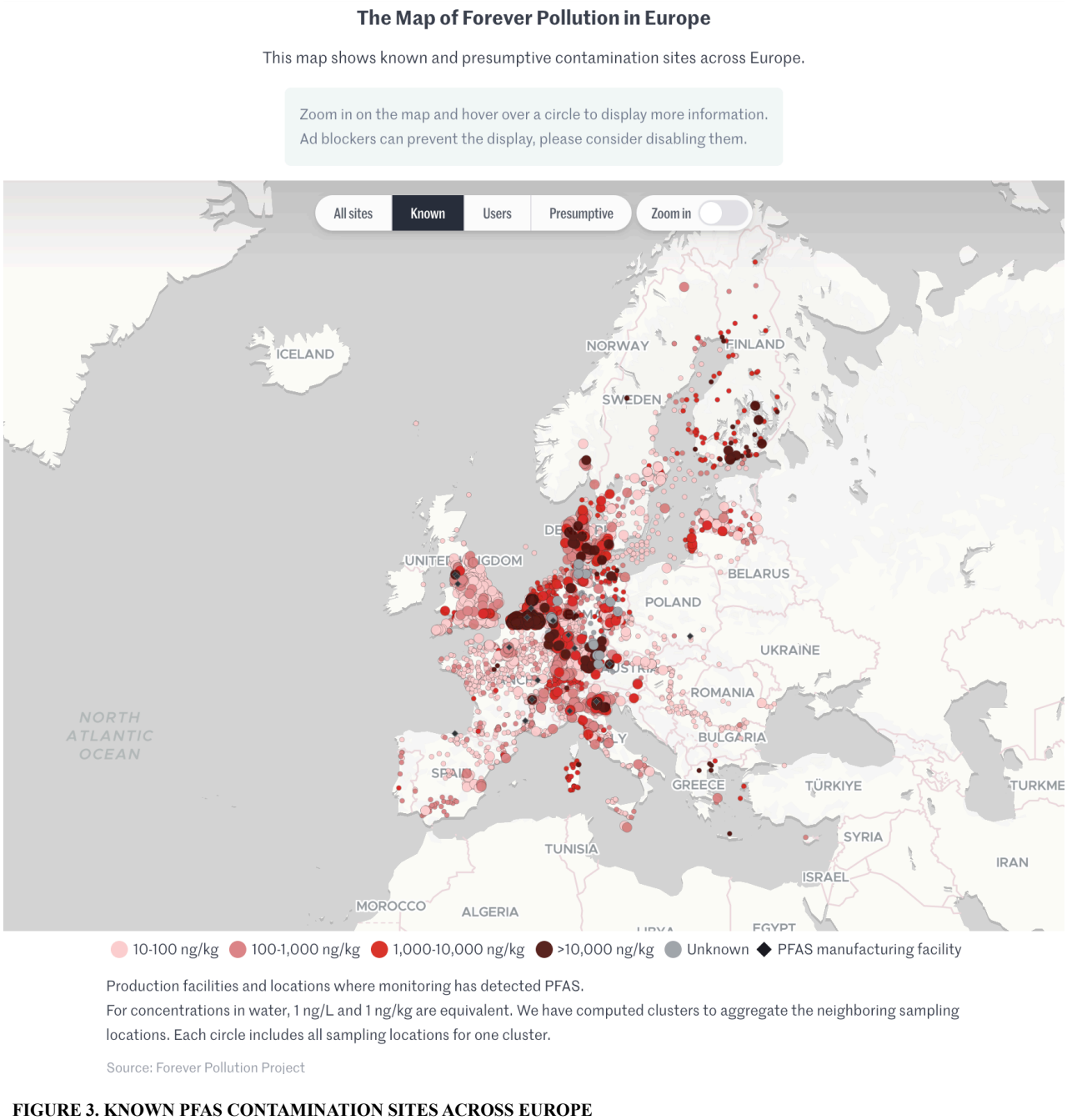

FIGURE 3. KNOWN PFAS CONTAMINATION SITES ACROSS EUROPE
For more detailed information see original Le Monde article https://www.lemonde.fr/en/les-decodeurs/article/2023/02/23/revealed-the-massive-contamination-of-europe-by-pfas-forever-chemicals_6016906_8.html

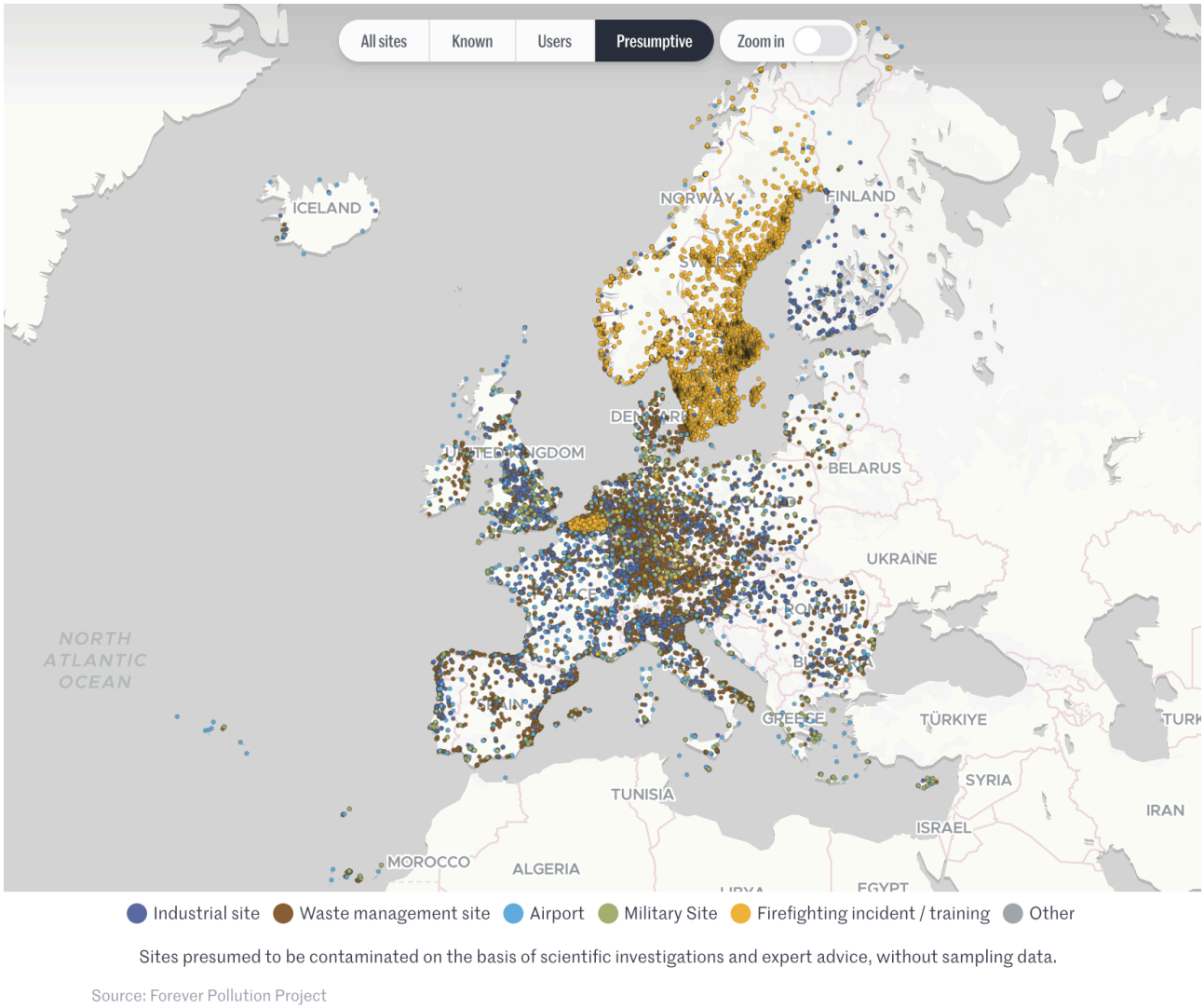

FIGURE 4. PRESUMPTIVE PFAS CONTAMINATION SITES ACROSS EUROPE
For more detailed information see original Le Monde article https://www.lemonde.fr/en/les-decodeurs/article/2023/02/23/revealed-the-massive-contamination-of-europe-by-pfas-forever-chemicals_6016906_8.html

Twelve plants, eight question marks

So how do we evaluate the severity of the problem on our continent? In 2019, the Nordic Council of Ministers (an intergovernmental organization comprising Denmark, Finland, Iceland, Norway and Sweden) commissioned a report – which has become a major reference point – from Gretta Goldenman, an expert on PFAS. Despite a year of work and an impressive compilation of data, one figure never ceased to elude this environmental lawyer's team: How many chemical plants manufacture PFAS in Europe? How many Teflon or Scotchgard plants? How many polluters like DuPont? "It's about time that finally comes out into the public eye, especially for the people who are living next to these plants," Goldenman said. "They are the frontline communities."

As more knowledge is gained, the effects, even at low doses, of exposure to PFAS grow like a nightmare medical checkup that spares no area of the body. These include the decreased birth weight of babies; decreased fertility or immune response to vaccines in children; increased risk of breast, kidney or testicular cancers; thyroid disease; ulcerative colitis; increased cholesterol and blood pressure; and preeclampsia in pregnant women ; cardiovascular effects. Goldenman's team estimated that the burden of PFAS on European healthcare systems amounts to between €52 and €84 billion each year.

Europe's best-known "hotspots" of massive pollution all have PFAS production facilities at their epicenter. In Trissino, Italy, the Miteni company synthesized and emitted a range of PFAS for half a century. Discovered in 2013, the contamination of drinking water and soil extends over 200 square kilometers and is believed to affect up to 350,000 people in the Veneto region.

This industrial pollution contains various "long-chain" PFAS because of their chain of more than eight carbon atoms (called "C8"), in particular

perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA). Banned by the Stockholm Convention on Persistent Organic Products in 2009 and 2019 respectively, they have been replaced by "short-chain" PFAS, which pose the same problems. This is a typical case of "regrettable substitution" that always keeps manufacturers one step ahead of the regulations.
Twelve plants were eventually named in the report led by Goldenman. But a footnote stated that "it is assumed that there are between 12 and 20 sites." Where are the other eight? We set out on the trail of the forever polluters, a much more difficult task than we thought. But not impossible.

The forever polluters

In order to locate the sites with certainty, we immersed ourselves into a sort of binge-watching of industrial capitalism, spending entire weeks on Google Maps scrutinizing the landscapes by satellite view, zooming in on the pale patches of the industrial zones, wandering from riverbanks taken over by interlacing smoldering piping to forests with holes of discolored, lifeless crusts. In 3D, we surveyed this ugly Europe of chemical parks sometimes so vast that they are served by several bus stops, like Burghausen in Germany, which covers an area equivalent to more than 280 football fields.
The industrial fluorination process is complex and costly and requires specific know-how and facilities. It is mostly large companies that are involved and sell their production to thousands of downstream users. Germany, the cradle of industrial chemistry, has no fewer than six plants, including three at the Gendorf site in Bavaria, where Archroma, 3M Dyneon and W. L. Gore, creator of the famous Gore-Tex, are located. Second on the list, France has five sites: the Arkema and Daikin plants in the chemical valley at Pierre-Bénite (eastern France); Chemours, a spinout company from DuPont created in 2015 to cut DuPont from any PFAS activities, in Villers-Saint-Paul (northern France); and the Solvay facilities in Tavaux (eastern France) and Salindres (southern France). This is followed by three sites in the United Kingdom, two in Italy and one each in Poland, Spain, the Netherlands and Belgium.
As in Parkersburg, West Virginia, Chemours is causing severe pollution around its Dordrecht plant, and the Netherlands has been in a crisis situation since 2015. Air, soil and water there are chock-full of PFOA and GenX, a short-chain substitute that has spread to vegetable gardens more than a kilometer away. As for 3M, which supplied DuPont with the PFOA needed to make its Teflon, the firm has so polluted the area around its Zwijndrecht plant (near Antwerp, Belgium) and beyond, that the area is thought to be one of the most PFAS-contaminated in the world.
To our knowledge, no sampling campaign has been conducted in the vicinity of more than half of the 20 production facilities we have identified to measure the extent of possible contamination. Or the results are not public. While three of these plants are now inactive, their pollution is probably there forever.

Anthropocene hotspots

Who polluted Lake Tyrifjorden? Every PFAS assemblage contains, in its chemical structure, traces of the industrial activity or use that disseminated it into nature. This is how detectives of the "Contamination of the Earth" – often environmental chemistry researchers in boots – were able to identify a paper mill 15 kilometers upstream.
How many sites have high contamination in Europe? What are the consequences for the communities that suffer from it? Can we identify the sources of this pollution and, if not stop it, at least halt the emissions released into the environment? No official census of the most contaminated places exists at the European level, and only a few countries have worked to map this invisible pollution. No data, no information. The absence of points in many countries on our map reflects only the lack of measurements.
Thirty or so locations are now labeled "hotspots" by authorities or scientists. The first of these are in the vicinity of production plants, where PFAS concentrations can reach record levels. Then come about 20 sites, most of them discovered by chance. The pollution at most of these sites comes from the use of AFFF firefighting foam, the banning of which was proposed by the European Chemicals Agency (ECHA) in February 2022. Used to extinguish hydrocarbon fires, against which water is ineffective, these foams form a mat that deprives the fire of oxygen. After use, the PFAS they contain seep into the soil, percolate to the groundwater and can then be delivered to taps through water distribution systems.

Europe paves the way for massive ban on ultra-toxic chemicals

Airports and military bases are major consumers. So these hotspots include the areas around the civilian airports of Düsseldorf and Nuremberg (Germany), Schiphol (Netherlands) and Jersey (Channel Islands), as well as several military air bases in Sweden. The drinking water of Ronneby (Sweden), a town of 28,000 inhabitants, was contaminated by the use of foam during firefighting exercises on an army base located 2 kilometers away. Since the pollution was discovered, the residents have been the subject of several studies monitoring their health, unwilling guinea pigs in a life-size experiment.
In the vicinity of Rastatt, Germany, tons of PFAS-soaked compost from a paper mill were spread

across fields as fertilizer. Nearly 900 hectares were contaminated. The area has been under high surveillance since 2013 and is of great concern. The underground plume of pollution is slowly flowing toward the Rhine and will soon reach it.

The ups and downs

"We've made the planet rather inhospitable to us," said Ian Cousins, a professor of environmental chemistry at Stockholm University in Sweden and an expert on PFAS. "We're at the point where the different environments and resources are contaminated and they will be for a long time. And in many cases, the levels are above what we consider to be safe levels. We are no longer in a safe operating space anymore."

PFAS are a "planetary boundary" ("planetary limit") on par with climate change or the ozone hole, Cousins and colleagues argue. In a scientific paper published in August 2022 in Environmental Science & Technology, they exposed that rain everywhere in the world contains concentrations of PFOA above the US health advisories.

But between the 0.055 nanograms per liter (ng/l) found in the rain in Tibet, where no factory produces or uses PFAS, and the 68,900,000 ng/l detected in the groundwater near the 3M factory in Zwijndrecht, where exactly is the line between low and high? What is a safe value? Many experts suggest a maximum limit of one tiny nanogram per liter. Yet in the US, 200 million Americans, nearly two-thirds of the population, consume water that contains more. And in Europe?

Presumption of contamination

As alarming as it is, our investigation probably underestimates the reality of the European situation. For in addition to the PFAS-producing facilities and the thousands of contaminated sites, our investigation managed to locate nearly 21,500 presumptive contamination sites. This is a complex task that no agency and no scientific team in Europe had, until now, undertaken in a systematic way.

To do this, we adapted the methodology developed by a team of researchers from the PFAS Project Lab in Boston with their colleagues from the "PFAS Sites and Community Resources Map" to map pollution in the US. The main difficulty was the lack of databases containing the geolocation of industrial activities in Europe as well as the lack of transparency by the authorities. Nevertheless, we managed to locate thousands of sites in three types of "presumptive contaminating" activities. First, sites where firefighting foams were stored and used. Second, waste treatment and wastewater treatment sites. Finally, industrial activities spread over nearly 3,000 factories, including more than 1,000 paper mills, and metal manufacturing and processing plants (about 800 sites).

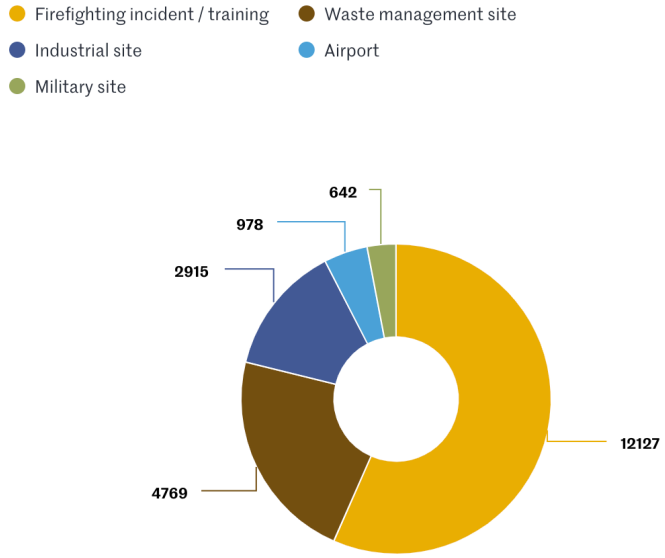

FIGURE 4. PRESUMPTIVE CONTAMINATION BY LOCATION TYPE, IDENTIFIED ON THE BASIS OF SCIENTIFIC INVESTIGATIONS AND EXPERT ADVICE, WITHOUT SAMPLING DATA.
Source: Forever Pollution Project

In the US, Chemours is the target of the vast majority of the 6,400 PFAS lawsuits filed since 2005. Liabilities could reach $30 billion for 3M, according to an analysis by Bloomberg Law.

Gretta Goldenman readily admits that her report's figure of €170 billion for compensating environmental damage across Europe is a significant underestimate. Wherever the damage from PFAS pollution has to be repaid, the amounts

are indeed staggering. For Martin Scheringer, a researcher in environmental chemistry at the Swiss Federal Institute of Technology in Zurich, "the dimensions of this problem are so enormous that it's just impossible to quantify."

Managing the contamination of water drunk by 1.2 million people around Düsseldorf airport cost €100 million. Filtering water in Italy's Veneto province cost over €16 million. While harmful contamination is measured in nanograms, the PFAS extracted from Norwegian soil is weighed in kilograms at some 40 airports. The cleanup of civil and military airports across Europe would cost €18 billion.

In the US, the cost of eliminating PFAS from drinking water could run up to $400 billion (€370 billion). While in Brussels, the European Federation of National Associations of Water Services (EurEau) prefers not to venture into the territory of figures, it does estimate that the cost of water could increase by an additional €0.28 and €0.36 per cubic meter. "This industry is very profitable, and that's because they have been able to get away with not incorporating the cost of preventing pollution from leaving their borders for way too long," said Goldenman. "The polluter really needs to pay here."

State-facilitated corporate crime

"Who is responsible is a very difficult question," said Cousins. Like oil companies with climate change, "the chemical industry obviously knew a lot about PFAS problems a long, long time ago." Since 1961 to be exact, when DuPont and 3M became aware of the toxicity of PFOA, as proven by the internal documents later made public after trials in the United States. On the government side, decision-makers have been aware of the danger since at least 2006, when the US authorities required a phase-out of PFOA.

"So, is it the chemical industry that's responsible or is the state being too weak and not demanding more of the chemical industry?" asked Cousins. No one to date has ever been put in jail for committing this landmark, ubiquitous and surely eternal contamination. But can it really be called a crime?

Lieselot Bisschop, a professor of law at Erasmus University in Rotterdam, the Netherlands, is specifically interested in the concept of state-facilitated corporate crime "to understand corporate environmental and human harm" in the context of PFAS pollution. The term refers "to situations where government institutions fail to regulate illegal or socially harmful business activities, or when they create a legal environment that allows these harms to occur and/or continue," Bisschop explained. These activities are often "awful but lawful."

While the researcher has yet to deliver her academic verdict, Scheringer readily embraces the notion. "For a long time, the authorities have not seen this as a crime but as a factor of development and a source of wealth in their countries," he said. "In a way, all the state actors have made huge mistakes over the last 50 or 60 years, and these mistakes have turned into crimes."

PFAS CONTAMINATED SITES – A PERSONAL JOURNEY AND SOME LESSONS LEARNED

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Abstract

One of the first large PFAS contaminated sites in Europe was discovered 2006 in North Rhine Westphalia/ Germany, where the drinking water of several million citizens had been impacted by PFOA and other PFAS.[1] The source of the PFAS was contaminated sludge from Belgium, imported via Netherlands by a small German company and given to farmers as "soil improver" dozens of agricultural areas.[1] Similarly, at one of the first discovered PFAS contaminated city in the United States (US), surface and groundwater were found contaminated in the early 2000, with releases from production and from landfills of production waste.[2] Based on these and further experiences of large contaminated sites from PFAS production, associated landfilling of PFAS waste and mismanagement of PFAS contaminated sludge causing all contamination of land and water resources, recommendations for risk reduction measures of PFOS and related compounds were developed in the frame of the Stockholm Convention when PFOS and related compounds where listed as first fluorinated POPs in 2009 for global action.[3]

Further assessment by the scientific community in the following years documented the huge ecological and health risks of the several thousand PFAS substances and consequently scientists published in 2014 the Madrid Statement[4] calling on policy makers, the industry and scientists for phasing out PFAS in any non-essential uses.

Meanwhile systematic drinking water monitoring or compilation of drinking water data in some countries such as the US[5] and China[6] have revealed that several hundred millions people are at or above drinking water limits considering the tolerable daily intake established by the European Food Safety Authority in 2020[7] calling for global assessment and action.

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PFAS IN SOIL AND GROUNDWATER – PROGRESS AND COMPREHENSIVE CHALLENGES IN GERMANY

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Abstract

The substance group of PFAS poses challenges for the protection of the environment and also for their regulation. The talk focuses on the current knowledge, management and policy issues and progress regarding PFAS in soil and groundwater in Germany and in Europe.

With regard to PFAS levels in soils in Germany, the greatest attention is paid first to groundwater protection. In 2017, so-called insignificance thresholds values were derived for PFAS in groundwater. The insignificance threshold values for PFAS are therefore based throughout on human toxicological impacts and on the provisions of the German Drinking Water Ordinance. In view of the solubility of many PFAS and their associated relevance to the soil-groundwater pathway, the insignificance threshold values are directly connected to the values applied to classify soil material. The 2021 revision of the German Federal Soil Protection and Contaminated Sites Ordinance includes the insignificance threshold values as trigger values for the soil-groundwater pathway. Moreover, in Germany some large areas of agricultural land were found, polluted with high PFAS. Authorities implemented a so-called pre-harvest monitoring to make sure that highly contaminated crops were not put on the market. Until today a lot of research was done to find out which plants easily take up PFAS and which crops are suitable to be grown on polluted land.

A strategy change is necessary in order to elaborate more promising approaches through improved soil monitoring and more data. PFAS-background levels in soil will be used to derive further measures to assess PFAS levels in soil and groundwater. Until the implementation of legally binding values and their verified derivation a German guideline for PFAS assessment provides currently available media-related assessment bases and criteria.

European chemical regulation is controlled via REACH. Some PFAS the manufacture, use, and import are restricted with derogations. However, still a number of uses are allowed, emissions of PFAS into the environment still occur or are caused by contaminated sites. European Environmental administrations are lacking legal binding values and regulations for PFAS and in particular for soil. On the other hand, the thresholds for PFAS in drinking water and food are at such a low level, that environmental concentrations are often already above those levels. The best way forward seems to be a PFAS group restriction connected with strict regulation of industrial emissions for the remaining uses. Otherwise, gaps between the development and release of new chemical substances and mixtures and successful approaches to protecting environmental media like soils and groundwater cannot be narrowed. The European Green Deal the EU has set an ambitious sustainability plan. PFAS have been incorporated into a specific action plan for a Zero Pollution Ambition for a future of a non-toxic environment.

INVESTIGATIVE SOIL AND WATER ANALYSIS AT AN OUTSTANDING LARGE-SCALE CONTAMINATED SITE: HOW NOVEL APPROACHES CAN HELP TO SOLVE THE PFAS PUZZLE

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Abstract

The sheer number (estimated ≈ 5000) of existing poly- and perfluorinated substances (PFASs) the application of target analysis by liquid-chromatography-tandem mass spectrometry to samples from PFAS contaminated sites is limited, predominantly due to the lack of available analytical standards. Novel analytical approaches have been developed within the past decade, aiming at an integral assessment of PFASs with the ambitious goal to measure "total PFAS".

At the example of the region Rastatt/Baden-Baden in southwest Germany, where a large scale contamination of agricultural soil (>1200 ha) and groundwater exists, the subsequently combined application of analytical tools is demonstrated. The contamination was caused predominantly by soil amendment of agricultural land with compost mixed with paper-fiber biosolids. Since the first findings about a decade ago, proceedings have been achieved in the development and application of novel trace-analytical methods for PFASs in soil and groundwater. The innovations comprise the extension of target analysis to additional active ingredients of grease-proofing chemicals for food-contact materials. These are precursors that can degrade in soil to perfluoroalkyl acids (PFAAs) as persistent and mobile final products, and leach into groundwater. Another useful tool is the oxidative digestion of unknown/not analyzable precursors to detectable PFAAs in the total oxidizable precursor (TOP) assay. Fluorine specific sum parameters, such as adsorbable organic fluorine (AOF) for water samples and extractable organic fluorine (EOF) for soil samples also complete the picture. Extraction methods for soil play a key role. By comparison of extractable PFAS/organofluorine in soils with CF_2-/CF_3-group specific organofluorine directly measured by ^{19}F nuclear magnetic resonance (NMR) spectrometry >80% of PFAS-related organofluorine turned out to originate from yet inaccessible, non-extractable residues (NER).

THE BELGIAN 3M CASE FROM A HEALTH PERSPECTIVE

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Abstract

Since 1970, the 3M plant has produced PFAS in Zwijndrecht (Belgium), in the neighbourhood of the Antwerp harbour. In 2002, the production of C8 PFAS chemicals was voluntarily stopped by the company, while the production of short chain PFAS continued. During soil excavations to build a tunnel under the river Scheldt, soil near the 3M site was discovered to be highly contaminated with PFAS. This raised awareness of local residents and action groups. In response, samples of soil, groundwater, locally grown vegetables and chicken eggs were analysed. PFAS were also measured in serum samples of about 800 residents living within 3km of the 3M site. Results showed that living closer to the 3M plant and consuming more home-grown products were risk factors for increased serum levels of mainly PFOS. Some individuals had high serum levels (P95 of linear and branched PFOS up to 145 µg/L serum). The health concerns and lack of knowledge and transparency on the current PFAS emissions opted the authorities to take immediate action. The 3M company had to stop the production process of PFAS. The infrastructure works were halted. The residents received targeted advice to limit further exposure to PFAS. A coordinator was appointed to bring the stakeholders together and streamline further research, policy actions and communication. Advisory expert groups were installed. A parliamentary inquiry commission was established to find out what went wrong, who was responsible and to deduce lessons learned and propose solutions. In 2022, an agreement was obtained between the Ministry of Environment and the 3M company about financial compensation and remediation of the area.

PFAS POLICY FOR SOIL AND GROUNDWATER IN FLANDERS (BELGIUM)

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Abstract

In Flanders, standards were published in the spring of 2021 for PFAS for soil and groundwater. During the same period, measurements in a residential area near a 3M site in Antwerp (Zwijndrecht) found elevated PFAS levels in the soil. This was the beginning of a PFAS crisis, which meant that these forever chemicals dominated the news and the political world in Flanders for several months. The experiences and the knowledge gained are explained in the presentation.

A large number of locations in Flanders were flagged for further investigation on PFAS. Typically, the most worrying of these are industrial sites where PFAS is/was produced and used, as well as the training grounds of fire departments and sites of historical fire incidents where extinguishing foams containing PFAS have been used.

The OVAM started a campaign to map and investigate the locations with suspected PFAS contamination. From the many studies on PFAS and the ongoing social debate, it became clear that the existing Flemish standards frameworks must be tightened.

Several gaps in knowledge remain in order to arrive at a conclusively human risk assessment framework: transfer from soil to crops/eggs, contribution of inhalation, uncertainty on measured values at very low concentrations, mixture toxicity. The background exposure through food already leads to the threshold value being exceeded. The experiences lead to a tightening of the action framework for soil and groundwater.

In Flanders, a great deal of attention and effort went into measuring and mapping PFAS contamination in the past year. This went hand in hand with the gathering of new knowledge about the risks and spread of PFAS. The presenter brings the insights that these experiences have yielded.

THE CRITICAL ROLE OF CHEMICAL REFERENCE STANDARDS IN THE RISK GOVERNANCE OF CHEMICALS

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Abstract

Access to pure reference standards for chemicals is key to generating the hazard and exposure data for risk assessment, and to enforce and monitor for the effectiveness of legislation. A recent case where the producer and sole vendor of C604, a newer type of PFAS, obstructed unlimited access to this chemical for scientific purposes illustrates the need for scientists to have access to reference standards for conducting scientific studies. In this presentation I will outline (i) that information used for regulatory purposes relies heavily on the access to reference standards to generate data for determination of human and environmental hazards, occurrences, exposure/uptake, fate and (ii) the impact of the C604 case for scientists to support policy makers, regulators and society as a whole. Possible ways forward include (a) suggestions for improving and guaranteeing access to reference standards e.g. by revision of chemical regulations, (b) technical solutions for improving/agreeing on sufficient levels of confidence when reference standards are not available and (c) the risk governance of chemicals in absence of reference standards.

Following this presentation I will briefly mention a new EU HORIZON EUROPE project ARAGORN, which we are pleased to have been invited to negotiate with the EU. It is a project under The Soil Mission/ Farm-to-Fork research initiatives under the European Green deal, and is foreseen to start in October 2023 and run for four years. The project aims to enable the decision making of landowner across Europe to remediate hot-spot polluted soils and restore the nature on it, with a focus on persistent contaminants. ARAGORN is led by University of Copenhagen, and consists of 17 partners, across 12 countries, and collaborates with 22 identified polluted sites. It will build on existing networks and knowledge and we are therefore interested in reaching out to other networks working on analysis, remediation, cost-benefit analyses, stakeholder processes and regulations of metal, organochlorine, PFAS and PETCO pollutants at business, local, regional and national levels.

Reference

1. *The need for chemical reference standards to support science and policy*, Trier Xenia and van-Leeuwen Stefan P.J., Brambilla Gianfranco, Weber Roland, Webster Thomas F, submitted to EHP 2022 (accepted, going through revision)

"FOREVER CHEMICALS" VS. "ONE HEALTH" – PFAS, A CALL TO RETHINK HOW WE MANAGE CONTAMINATED LAND

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COMMON FORUM on Contaminated Land in Europe

Abstract

The new scientific findings published by the European Food Safety Authority in 2019 have caused an unexpected tipping point in contaminated land management. Since then PFAS is turning out as a "perfect" challenge in risk management. Accordingly COMMON FORUM took action in 2020 and as a result published its **PFAS-Memorandum** calling for a policy dialogue of all stakeholders and defining 5 key requirements which are:

1. to establish improved high standard risk assessment,
2. to refine and validate risk-based modelling by biomonitoring,
3. to coordinate transnationally the development of remediation methods and integrated management approaches,
4. to develop and integrate alternatives to active technical solutions into policy frames, and
5. to harmonise regulatory approaches for soil, water and waste within EU and national regulatory approaches.

We not only need to deal with still increasing uncertainties, but enhanced complexity in risk characterisation, and unforeseen ambiguities as well. To overcome it needs a new momentum at science-policy interfaces, in technology development and cooperation of all societal actors.

The European Human Biomonitoring Initiative (HBM4EU) started in 2017 to coordinate and advance human biomonitoring studies as a joint effort at European level. Among the results published until 2022 it established baselines for the internal exposure to 12 PFASs for European teenagers in 9 countries, evidencing that 14,3% exceed the guideline value for a tolerable weekly intake, with a country-specific maximum exceedance found at 23,8%. (HBM4EU 2022). Higher PFAS blood levels were found linked to the consumption of fish, seafood, eggs, offal and locally produced food (Richterová et al., 2023). Like the European Commissions first Zero Pollution Monitoring and Outlook report (EC, 2022) reveals that EU policies have contributed to reduce environmental pollution, still to reach mid-term targets envisaged for 2030 much stronger action is needed.

References

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3. Richterová et al., 2023: PFAS levels and determinants of variability in exposure in European teenagers – Results from the HBM4EU aligned studies (2014-2021); International Journal of Hygiene and Environmental Health, Vol. 247, January 2023;
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PER- AND POLY-FLUORALKYL SUBSTANCES (PFAS) AND THE GLOBAL DIMENSION OF SOIL POLLUTION

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Abstract

At the initiative of the FAO Global Soil Partnership, the International Network on Soil Pollution (INSOP) was established in 2022. Its mission is to support and facilitate joint efforts to reduce soil pollution risks globally and effectively remediate already polluted areas.

PFAS, in particular, are a fast-evolving issue receiving increasing governmental and public attention, as the presence of these contaminants in the environment is ubiquitous. Soil pollution impacts the critical zone of soil ecosystems and their ecosystem services, which supply not only agricultural products but a wide range of functions and services that benefit our societies and citizens.

INSOP works on the full cycle of soil pollution, from assessment to remediation, as well as environmental and human health effects. Data from around the world on PFAS are alarming. They are everlasting contaminants and require increased efforts and budgets for risk analysis, control, adaptation and rehabilitation to restore soil ecosystem functions and services and limit damage.