

the forever pollution project

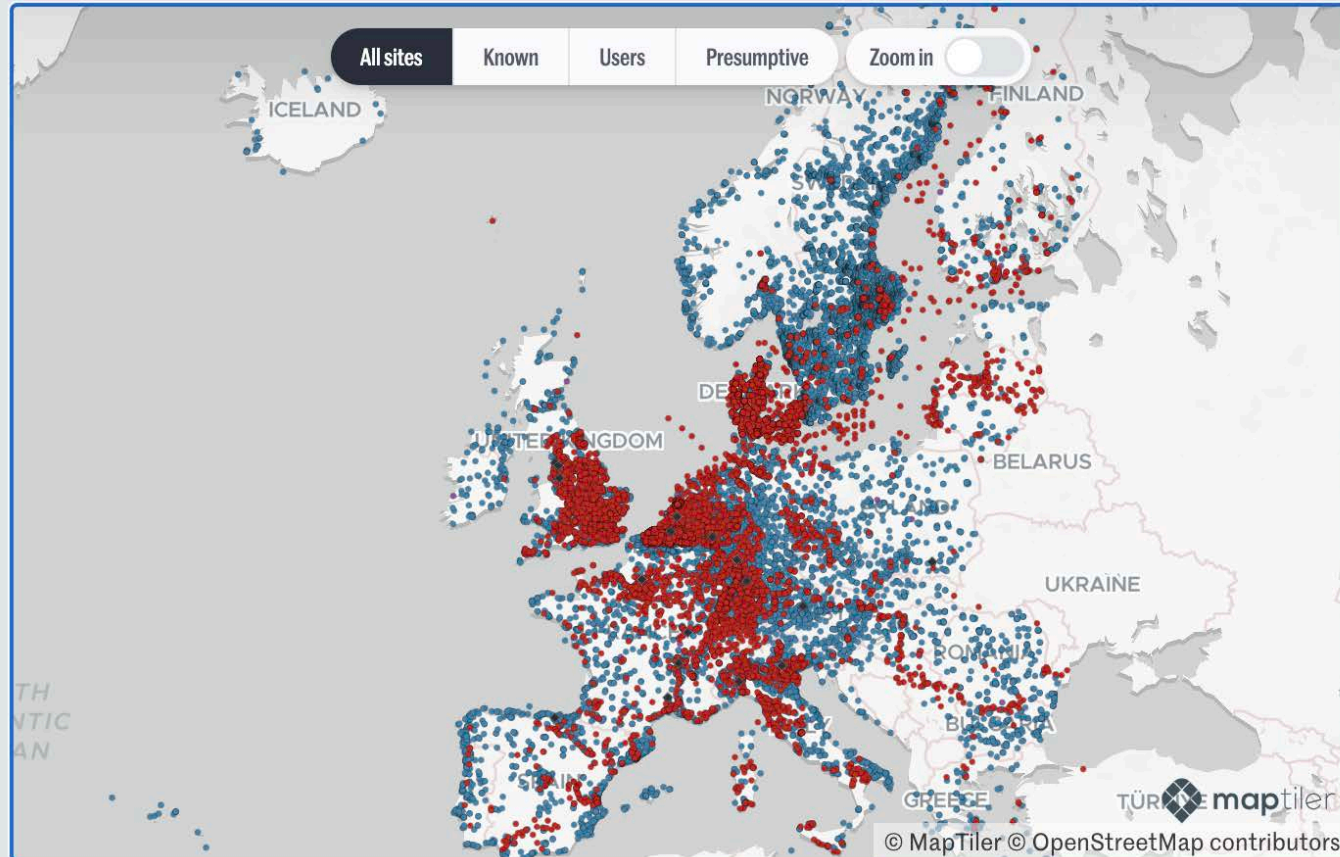
Stéphane Horel

Le Monde

World Science Forum
20/11/2024



the map of Forever Pollution in Europe



● Known contamination ● Known PFAS User ● Presumptive contamination ◆ PFAS manufacturing facility

a cross-border investigation

Le Monde

France

Süddeutsche Zeitung NDR® WDR®

Germany

RADAR le Scienze

Italy

THE INVESTIGATIVE DESK nrc

The Netherlands

Knack

Belgium

Deník Referendum

DR

Czechia

yle

Finland

REPORTERS UNITED

Greece

Latvijas Radio

Latvia

DATADISTA

Spain

SRF

Switzerland

WATERSHED

United Kingdom

The Guardian

12 countries, 16 media
February-June 2023

<http://foreverpollution.eu>

Work grants

journalismfund.eu

Coordination

IJ4 EU

Arena
for
journalism
in Europe

Map design

Le Monde

Mapping partner






maptiler

peef-WHAT? PFAS

PFAS are **poly- and perfluoroalkyl substances**

Man-made chemicals used since the 1940/50s

> 200 applications (Glüge 2020)

-  Non-stick cookware (Teflon)
-  Water-repellent outdoor clothing (Gore-Tex)
-  Stain resistant textile (Scotchgard)
-  Food packaging
-  Fire-fighting foams for hydrocarbon fires

Ultra toxic

The worst pollution crisis humanity has ever faced



PFAS manufacturers

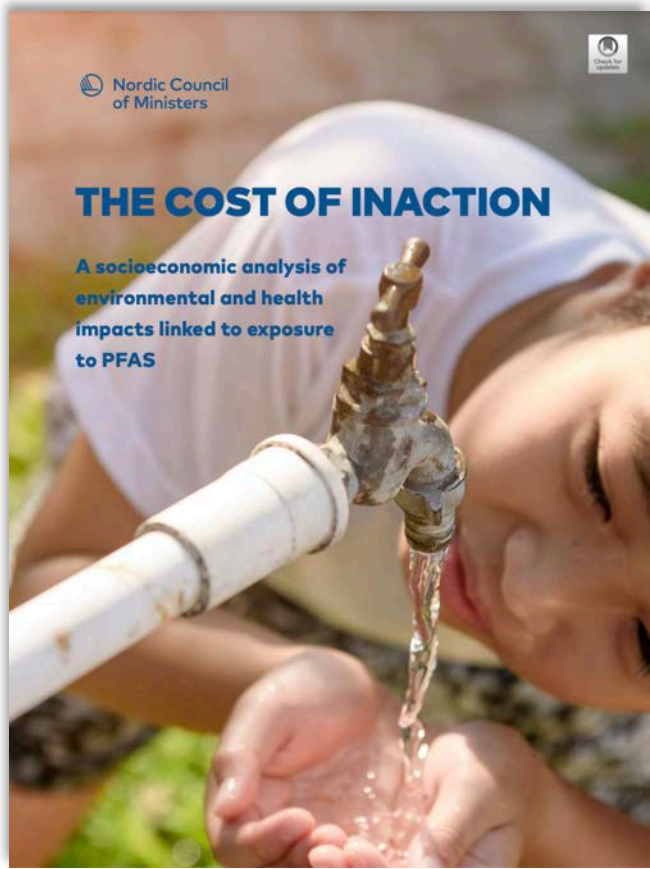


Table 10: List of manufacturers of fluorochemicals and/or fluoropolymers

Country	Company and site of plant	What is being produced
Belgium	3M (Zwijndorf)	Fluorochemicals
France	Arkema (Pierre-Bénite)	Fluoropolymers (PVDF)
	Solvay Solexis (Tavaux)	Fluoropolymers (PVDF)
	Daikin Chemical France S.A.S. ¹	Fluorochemicals
Germany	Dyneon (Gendorf)	Fluorochemicals, fluoropolymers (PTFE, FEP, PFA, THV)
	BASF (Ludwigshafen)	n.a.
Italy	Solvay Solexis (Spinetta-Argeno)	Fluoropolymers) – PTFE, MFA
	Heroflon S.p.A. (Collebeato)	Fluoropolymers (PTFE compounds and micropowders)
	Miteni (Trissino) ²	Fluorinated intermediates; performance fluorinated products
Netherlands	Chemours (Dordrecht)	Fluoropolymers (PTFE, FEP)
	Daikin Chemical Netherlands (Oss) – Pre-compounding of fluoroelastomers	Fluorochemicals
United Kingdom	AGC (Blackpool)	Fluoropolymers – PTFE, PFA

“Based on this list, it is further assumed that the number of PFAS production sites in Europe is between 12 and 20 plants”.

define: PFAS production facility

Company Name	Country	Location (town)	Type	HQ	Latitude	Longitude	Trade name	PFAS produced	Evidence/notes on production or use
3M	BE	Zwijndrecht	Producer	USA	51.2342734974	4.3345424061	Novec™ Fluorinert™		Emitted PFOS until 2004, now PFOA, PFBS, PFHpA, PFHxA, PFHxS, PFOSA, PFPA and PFBA (emission norm for waste water in the river Scheldt 0,1 µg/l). 3M Belgium produces a wide range of products like Post-It's, glue, coatings. See: https://www.3mbelgie.be/3M/nl_BE/p/ 3M itself writes: "M's innovative solutions that rely on PFAS include 3M's™ Novec™ Engineered Fluids, 3M™ Fluorinert™ Electronic Liquids, 3M™ Performance Fluids and fluoropolymer products." Novec and Fluorinert are both Fluon® PTFE/ETFE Fluoropolymers
AGC (Asahi Glass Company)	UK	Thornton-Cleveleys	Producer	UK	53.879144035	-2.999966481	Fluon®	PTFE, ETFE	Fluon® PTFE/ETFE Fluoropolymers
Archroma	DE	Gendorf	Producer				Novec™ Fluorinert™		Emitted PFOS until 2004, now PFOA, PFBS, PFHpA, PFHxA, PFHxS, PFOSA, PFPA and PFBA (emission norm for waste water in the river Scheldt 0,1 µg/l). 3M Belgium produces a wide range of products like Post-It's, glue, coatings. See: https://www.3mbelgie.be/3M/nl_BE/p/ 3M itself writes: "M's innovative solutions that rely on PFAS include 3M's™ Novec™ Engineered Fluids, 3M™ Fluorinert™ Electronic Liquids, 3M™ Performance Fluids and fluoropolymer products." Novec and Fluorinert are both Fluon® PTFE/ETFE Fluoropolymers
Arkema	FR	Pierre-Bénite	Producer				Fluon®	PTFE, ETFE	Confirmed by email: https://drive.google.com/drive/folders/1CcNjHUZcj2ya-uyy5vD2xx290FoA5P85
Arkema	ES	Zaramillo	Legacy Producer				Nuva®	C6	Archroma is the "only European producer of C6 fluorinated telomer products, a sub-category of PFAS. Archroma's production facility is located in Germany (Gendorf, Bavaria)." [FOI DG GROW document]
Chemours	NL	Dordrecht	Producer						"At the GENDORF Chemical Park, Archroma's approx. 70 employees produce and develop new products based on short chain fluortelomers, which are sold to the global market as

7 “expert-reviewers”

Social scientists

Alissa Cordner (Whitman College, Walla Walla, USA)

Phil Brown (Northeastern University, Boston, USA)

Environmental chemists

Ian Cousins (Stockholm University, Sweden)

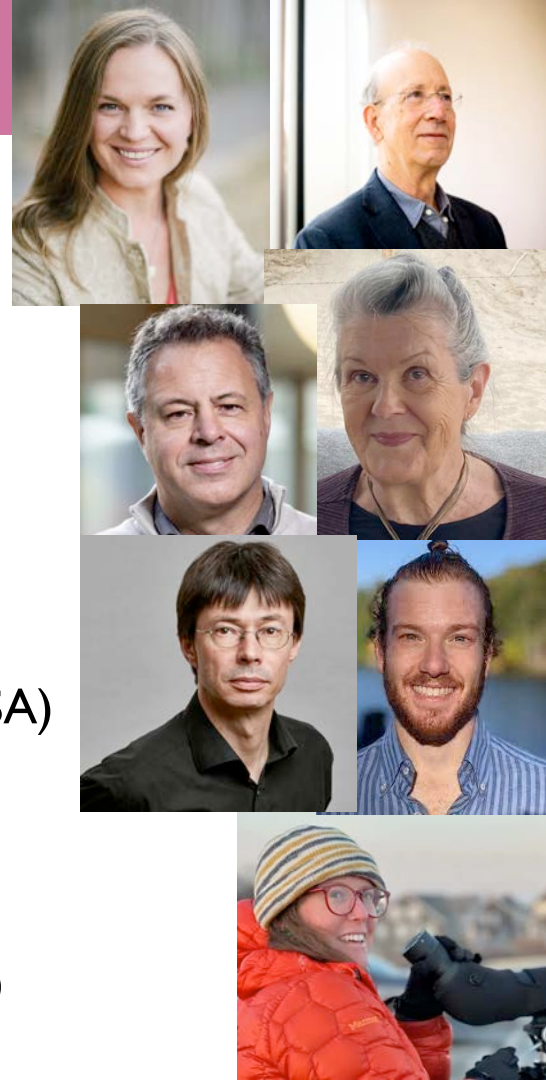
Martin Scheringer (ETH Zürich, Switzerland)

Kimberly K. Garrett (Northeastern University, Boston, USA)

Derrick Salvatore (Massachusetts Department of Environmental Protection, USA)

Environmental lawyer, consultant

Gretta Goldenman (Global PFAS Science Panel, Brussels)



adapting the map of US contamination to Europe

Presumptive Contamination: A New Approach to PFAS Contamination Based on Likely Sources

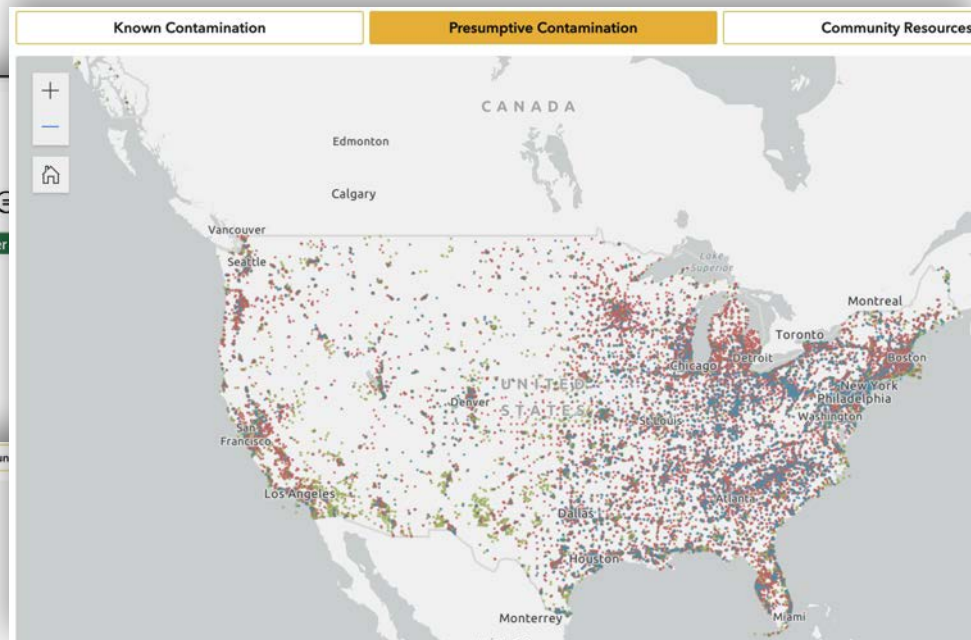
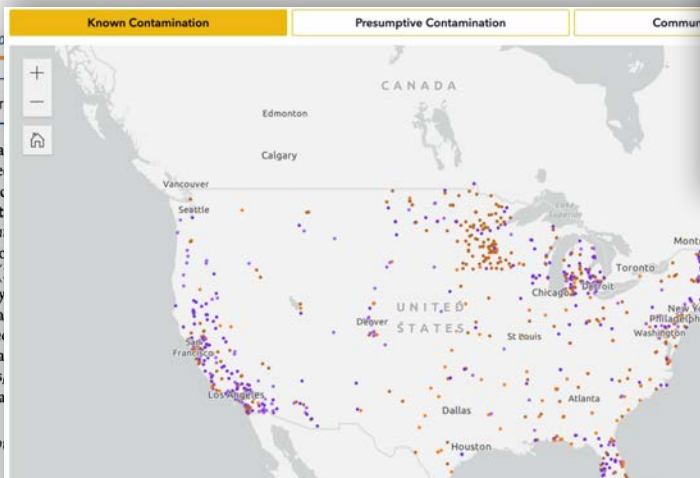
Derrick Salvatore, Kira Mok, Kimberly K. Garrett, Grace Poudrier, Phil Brown, Linda S. Birnbaum, Gretta Goldenman, Mark F. Miller, Sharyle Patton, Maddy Poehlein, Julia Varshavsky, and Alissa Corder*

Cite This: *Environ. Sci. Technol.*

ACCESS | Metr

ABSTRACT: While research about PFAS contamination in the United States is incomplete, PFAS contamination is widespread. This study uses quality testing data, PFAS contamination data, and (1) fluorinated aqueous phase extraction (AQE) data from certain industrial facilities, and (2) are incomplete on all three to integrate available geocoded, national contamination sites in the United States. This approach allows governments, industries, and a potential exposure sources.

KEYWORDS: per- and polyfluorinated substances (PFAS) waste and disposal



Collecting and harmonizing sampling data (known)

country	ID	category	Name	Blocking problems	Status	Automated check	Link to final data	source_type	source_text	source_url
Spain	68	Known	Valencia region		Done	OK	https://docs.google.com	Scientific art	Campo 2016, Campo 2017, Lorenzo 2019	dx.doi.org/10.1016/j.envres.2016.0
Sweden	69	Known	Groundwater contamination from firefighting foam		Done	OK	https://docs.google.com	Authorities	Swedish Environmental Protection Agency/Swedish	https://www.diva-portal.org/smash/
Sweden	70	Known	Arlanda airport		Done	OK	https://docs.google.com	Authorities	Sveriges geologiska undersökning	https://www.diva-portal.org/smash/
Sweden	71	Known	500 Groundwater and surface water samples		Done	OK	https://drive.google.com	Scientific art	Gobelius 2018	https://doi.org/10.1021/acs.est.7b0
Switzerland	72	Known	Surface water, 16 sampling locations 2018-2020		Done	OK	https://drive.google.com	Authorities	Swiss Federal Office for the Environment	https://www.bafu.admin.ch/bafu/en
Switzerland	73	Known	Rhine in Schwebstoffe		Done	OK	https://drive.google.com	Authorities	Amt für Umwelt und Energie	https://opendata.swiss/en/dataset/r
Switzerland	74	Known	Groundwater sampling campaign 2007		Done	OK	https://drive.google.com	Authorities	Swiss Federal Office for the Environment	https://www.bafu.admin.ch/bafu/fr/
England	75	Known	Water quality monitoring		Done	OK	https://drive.google.com	Authorities	Environment Agency	https://www.data.gov.uk/dataset/Oc
Scotland	76	Known	Water quality		Done	OK	https://drive.google.com	FOI	Scotland Scottish Environment Protection Agency (S	
Wales	77	Known	Wales PFOA-PFOS 2016 - 2022		Done	OK	https://drive.google.com	Authorities	Natural resources Wales	Natural resources Wales Telephone: 029 2046 4227 Email: communications@naturalres
United Kingdom	78	Known	Watershed's DW sampling: drinking water samples we took across England		Done	OK	https://docs.google.com	Own samplir		
United Kingdom	78_1	Known	Watershed's SW sampling: drinking water samples we took across England		Done	OK	https://docs.google.com	Own samplir		
United Kingdom	79	Known	EA water for potable supply FOI: Environment Agency sampling data, mostly from 2005-2008, a few from 2011-2021		Done	OK	https://drive.google.com	FOI	Environment Agency	
United Kingdom	80	Known	Watershed Manual data		Done	OK	https://docs.google.com			
United Kingdom	81	Known	UK CIP		Done	OK	https://drive.google.com	Authorities	UKWIR	https://ukwir.org/sign-up-and-access
United Kingdom	82	Known	EA ground water for supply FOI: part of the response from the above request		Done	OK	https://drive.google.com	FOI	Environment Agency	
United Kingdom	82_1	Known	Cafes data		Done	OK	https://docs.google.com	Authorities	Centre for Environment Fisheries & Aquaculture Sci	

23,000 known contamination sites

2,300 hotspot clusters

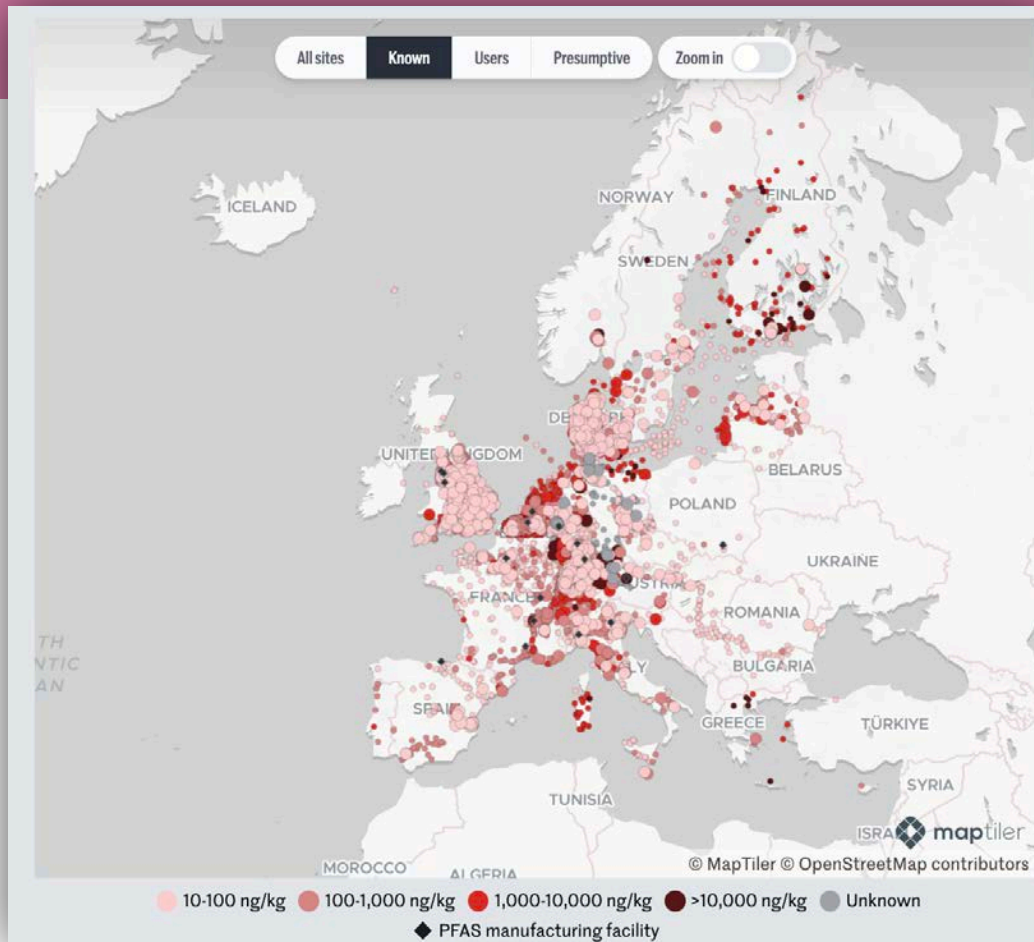
EU limit value

= 100 ng/l (20 PFAS)

= 500 ng/l (sum PFAS)

Hotspot according to experts

= 100 ng/l



Investigative tools (OSINT) (Plants & Presumptive)

- ECHA list of registrants
 - Corporate material (websites, annual reports, financial documents, safety and product data sheets, certificates of registration)
 - Trade associations member companies
 - List provided by Ian Cousins (Stockholm university)
 - Google maps
 - Consultants intelligence reports
 - Scientific papers
 - Right to reply emails to companies
- ...and

freedom of information material



Ref. Ares(2022)5578121 - 04/08/2022

From: [REDACTED]@kreab.com>
Sent: vendredi 3 juin 2022 10:25
To: [REDACTED] (GROW)
Cc: [REDACTED] (GROW); [REDACTED] (GROW); [REDACTED] (GROW); [REDACTED]; [REDACTED]; [REDACTED]; [REDACTED]
Subject: Archroma Letter / C6 transported intermediates under PFOA POP regulation & C9-C14 REACH restriction
Attachments: Archroma-Letter_DG GROW_C6 transported intermediates.pdf; CONFIDENTIAL_C6 telomer products line_Archroma_June2022.pdf

Dear [REDACTED],

We're writing to you on behalf of Archroma, producer of speciality chemicals and notably the only European producer of C6 fluorinated telomer products, a sub-category of PFAS. Archroma's production facility is located in Germany (Gendorf, Bavaria).

allow continued production of C6 telomer chemistry according to state of the art techniques. The C6 telomer chemistry continues to remain necessary in a number of downstream sectors, as shown by the ongoing discussions on the REACH PFHxA restriction dossier.

forensics of the Anthropocene



Dordrecht



Pierre-Bénite














Zwijndrecht



Gendorf

20 PFAS producing facilities

Company	Town	Country
Dyneon / 3M	Gendorf	
Solvay	Bad Wimpfen	
Archroma	Gendorf	
Gore	Gendorf	
Daikin refrigerants	Frankfurt am Main	
Lanxess	Leverkusen	
Arkema	Pierre-Bénite	
Daikin	Pierre-Bénite	
Solvay	Tavaux	
Solvay	Salindres	
Chemours	Villers Saint-Paul	

AGC	Thornton-Cleveleys	
F2	Preston	
Mexichem/Koura	Runcorn	
Miteni	Trissino	
Solvay	Spinetta-Marengo	
3M	Zwijndrecht	
Chemours	Dordrecht	
Grupa Azoty	Tarnów	
Arkema	Zaramillo	

presumptive contamination sites

1 – Fluorinated aqueous film-forming foam (AFFF) discharge sites

642 Military sites

978 Airports

1096 Firefighting training sites (Flanders, Sweden, Norway)

Firefighting incidents (10,774 in Sweden, 279 in Flanders)

2 – Sites related to PFAS-containing waste

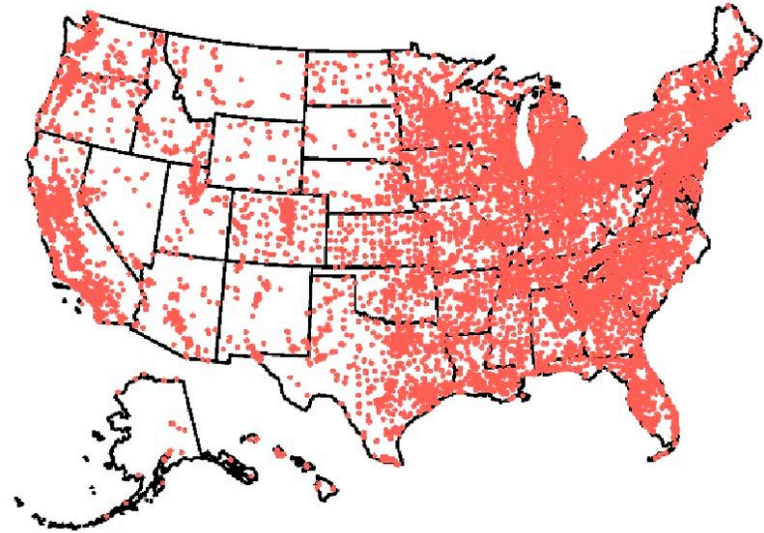
2,620 Wastewater treatment plants treating $>3,700\text{m}^3/\text{day}$

2,167 Waste management sites (landfills for non-hazardous and hazardous waste and incinerators)

presumptive contamination sites

3 – Industrial facilities

38 NAICS codes in Salvatore 2022
= 49,145 sites



BUT
No geolocation data in Europe!

NAICS code US	Title	Sources	Quantity	NACE code EU	Activity	Definition
313320	Fabric Coating Mills	bcdcfghik	380	C13.96	Manufacture of other technical and industrial textiles	https://nacev2.co
325510	Paint and Coating Manufacturing	abcdefghik	2100	C20.3	Manufacture of paints, varnishes and similar coatings, printing ink and mastics	https://nacev2.co
322220	Paper Bag and Coated and Treated Paper Manufacturing	bcdcfghi	0	C17.1	Manufacture of pulp, paper and paperboard	https://nacev2.co
313210	Broadwoven Fabric Mills	bcdcfhk	484	C13.2.0	Weaving of textiles	https://nacev2.co
322121	Paper (except Newsprint) Mills	bcdcfhk	610	C17.1	Manufacture of pulp	https://nacev2.co
	Idem			C17.2	Manufacture of paper and paperboard	https://nacev2.co
332813	Electroplating, Plating, Polishing, Anodizing, and Coloring	bcdcfhi	5642	C25.6.1	Treatment and coating of metals	https://nacev2.co
324110	Petroleum Refineries	abcdehk	594	C19.2.0	Manufacture of refined petroleum products	https://nacev2.co
325612	Polish and Other Sanitation Good Manufacturing	abdefhk	673	C20.4.1	Manufacture of soap and detergents, cleaning and polishing preparations	https://nacev2.co
334413	Semiconductor and Related Device Manufacturing	bcdcfi	1552	C26.1.1	Manufacture of electronic components	https://nacev2.co
326113	Unlaminated Plastics Film and Sheet (except Packaging) Manufacturing	bcdcfi	597	C22	Manufacture of rubber and plastic products	https://nacev2.co
332812	Metal Coating, Engraving (except Jewelry and Silverware), and Allied Services to Manufacturers	bcdcfji	3587	C25.6.1	Treatment and coating of metals	https://nacev2.co
333318	Other Commercial and Service Industry Machinery Manufacturing	bdefgh	0	C26.7.0	Manufacture of optical instruments and photographic equipment	https://nacev2.co
	Idem			C28.2.3	Manufacture of office machinery and equipment (except computers and peripheral equipment)	https://nacev2.co
334419	Other Electronic Component Manufacturing	bcdcfjg	1663	C26.1.1	Manufacture of electronic components	https://nacev2.co
	Idem			C26.1.2	Manufacture of loaded electronic board	https://nacev2.co
562212	Solid Waste Landfill	cdefjk	4765	E38.2.1	Treatment and disposal of non-hazardous waste	https://nacev2.co
325199	All Other Basic Organic Chemical Manufacturing	abdefi	1847	C20.1.4	Manufacture of other organic basic chemicals	https://nacev2.co
323111	Commercial Printing (except Screen and Books)	bcdhk	4226	C18.1.2	Other printing	https://nacev2.co
	Idem			C18.1.3	Pre-press and pre-media services	https://nacev2.co
313110	Fiber, Yarn, and Thread Mills	bcefh	0	C13.1.0	Preparation and spinning of textile fibres	https://nacev2.co
314110	Carpet and Rug Mills	bdhik	189	C13.9.3	Manufacture of carpets and rugs	https://nacev2.co
316110	Leather and Hide Tanning and Finishing	bdefg	276	C15.1.1	Tanning and dressing of leather; dressing and dyeing of fur	https://nacev2.co
325211	Plastics Material and Resin Manufacturing	bdgik	2141	C20.1.6	Manufacture of plastics in primary forms	https://nacev2.co
	Idem			C22	Manufacture of rubber and plastic products	https://nacev2.co
	Idem			C22.29	Manufacture of other plastic products	https://nacev2.co
324191	Petroleum Lubricating Oil and Grease Manufacturing	abcdk	919	C19.2.0	Manufacture of refined petroleum products	https://nacev2.co
325998	All Other Miscellaneous Chemical Product and Preparation Manufacturing	aefgk	2598	C20.5.9	Manufacture of other chemical products n.e.c.	https://nacev2.co
562211	Hazardous Waste Treatment and Disposal	acefj	1357	E38.2.2	Treatment and disposal of hazardous waste	https://nacev2.co
562213	Solid Waste Combustors and Incinerators	acefj	407	E38.2.1	Treatment and disposal of non-hazardous waste	https://nacev2.co
313310	Textile and Fabric Finishing Mills	bcdh	0	C13.3.0	Finishing of textiles	https://nacev2.co
322219	Other Paperboard Container Manufacturing	bcdh	0	C17.2.1	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard	https://nacev2.co
323120	Support Activities for Printing	bcdh	0	C18.1.2	Other printing	https://nacev2.co
313220	Narrow Fabric Mills and Schiffli Machine Embroidery	cefk	0	C13.9.6	Manufacture of other technical and industrial textiles	https://nacev2.co
313230	Nonwoven Fabric Mills	bchk	239	C13.9.5	Manufacture of non-wovens and articles made from non-wovens, except apparel	https://nacev2.co
322130	Paperboard Mills	cefk	258	C17.1	Manufacture of pulp	https://nacev2.co
	idem			C17.2	Manufacture of paper and paperboard	https://nacev2.co
332999	All Other Miscellaneous Fabricated Metal Product Manufacturing	bdgh	4799	C25.9.9	Manufacture of other fabricated metal products n.e.c.	https://nacev2.co
424690	Other Chemical and Allied Products Merchant Wholesalers	bdhj	1698	G46.7.5	Wholesale of chemical products	https://nacev2.co
314910	Textile Bag and Canvas Mills	befi	0	C13.2.0	Weaving of textiles	https://nacev2.co
326112	Plastics Packaging Film and Sheet (including Laminated) Manufacturing	defi	350	C22	Manufacture of rubber and plastic products	https://nacev2.co
335999	All Other Miscellaneous Electrical Equipment and Component Manufacturing	befg	877	C27.9.0	Manufacture of other electrical equipment	https://nacev2.co
562112	Hazardous Waste Collection	cefj	2561	E38.1.2	Collection of hazardous waste	https://nacev2.co
562219	Other Nonhazardous Waste Treatment and Disposal	cefj	744	E38.2.1	Treatment and disposal of non-hazardous waste	https://nacev2.co
325611	Soap and Other Detergent Manufacturing	abeh	1012	C20.4.1	Manufacture of soap and detergents, cleaning and polishing preparations	https://nacev2.co

Sources: a: Facilities that reported PFAS to the TRI; b: [Eastern Research Group 2019](#), c: [Hu et al. 2016](#), d: [Schulz et al. 2021](#), e: [ASDWA 2020](#), f: [Kansas Department of Health and Environment 2019](#), g: [Massachusetts Science Advisory Board 2021](#), h: [Minnesota Pollution Control Agency 2020](#), i: [Utah Department of Environmental Quality 2020](#), j: [Environmental Protection Agency 2019](#), k: [Environmental Protection Agency 2021](#)

2,915 industrial sites

Industrial activity	Sites
Manufacture of pulp, paper and paperboard	1,120
Treatment and coating of metals	680
Manufacture of articles of paper and paperboard	302
Manufacture of plastics in primary forms	221
Manufacture of refined petroleum products	213
Manufacture of other fabricated metal products n.e.c.	132
Finishing of textiles	126
Manufacture of other organic basic chemicals	45
nan	45
Manufacture of rubber and plastic products	16
Tanning and dressing of leather; dressing and dyeing of fur	11
Treatment and disposal of hazardous waste	1

>21,420 presumptive contamination sites

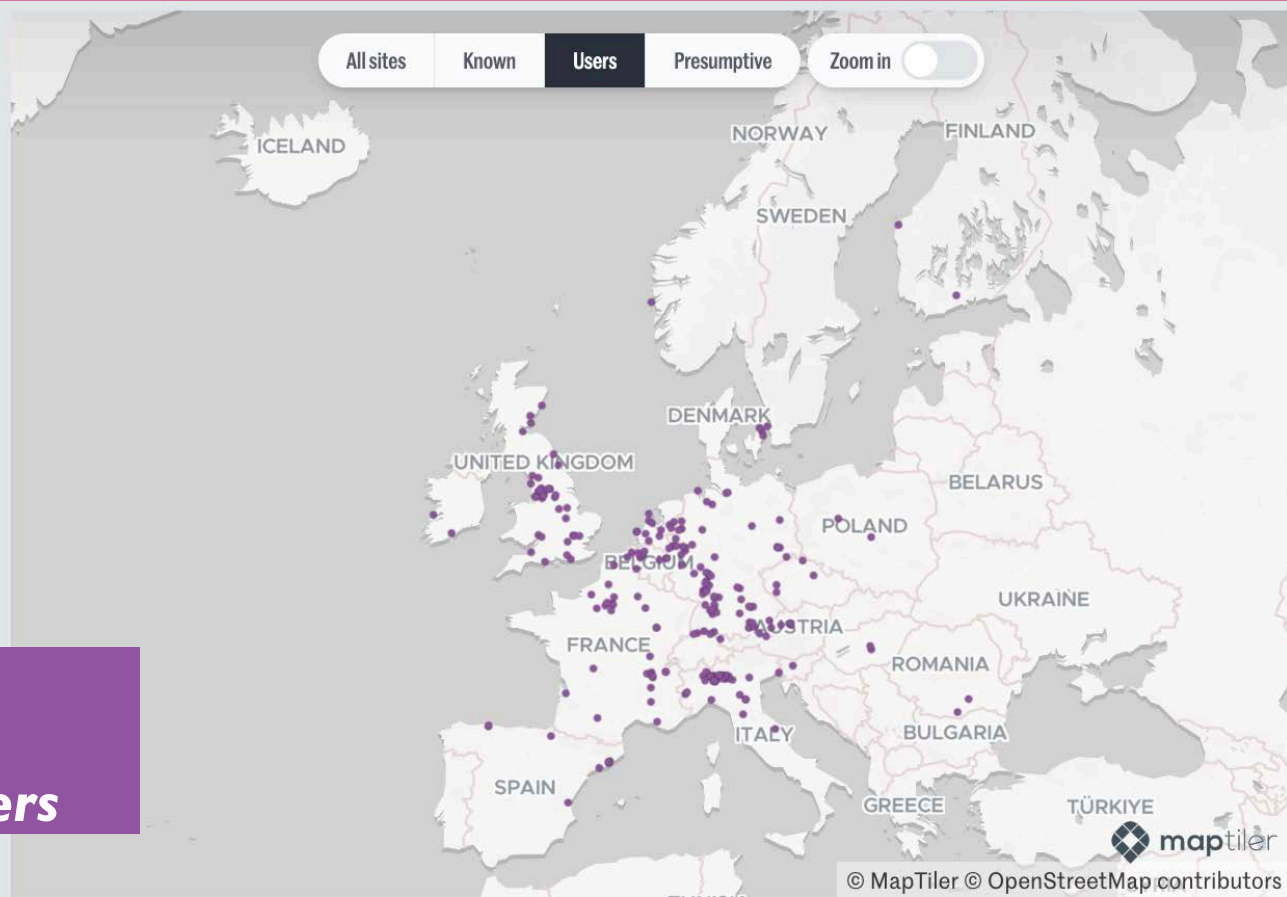
+ 15,000 in Denmark only
= 100,000 in Germany or France



231 known PFAS users

Sites where there is evidence of PFAS use

**= New category
Validated and adopted
by our academic partners**



● Known PFAS User

PFAS Contamination in Europe: Generating Knowledge and Mapping Known and Likely Contamination with “Expert-Reviewed” Journalism

Alissa Cordner, Phil Brown, Ian T. Cousins, Martin Schering, Luc Martinon, Gary Da Raphaëlle Aubert, Leana Hosea, Rachel Salvidge, Catharina Felke, Nadja Tausche, Dani Gianluca Liva, Ana Tudela, Antonio Delgado, Derrick Salvatore, Sarah Pilz, and Stéphan

Cite This: <https://doi.org/10.1021/acs.est.3c09746>

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ABSTRACT: While the extent of environmental contamination by per- and polyfluoroalkyl substances (PFAS) has mobilized considerable efforts around the globe in recent years, publicly available data on PFAS in Europe were very limited. In an unprecedented experiment of “expert-reviewed journalism” involving 29 journalists and seven scientific advisers, a cross-border collaborative project, the “Forever Pollution Project” (FPP), drew on both scientific methods and investigative journalism techniques

1/26/24-0.00	Perfluoro 1 octanemethanesulfonic acid (PFOS)	3700 ng/L	L	24,91180	60.11849
1/27/24-0.00	Perfluoro 1 octanemethanesulfonic acid (PFOS)	2500 ng/L	L	24,91121	60.11849
5/13/17-0.00	Perfluorooctanoic acid (PFOA)	2300 ng/L	L	34,33792	60.10771
1/26/24-0.00	Perfluorooctanoic acid (PFOA)	2200 ng/L	L	24,91004	60.10771
1/26/24-0.00	Perfluoro n pentanoic acid (PFPA)	2100 ng/L	L	24,91004	60.10221
7/7/19-0.00	Perfluorohexanoic acid	2000 ng/L	L	24,29311	61.03539
1/26/24-0.00	Perfluoro 1 octanemethanesulfonic acid (PFOS)	1900 ng/L	L	24,91180	60.11849
7/8/14-0.00	Perfluoro n pentanoic acid	1900 ng/L	L	21,80318	62.10885
7/8/14-0.00	Perfluoro n pentanoic acid	1900 ng/L	L	21,80318	62.10885
1/26/24-0.00	Perfluorooctanethiobenzoic acid (PFBS)	1800 ng/L	L	24,91121	60.11849
3/13/20-0.00	Perfluoro 1 octanemethanesulfonic acid (PFOS)	1400 ng/L	L	24,91191	60.11909
1/27/24-0.00	Perfluoro 1 octanemethanesulfonic acid (PFOS)	1400 ng/L	L	24,91004	60.10771
7/7/19-0.00	Perfluorohexanoic acid	1300 ng/L	L	24,29311	61.03539
5/13/18-0.00	Perfluoro 1 octanemethanesulfonic acid (PFOS)	1300 ng/L	L	24,91004	60.10221
1/26/24-0.00	Perfluoro 1 octanemethanesulfonic acid (PFOS)	1300 ng/L	L	24,91004	60.10221
1/26/24-0.00	Perfluoro 1 octanemethanesulfonic acid (PFOS)	1300 ng/L	L	24,91004	60.10221
7/8/14-0.00	Perfluorohexanoic acid	1200 ng/L	L	24,91004	60.10221
7/8/14-0.00	Perfluorohexanoic acid	1100 ng/L	L	21,80318	62.10885
7/8/14-0.00	Perfluorohexanoic acid	1100 ng/L	L	21,80318	62.10885
1/27/20-13.00	Perfluoro 1 octanemethanesulfonic acid (PFOS)	1100 ng/L	L	24,91296	60.11909



<https://pdh.cnrs.fr>

PFAS Data Hub

Welcome to PFAS Data Hub

We currently have 332,675 rows in the database:

- 13,112 of category “Presumptive”,
- 231 of category “Known PFAS user”,
- 319,332 of category “Known”, including 303,494 with precise coordinates, 14,838 with the city but no coordinates, these are not shown on the map

THE FOREVER
POLLUTION
PROJECT 

<http://foreverpollution.eu/>
horel@lemonde.fr



**Now!
You're safe
for years!**