

# Putting a Spotlight on PFAS

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FPF Workshop 2023

28 September 2023

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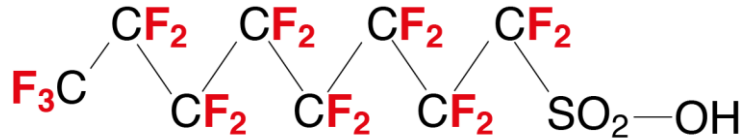
28 September 2023

# PFAS:

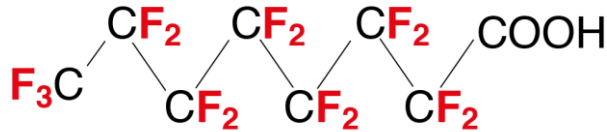
## Per- and Polyfluoroalkyl Substances

*Environ. Sci. Technol.* **2001**, *35*, 1339–1342

### ■ PFOS:



### ■ PFOA:



**perfluorinated alkyl chain**

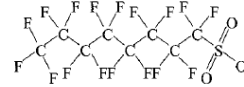
### Global Distribution of Perfluorooctane Sulfonate in Wildlife

JOHN P. GIESY\* AND KURUNTHACHALAM KANNAN

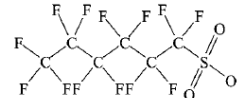
*Department of Zoology, National Food Safety and Toxicology Center, Institute for Environmental Toxicology, Michigan State University, East Lansing, Michigan 48824*

Here we report, for the first time, on the global distribution of perfluorooctanesulfonate (PFOS), a fluorinated organic contaminant. PFOS was measured in the tissues of wildlife, including, fish, birds, and marine mammals. Some of the species studied include bald eagles, polar bears, albatrosses, and various species of seals. Samples were collected from urbanized areas in North America, especially the Great Lakes region and coastal marine areas and rivers, and Europe. Samples were also collected from a number of more remote, less urbanized locations such as the Arctic and the North Pacific Oceans. The results demonstrated that PFOS is widespread in the environment. Concentrations of PFOS in animals from relatively more populated and

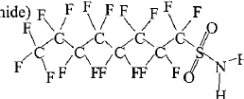
PFOS (Perfluorooctane sulfonate)  
 $C_8F_{17}SO_3^-$



PFHS (Perfluorohexane sulfonate)  
 $C_6F_{13}SO_3^-$



PFOSA (Perfluorooctanesulfonylamide)  
 $C_8F_{17}SO_2NH_2$



PFOA (Perfluorooctanoic acid)  
 $C_8F_{17}COOH$

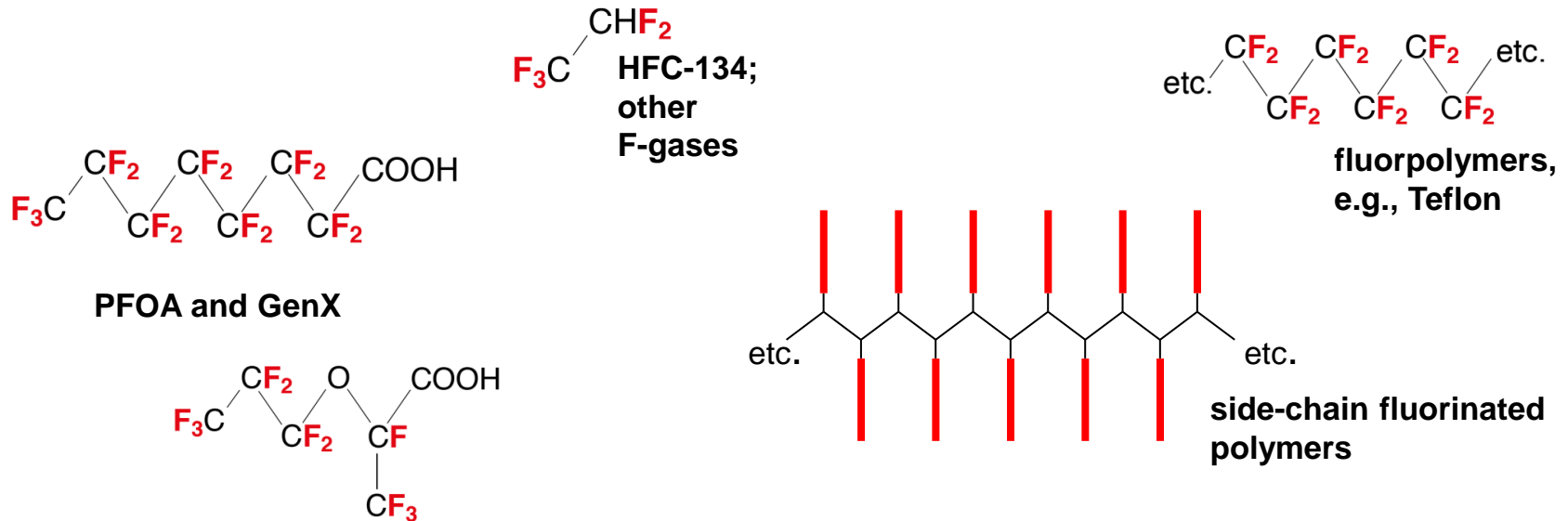


**FIGURE 1. Structures of target fluorinated organic compounds.**

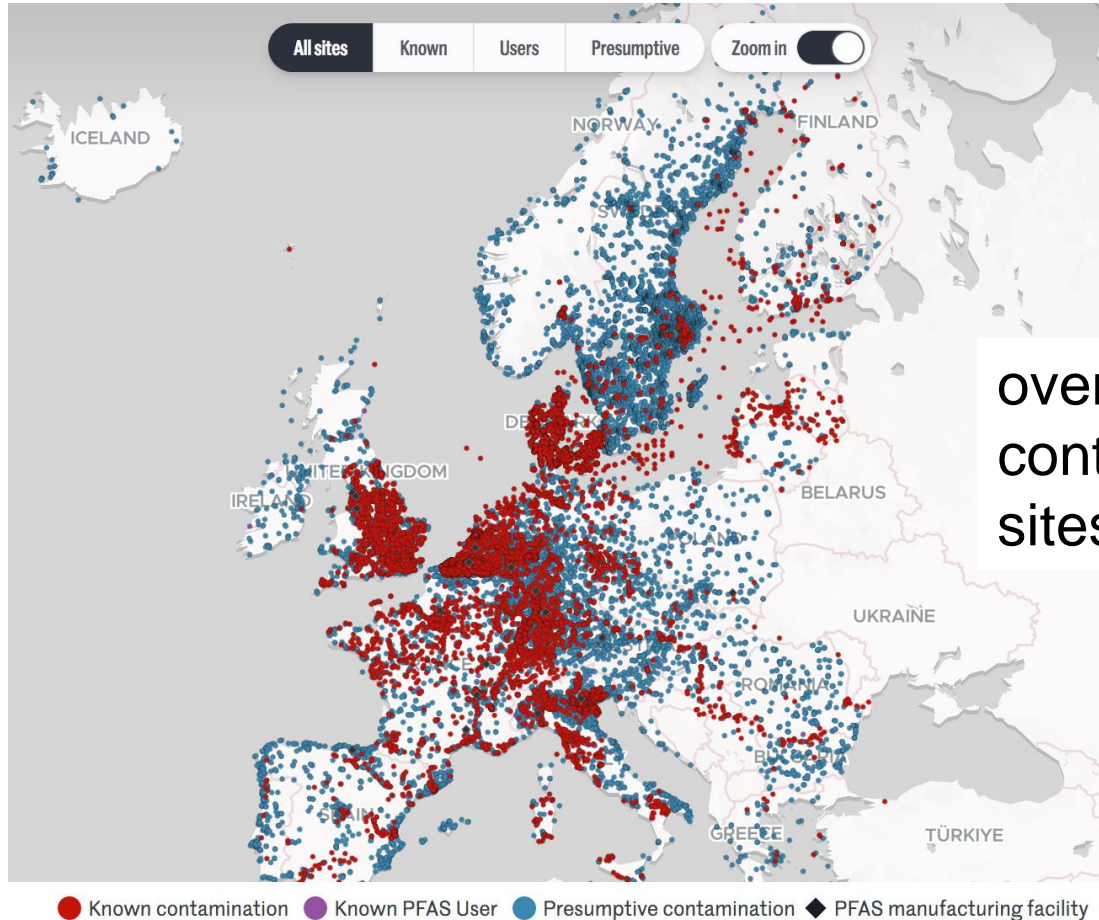
the high energy of the carbon–fluorine bond (known to be the strongest of covalent bonds), some perfluorinated compounds are very stable in the environment (3). Even though FOCs could be persistent, the magnitude and extent of distribution of FOCs in the environment was unknown. However, the occurrence of FOCs in human blood sera was

# Large Number and Diversity of PFAS

- PFAS definition by OECD (2018) very broad



# PFAS Contamination in the EU



# Over 70 Articles in European Newspapers



Home Maps and data Methodology About Contact

## The Forever Pollution Project

### Journalists tracking PFAS across Europe

More than 17 000 sites all over Europe are contaminated by the “forever chemicals” PFAS, an exclusive, months-long investigation from 18 European newsrooms shows. The investigation “The Forever Pollution Project” reveals an additional 21 000 presumptive contamination sites due to current or past industrial activity. The contamination revealed by this project spreads all over Europe.

In early February 2023, the European Chemicals Agency ECHA published a ban proposal on all PFAS – or per- and polyfluoroalkyl substances. “The Forever Pollution Project” can now reveal that there is way more contamination all over Europe than has been publicly known. The journalists gathered 100 datasets and filed dozens of FOIA requests to build a first-of-its-kind map of PFAS contamination in Europe. The scientific methodology behind this “peer-reviewed journalism experience” is borrowed from the [PFAS Project Lab](#) and the [PFAS Sites and Community Resources Map in the U.S.](#)

# Over 70 Articles in European Newspapers



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## Publications

### PFAS: the trail of eternal pollutants in Spain

2 July 2023 · Datadista / Spain [In Spanish](#)

### PFAS: the trail of eternal pollutants in Spain

2 July 2023 · elDiario.es / Spain [In Spanish](#)

### Chemical lobby moves full steam ahead to undermine European PFAS ban

17 May 2023 · Follow The Money / Netherlands

[In Dutch](#)

### MAP: Where dangerous “eternal chemicals” accumulate in Latvia

11 May 2023 · Latvijas Radio / Latvia

[In Latvian](#)

### Eternal chemicals: Latvia is polluted with substances harmful to human health

11 May 2023 · Latvijas Radio / Latvia

[In Latvian](#)

### PFAS, the case of the Spinetta Marengo chemical center. Part 3: The company

24 April 2023 · Radar Magazine / Italy

[In English](#)

### PFAS, the case of the Spinetta Marengo chemical center. Part 2: The institutions

24 April 2023 · Radar Magazine / Italy

[In English](#)

### PFAS, the case of the Spinetta Marengo chemical center. PART 1: The people

24 April 2023 · Radar Magazine / Italy

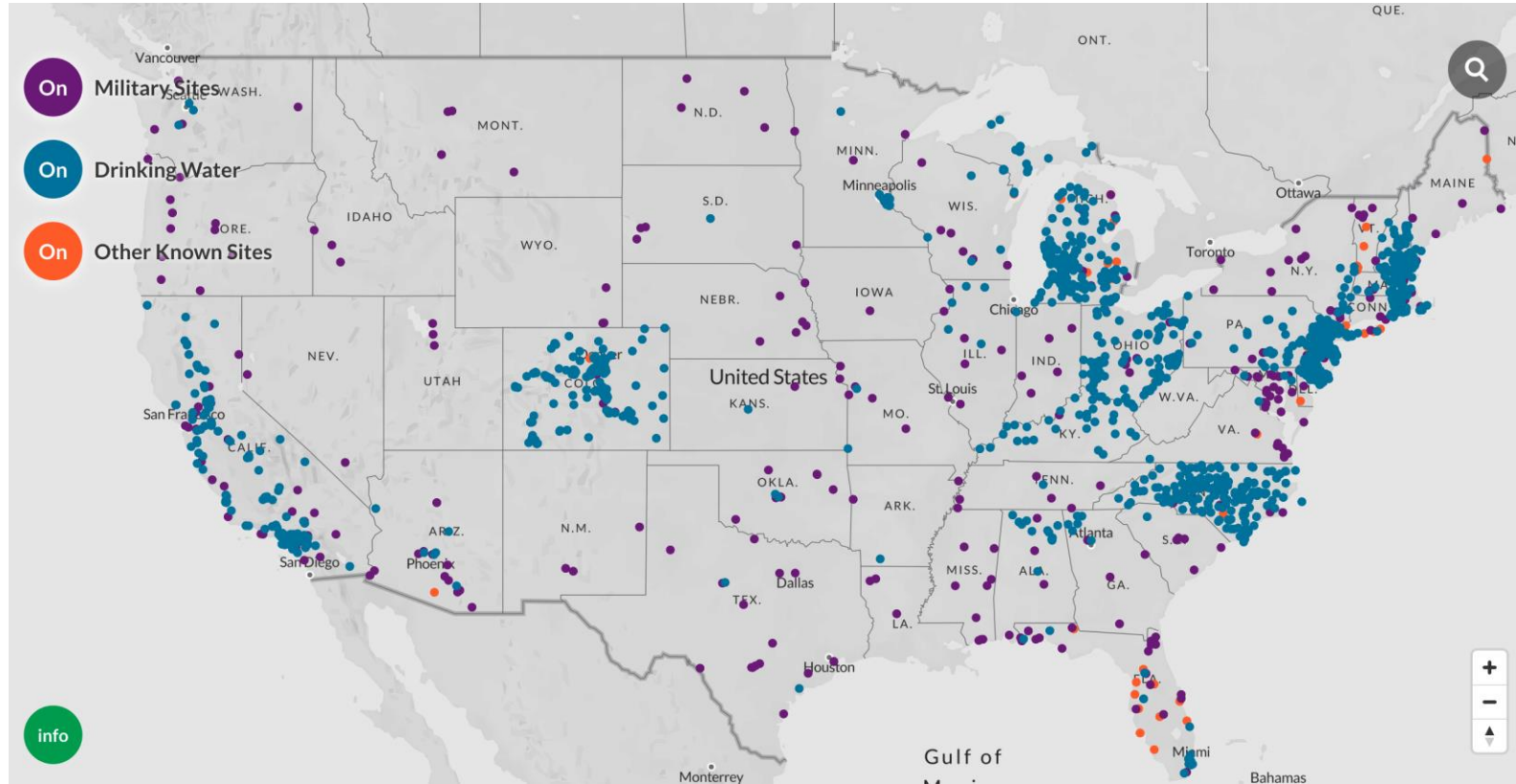
[In English](#)

### What you need to know about Pfas

17 April 2023 · The Guardian / United Kingdom

[In Italian](#)

# PFAS Contamination in the US





# 200 Applications of 1400 PFAS



The Intercept

Illustration: Soohs Cho/The Intercept

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## TOXIC PFAS CHEMICALS DISCOVERED IN HUNDREDS OF PRODUCTS

Climbing ropes, guitar strings, and hand sanitizer are among the newly reported uses for the toxic “forever” chemicals.

S. Lerner, The Intercept, December 2, 2020

<https://theintercept.com/2020/12/02/pfas-chemicals-products/>

# 200 Applications of 1400 PFAS

Environmental  
Science  
Processes & Impacts



PAPER

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Cite this: *Environ. Sci.: Processes Impacts*, 2020, 22, 2345

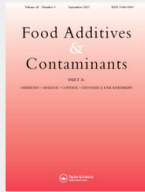
## An overview of the uses of per- and polyfluoroalkyl substances (PFAS)<sup>†</sup>

Juliane Glüge,<sup>id \*a</sup> Martin Scheringer,<sup>id a</sup> Ian T. Cousins,<sup>id b</sup> Jamie C. DeWitt,<sup>c</sup> Gretta Goldenman,<sup>d</sup> Dorte Herzke,<sup>id ef</sup> Rainer Lohmann,<sup>id g</sup> Carla A. Ng,<sup>id h</sup> Xenia Trier<sup>i</sup> and Zhanyun Wang<sup>j</sup>

Per- and polyfluoroalkyl substances (PFAS) are of concern because of their high persistence (or that of their degradation products) and their impacts on human and environmental health that are known or can be deduced from some well-studied PFAS. Currently, many different PFAS (on the order of several thousands) are used in a wide range of applications, and there is no comprehensive source of information on the many individual substances and their functions in different applications. Here we provide a broad overview of many use categories where PFAS have been employed and for which function; we also specify which PFAS have been used and discuss the magnitude of the uses. Despite

<https://doi.org/10.1039/d0em00291g>

# Bad Surprises ...



**Food Additives & Contaminants: Part A** >

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Articles

## Assessment of poly- and perfluoroalkyl substances (PFAS) in commercially available drinking straws using targeted and suspect screening approaches

Pauline Boisacq, Maarten De Keuster, Els Prinsen, Yunsun Jeong, Lieven Bervoets, Marcel Eens, ...show all

Pages 1230-1241 | Received 13 May 2023, Accepted 14 Jul 2023, Published online: 24 Aug 2023

Cite this article <https://doi.org/10.1080/19440049.2023.2240908>



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# Bad Surprises ...



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Articles

## Assessment of poly- and perfluoroalkyl substances (PFAS) in commercially available drinking straws

PFAS were found to be present in almost all types of straws, except for those made of stainless steel. PFAS were more frequently detected in plant-based materials, such as paper and bamboo. (...). The presence of PFAS in plant-based straws shows that they are not necessarily biodegradable and that the use of such straws potentially contributes to human and environmental exposure of PFAS.

# Bad Surprises ...

## SEHR HOHE PFAS-GEHALTE IN LEBENSMITTELVERPACKUNGEN (BEISPIELE)

	LAND	LEBENS- MITTEL	VERPACKUNG	UNTERNEHMEN/ HÄNDLER	TOF- WERT
<b>Einweggeschirr</b>					
	Niederlande		Einwegschüssel aus Zuckerrohr	Sabert	1.200 mg/kg
	Dänemark		Einwegteller aus Zuckerrohr	Abena	1.200 mg/kg
	Deutschland		Einwegschüssel aus Zuckerrohr	MCC Trading International GmbH	1.100 mg/kg
	Deutschland		Einwegschüssel aus Zuckerrohr	PAPSTAR	850 mg/kg

# FPF's Current Work on PFAS

## ABSTRACT

PFASs are linked to serious health and environmental concerns due to their persistence and toxicity. Among their widespread applications, PFASs are known to be used in food packaging, directly contributing to human exposure. However, information on PFASs in food packaging is scattered. Therefore, we systematically map the evidence on PFASs detected in migrates and extracts of food contact materials and provide an overview of available hazard and biomonitoring data. Based on the FCCmigex database, 68 PFASs have been identified in various food contact materials by targeted and untargeted analyses, including paper, plastic, and coated metal. 87% of these PFASs belong to the perfluorocarboxylic acids and fluorotelomer-based compounds. Trends in the chain-length demonstrate that long-chain perfluoroalkyl acids continue to be found, despite years of global efforts to reduce the use of these substances. We utilized ToxPi to illustrate that hazard data are available for only 57% of the PFASs that have been detected in food packaging. For those PFASs where toxicity testing has been performed, many adverse outcomes have been reported. The data and knowledge gaps presented here support international proposals to restrict PFASs as a group, including their use in food contact materials to protect human and environmental health.

Per- and polyfluoroalkyl substances in food packaging: Migration, toxicity, and management strategies

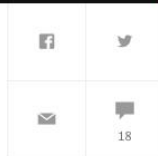
Drake W. Phelps,  
Lindsey V. Parkinson,  
Justin M. Boucher,  
Jane Muncke,  
Birgit Geueke\*

under review

# Toxic Effects of PFAS



Illustration: Soohie Cho/The Intercept



## **PFOA AND PFOS CAUSE LOWER SPERM COUNTS AND SMALLER PENISES, STUDY FINDS**



Sharon Lezner

November 30 2018, 3:52 p.m.

# Toxic Effects of PFAS

*Environmental Toxicology and Chemistry*—Volume 40, Number 3—pp. 606–630, 2021

Received: 20 July 2020 | Revised: 29 August 2020 | Accepted: 20 September 2020

606

## Critical Review

### Per- and Polyfluoroalkyl Substance Toxicity and Human Health Review: Current State of Knowledge and Strategies for Informing Future Research

Suzanne E. Fenton,<sup>a</sup> Alan Ducatman,<sup>b</sup> Alan Boobis,<sup>c</sup> Jamie C. DeWitt,<sup>d</sup> Christopher Lau,<sup>e</sup> Carla Ng,<sup>f</sup> James S. Smith,<sup>g</sup> and Stephen M. Roberts<sup>h,\*</sup>

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<sup>c</sup>Imperial College London, London, United Kingdom

<sup>d</sup>Department of Pharmacology and Toxicology, Brody School of Medicine, East Carolina University, Greenville, North Carolina, USA

<sup>e</sup>Public Health and Integrated Toxicology Division, Center for Public Health and Environmental Assessment, Office of Research and Development, US Environmental Protection Agency, Research Triangle Park, North Carolina, USA

<sup>f</sup>Departments of Civil and Environmental Engineering and Environmental and Occupational Health, University of Pittsburgh, Pittsburgh, Pennsylvania, USA

<sup>g</sup>Navy and Marine Corps Public Health Center, Portsmouth, Virginia, USA

<sup>h</sup>Center for Environmental & Human Toxicology, University of Florida, Gainesville, Florida, USA



# The PFAS Restriction Proposal in the EU

An agency of the European Union

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## Per- and polyfluoroalkyl substances (PFAS)

Per- and polyfluoroalkyl substances (PFAS) are a large class of thousands of synthetic chemicals that are used throughout society. However, they are increasingly detected as environmental pollutants and some are linked to negative effects on human health.

They all contain carbon-fluorine bonds, which are one of the strongest chemical bonds in organic chemistry. This means that they resist degradation when used and also in the environment. Most PFAS are also easily transported in the environment covering long distances away from the source of their release.

PFAS have been frequently observed to contaminate groundwater, surface water and soil. Cleaning up polluted sites is technically difficult and costly. If releases continue, they will continue to accumulate in the environment, drinking water and food.

### Latest updates

Universal PFAS restriction proposal:

- [ECHA receives more than 5 600 comments on PFAS restriction proposal, 26 Sept 2023](#)
- [Listen to our podcast: committee chairs María Ottati and Roberto Scazzola give an update on the universal restriction proposal, 20 Sept 2023](#)

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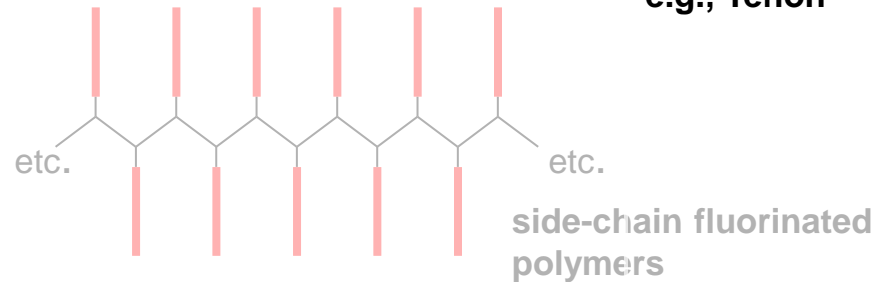
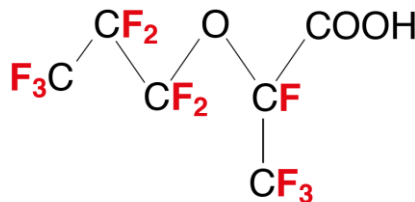
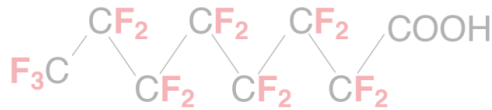
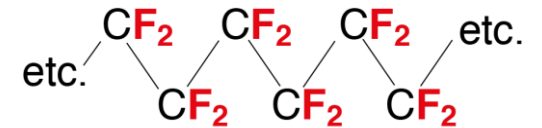
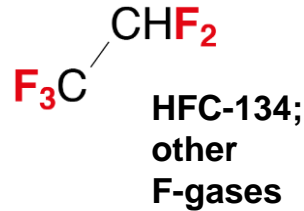
ECHA

- [Persistent Organic Pollutants \(POPs\)](#)
- [Substances restricted under](#)
- [Candidate List of substances high concern for Authorisation](#)
- [Authorisation List](#)
- [Community Rolling Action Plan](#)
- [Harmonised classification and labelling](#)

<https://echa.europa.eu/hot-topics/perfluoroalkyl-chemicals-pfas>

# Changes in the PFAS Landscape

- Two groups of PFAS with largest market volumes



# There are Alternatives ...

EDITORIAL

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## Innovate beyond PFAS

New proposed legislation on “forever” chemicals is under consideration in Europe and the United States, where per- and polyfluoroalkyl substances (PFAS) are a hot topic for regulators and lawmakers. On both sides of the Atlantic, regulation of widely used PFAS has been complex and evolving. Their presence in hundreds of different products—from nonstick cookware to food packaging to fire-fighting foam—and their persistence in food, drinking water, and the environment have resulted in a pollution problem of unprecedented scale. Recently, for example, it was reported that 45% of the tap water in the United States contains at least one type of PFAS. Because these compounds are so chemically stable that they do not degrade in the environment (including in the human body), PFAS seriously challenge long-established ideas of how chemicals can be used, assessed, and regulated, and it remains to be seen whether the new regulations will solve this problem.

Chemicals assessment traditionally has been centered around toxicity and physical hazards such as flammability. Chemicals that are carcinogenic, mutagenic, or toxic for reproduction (so-called CMR chemicals), as well as chemicals with high acute toxicity such as many neurotoxicants, stand out as particularly hazardous sub-

The implications are substantial. One aspect is that chemicals that are only moderately toxic, but highly persistent, cannot be used in open and dispersive applications as has been the case for PFAS, but have to be used in closed systems, such as industrial equipment without any leaks or vents (which is required for highly toxic chemicals). Another aspect is that persistence does not carry sufficient weight in the assessment and regulation of chemicals. Persistence should be seen as a direct element of chemical hazard. The current approach of treating persistence only as a factor that modulates exposure to a chemical is not adequate. Under this approach, low persistence leads to lower estimated exposure and, thereby, a rating of lower risk in current chemicals assessment, whereas high persistence does not lead to a “red flag.”

Accordingly, the way forward should include changes to the established system of chemicals assessment and regulation that go beyond the case of PFAS. For the specific problem of PFAS, it will be necessary to develop PFAS-free alternatives for many of the current PFAS uses. In general, this is possible for the vast majority of cases. Even for challenging and demanding uses such as fire-fighting foams for jet-fuel fires, it has been possible



**Martin Scheringer** is a professor of environmental chemistry at RECETOX, Masaryk University, Brno, Czech Republic, and a senior scientist and group leader at ETH Zürich, Zürich, Switzerland. He is also the chair of the International Panel on Chemical Pollution and a co-coordinator of the Global PFAS Science Panel. [scheringer@usys.ethz.ch](mailto:scheringer@usys.ethz.ch)

“...persistence acts as a multiplier of toxicity. This insidious aspect...has been underestimated...”

Science,  
21. Juli 2023

Many Thanks  
for Your Attention