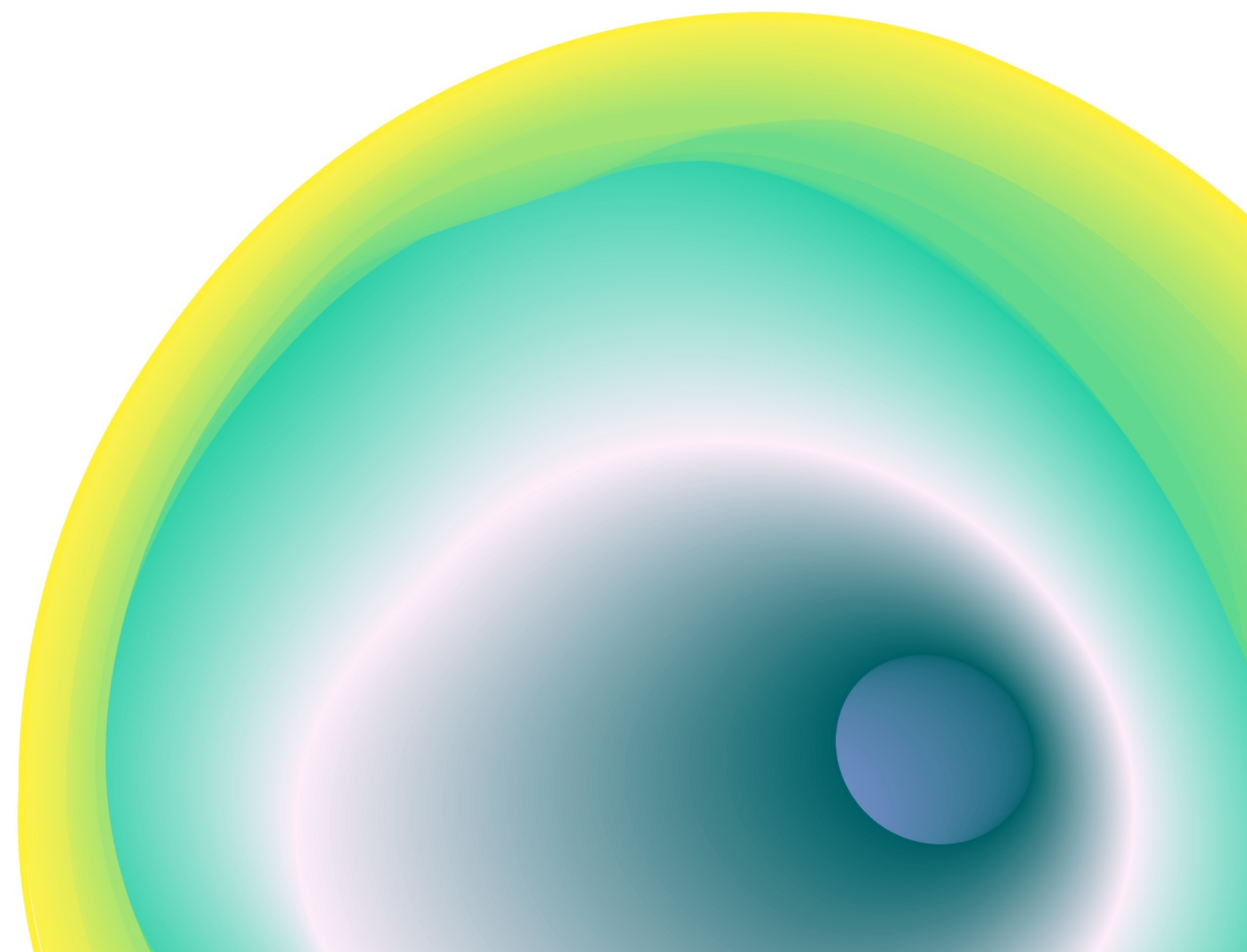




PFAS, F-gasses and persistence: a closer look

Thomas Trevisan,
Deputy Manager for Public Affairs –
Ozone, Climate, Energy and Chemicals



Agenda

- Introduction
- Prof. Ian T. Cousins
- Prof. Hans P. Arp
- Q&A
- Mr. Thomas Trevisan
- Mr. Philipp Denzinger
- Q&A



PFAS, F-gas and persistence: a closer look



ATMOsphere is a global independent market accelerator with the mission to clean up cooling and heating.

ATMOsphere is an industry observer to the UN Montreal Protocol.



Bjorn Gaarn Hansen, former executive director of the European Chemical Agency (ECHA) on per- and polyfluoroalkyl substances (PFAS)

<https://chemicalsinourlife.echa.europa.eu/why-we-care-about-forever-chemicals-and-why-you-should-too>

‘I am pretty sure I have PFAS in my blood’

(2min 19sec)

Recital 6(a): Some fluorinated greenhouse gases subject to this Regulation are Per- and Polyfluorinated Substances (PFAS) or are proven to or suspected to degrade into PFAS.

PFAS are chemicals which resist degradation and potentially have negative effects on health and the environment. In line with the precautionary principle, undertakings should consider using, where available, alternatives which are less harmful for the health, environment and the climate.

In 2023 a proposal to restrict the use of PFAS, including fluorinated greenhouse gases, was submitted to the ECHA. When considering potential PFAS restrictions, the Commission and Member States should take into account the availability of those alternatives.

Provisional Agreement on the EU F-gas Regulation

Source: <https://data.consilium.europa.eu/doc/document/ST-14409-2023-INIT/en/pdf>

What are we talking about?

OECD (2021) PFAS are “substances that contains at least one fully fluorinated methyl (CF₃-) or methylene (-CF₂-) carbon atom (without any H/Cl/Br/I attached to it).”

HFC-125 **CF₃-CHF₂**
HFC-134a **CF₃-CH₂F**
HFC-143a **CF₃-CH₃**
HFC-245fa **CF₃-CH₂-CHF₂**
HFO-1233zd(E) CHCl=**CH-CF₃**
HFO-1234yf CH₂=**CF-CF₃**
HFO-1234ze(E) CHF=**CH-CF₃**
HFO-1336mzz(E) **CF₃-CH=CH-CF₃**
HCFO-1224yd CHCl=**CF-CF₃**
HCFO-1233zd(E) CHCl=**CH-CF₃**
And blends thereof...



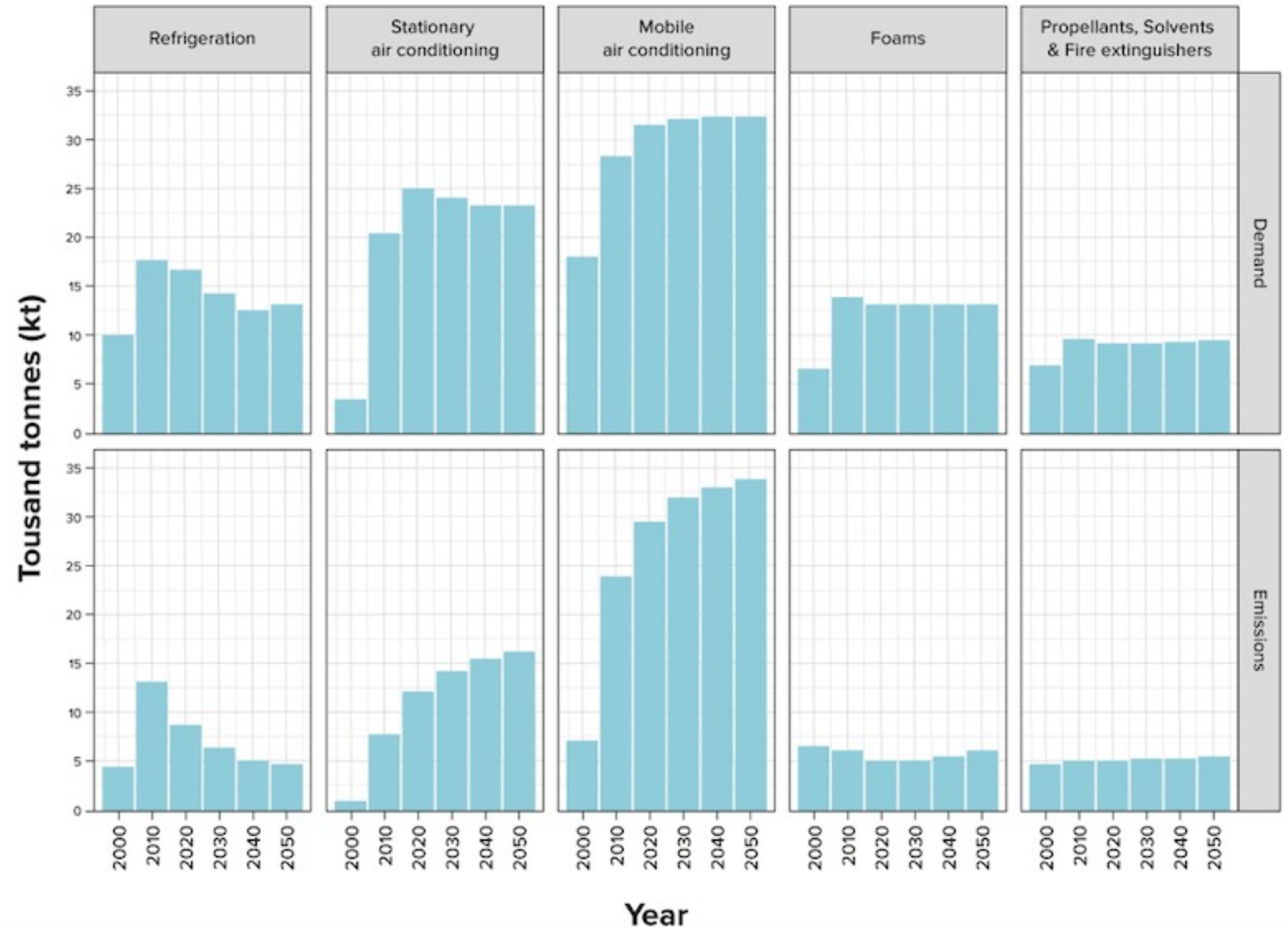
And many more -> Table A.96. List of specific fluorinated gas substances identified in different commercial applications -> [Annex A to the EU PFAS Restriction Proposal](#)

Why it is important?

Application	Tonnage range	Emission range % emitted in manufacturing and use phase	Emission contribution - contribution to total emission
Applications of fluorinated gases	5	2	5
TULAC	5	2	4
Medical devices	5	2	3
Manufacture	5	1	2
Food contact materials and packaging	5	1	1
Transport	5	1	1
Construction products	4	3	2
Electronics and semiconductors	4	2	1
Lubricants	4	2	1
Petroleum and mining	4	1	1
Energy sector	4	1	1
Metal plating and manufacture of metal products	3	1	1
Cosmetics	2	5	1
Consumer mixtures	2	4	1
Ski wax	1	3	1

Tonnage range (t/y)	Emission range (%)	Emission contribution (%)
1 0 - 10	1 0 - 5	1 0 - 1
2 10 - 100	2 5 - 25	2 1 - 5
3 100 - 1 000	3 25 - 75	3 5 - 10
4 1 000 - 10 000	4 79 - 95	4 10 - 50
5 > 10 000	5 > 95	5 > 0-50

Figure B.74. Quantity of projected demand and emissions of sum HFCs/HCFCs and HFOs/HCFOs in Europe (EU-28) in metric kilotonnes (kt) in the years 2000 to 2050 in 10-year increments by sector, from UBA (2021c).



E.g: MAC systems -> R1234yf -> 100% TFA conversion -> estimated leakage per year per car is 10% of the charge

Who is doing what? (a)

Australia and New Zealand -> [National Environmental Management Plan on PFAS 3.0](#)

- Refers to PFAS as OECD (2021) -> Most F-gases in
- (Version NEP 3.0 still in the making)

Canada -> [Risk management scope for per- and polyfluoroalkyl substances \(PFAS\)](#)

- Refers to PFAS as OECD (2021) -> Most F-gases in
- Actions on the table:
 1. Regulatory and/or non-regulatory controls to minimize environmental and human exposure to the class of PFAS from firefighting foams;
 2. Gathering information necessary to identify and prioritize options for minimizing environmental and human exposure from the class of PFAS from other sources and products; and
 3. Considering aligning with actions in other jurisdictions, where appropriate.

United Kingdom -> [Analysis of the most appropriate regulatory management options \(RMOA\)](#)

- Refers to PFAS as OECD (2021) -> Most F-gases in
- Actions on the table:
 1. Preparation of background dossiers to potentially support one or more UK REACH restrictions of PFAS
 2. UK REACH authorisation of PFAS used in processing aids in the manufacture and processing of fluorinated polymers
 - 3. Further evaluation and investigation of substances that have been highlighted to be of concern, such as TFA**
 4. Continued collaborative work across government and with external stakeholders to bring together work on PFAS strategically, **such as a review of the F-gas regulations** to determine whether additional PFAS registered under UK REACH should be brought within scope

United States -> [US EPA PFAS Strategic Roadmap](#)

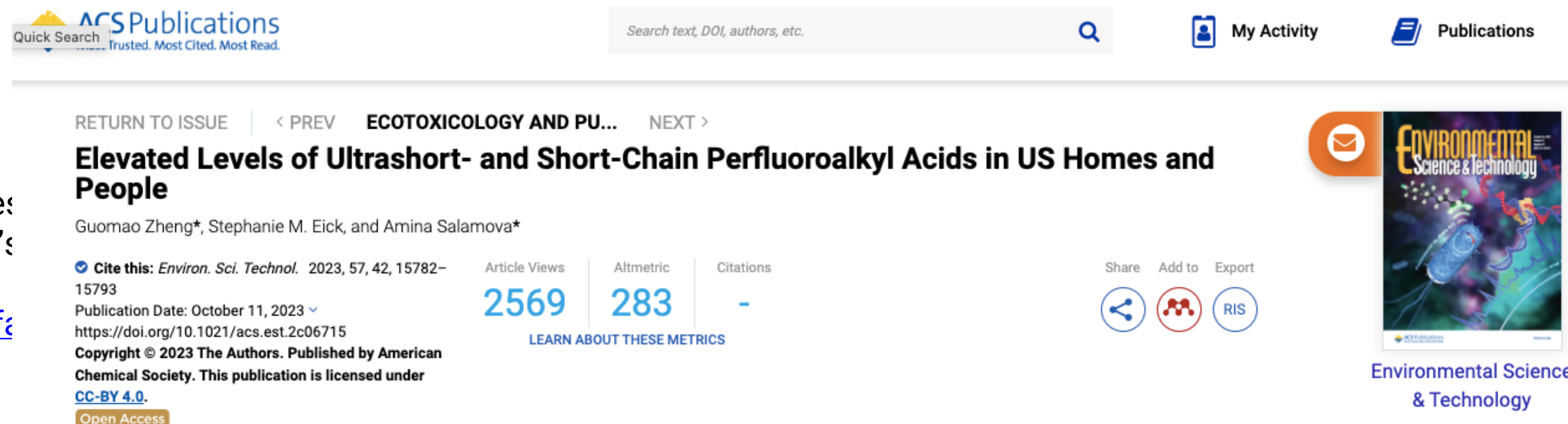
- Refers to PFAS as OECD (2021) -> No
- As of June 2023, lawsuit in process between Public Employees for Environmental Responsibility (PEER) and U.S. EPA on EPA's adoption of narrow definition excluding F-gases (Source: <https://peer.org/epa-sued-over-failure-to-explain-its-narrow-pfas-definition/>)

States -> different states have adopted bills adopting the OECD (2021)

- Refers to PFAS as OECD (2021) -> PFAS chemicals" means perfluoroalkyl and polyfluoroalkyl substances that are a class of fluorinated organic chemicals containing at least **one fully fluorinated carbon atom (-CF₃)**

Some examples of adopted bills: Arizona (SB 1526), California (SB 1044), Colorado (HB 19-1279), Connecticut (SB 837), Hawaii (HB 1644), Illinois (SB0561), Indiana (Ind. Code § 36-8-10.7-3), Maine (LD 1433), Maryland (House Bill 275), Minnesota (HF 359), Nevada (AB 97), New York (S 7167), Rhode Island (SB 2044), Vermont (S 20), Washington (HB 2658),...

Source: (<https://www.saferstates.org/bill-tracker>)



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Elevated Levels of Ultrashort- and Short-Chain Perfluoroalkyl Acids in US Homes and People

Guomao Zheng*, Stephanie M. Eick, and Amina Salamova*

Cite this: *Environ. Sci. Technol.* 2023, 57, 42, 15782–15793
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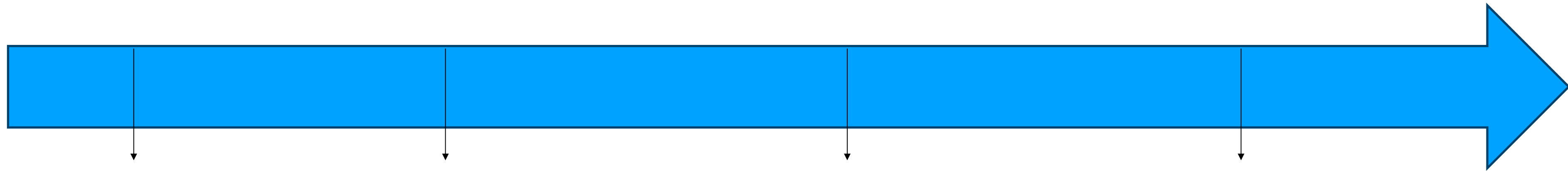
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Environmental Science & Technology

The study says it is the first to report “**a substantial prevalence**” of TFA and another similar substance in the U.S. indoor environment and the general population, and possibly **the first to correlate the presence of TFA in drinking water with TFA in blood samples**. Source: <https://pubs.acs.org/doi/full/10.1021/acs.est.2c06715>

Europe -> [ANNEX XV RESTRICTION REPORT](#)

Expected Entry into Force (EiF)
2025-2026



Ban on manufacturing, importing and placing on the market of PFAS

18 months after EiF (transition period) – ban for non-exempted uses

- 6.5 years after EiF, ban on PFAS used as:
- Refrigerants in low-temperature refrigeration below -50°C (-58°F)
 - Refrigerants in mobile air-conditioning (MAC) systems in combustion engine vehicles with mechanical compressors
 - Refrigerants in transport refrigeration other than in marine applications

- 13.5 years after EiF ban on PFAS used as:
- Refrigerants in laboratory test and measurement equipment
 - Refrigerants in refrigerated centrifuges
 - Refrigerants used in maintenance and refilling of existing HVACR equipment for which no drop-in alternative exist

- Unlimited exemptions:
- Refrigerants in HVACR-equipment in buildings where national safety standards and building codes prohibit the use of alternatives

Other measures:

- Reporting obligation for manufacturers and importers for PFAS used in exemptions → yearly reports on identity and quantity of the substances placed on the market the previous year

What is technologically possible without halogenated gases? (d)

	CO ₂ / R744	NH ₃ / R717	HC	H ₂ O / R718	Air / R729
Domestic applications	✓		✓	✓	
Commercial refrigeration	✓	✓	✓	✓	
Industrial refrigeration and heat pump systems	✓	✓	✓	✓	✓
Water and space heating heat pumps	✓	✓	✓		
Chillers	✓	✓	✓	✓	
Vehicle air conditioning	✓		✓		✓

And...

- Not-in-kind technologies
- Passive cooling, urban spatial management...



ATMO
Network

**Thank you
for listening.**

