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The ZeroPM alternatives database: a tool to identify potential alternatives to PFAS

Romain Figuière, Luc Miaz, Eleni Savvidou, Ian Cousins

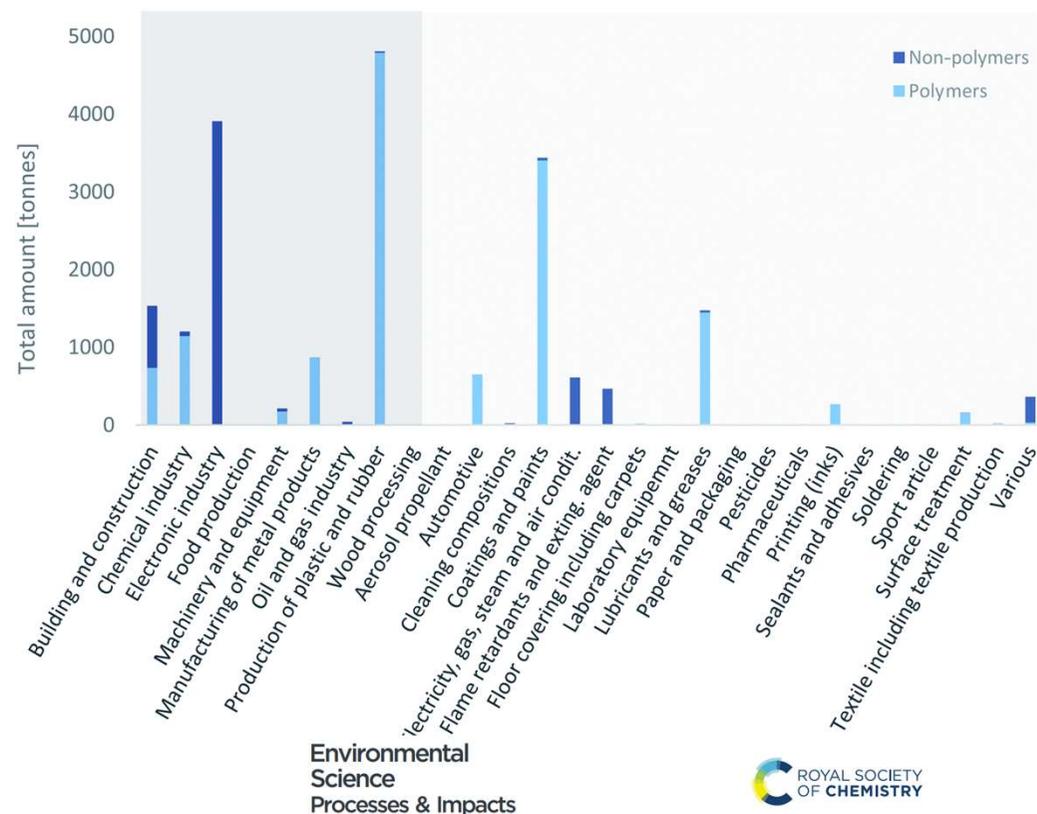
Department of Environmental Science, Stockholm University



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The issue of PFAS

- Group of substances that contains at least one fully fluorinated methyl (CF_3-) or methylene ($-\text{CF}_2-$) in its molecular structure
- Hundreds of different uses across many sectors have been identified, both in consumer products and in industrial applications



Environmental
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An overview of the uses of per- and polyfluoroalkyl substances (PFAS)[†]

Juliane Glüge,^{a,*} Martin Scheringer,^{a,*} Ian T. Cousins,^b Jamie C. DeWitt,^c Greta Goldenman,^d Dorte Herzke,^{e,f} Rainer Lohmann,^g Carla A. Ng,^h Xenia Trierⁱ and Zhanyun Wang^j

The issue of PFAS



 France 24

'Forever chemicals': French MPs approve PFAS product ban

French MPs on Thursday approved the first reading of a bill aimed at restricting the manufacture and sale of non-essential products...



 **ECHA**
EUROPEAN CHEMICALS AGENCY

ANNEX XV RESTRICTION REPORT

PROPOSAL FOR A RESTRICTION

SUBSTANCE NAME(S): Per- and polyfluoroalkyl substances (PFASs)

IUPAC NAME(S): n.a.

EC NUMBER(S): n.a.

CAS NUMBER(S): n.a.

CONTACT DETAILS OF THE DOSSIER SUBMITTERS:

BAuA
Federal Institute for Occupational Safety and Health
Division 5 - Federal Office for Chemicals
Friedrich-Henkel-Weg 1-25
D-44149 Dortmund, Germany

Bureau REACH, National Institute for Public Health and the Environment (RIVM)
Antonie van Leeuwenhoeklaan 9
3721 MA Bilthoven, The Netherlands

Swedish Chemicals Agency (KEMI)
PO Box 2,
SE-172 13 Sundbyberg, Sweden

Norwegian Environment Agency
P.O. Box 5672 Torgarden
N-7485 Trondheim, Norway

The Danish Environmental Protection Agency
Tolderlundsvej 5
5000 Odense C, Denmark

VERSION NUMBER: 2

DATE: 22.03.2023

 Just Style

Denmark to ban PFAS in clothing, shoes from July 2026

As part of a new PFAS action plan Denmark's government has proposed to introduce a national ban on PFAS in clothing and shoes.



 Pinsent Masons

New UK PFAS restrictions closer as debate over alternatives intensifies

Manufacturers could face restrictions on using per- and polyfluoroalkyl substances (PFAS) – so-called 'forever chemicals' – to make cleaning...





Objectives of the database

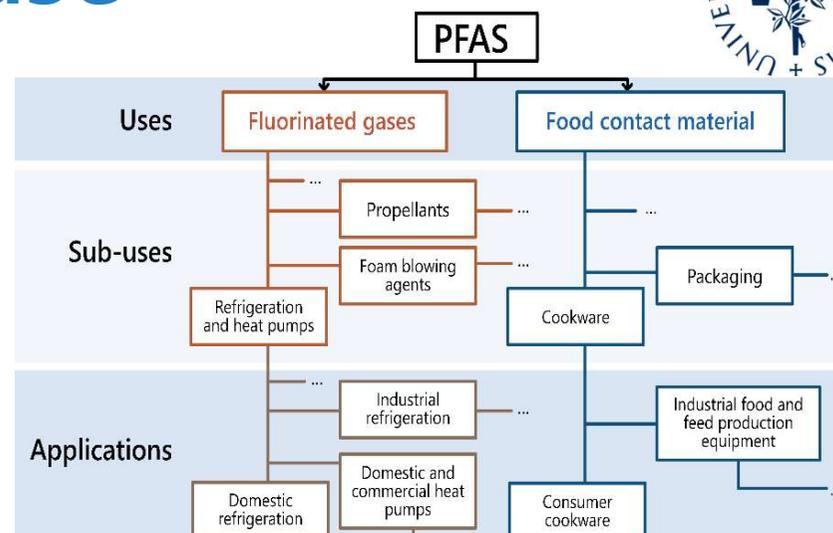
- To provide a list of uses of PFAS
- To provide information on the functions of PFAS for each use
- To provide a list of potential alternatives to PFAS for each use with hazard characterization; description of potential performance loss; and market availability



Overview of the database



- List of PFAS for each Use/sub-use/applications determined based on REACH restriction dossier, and similar work



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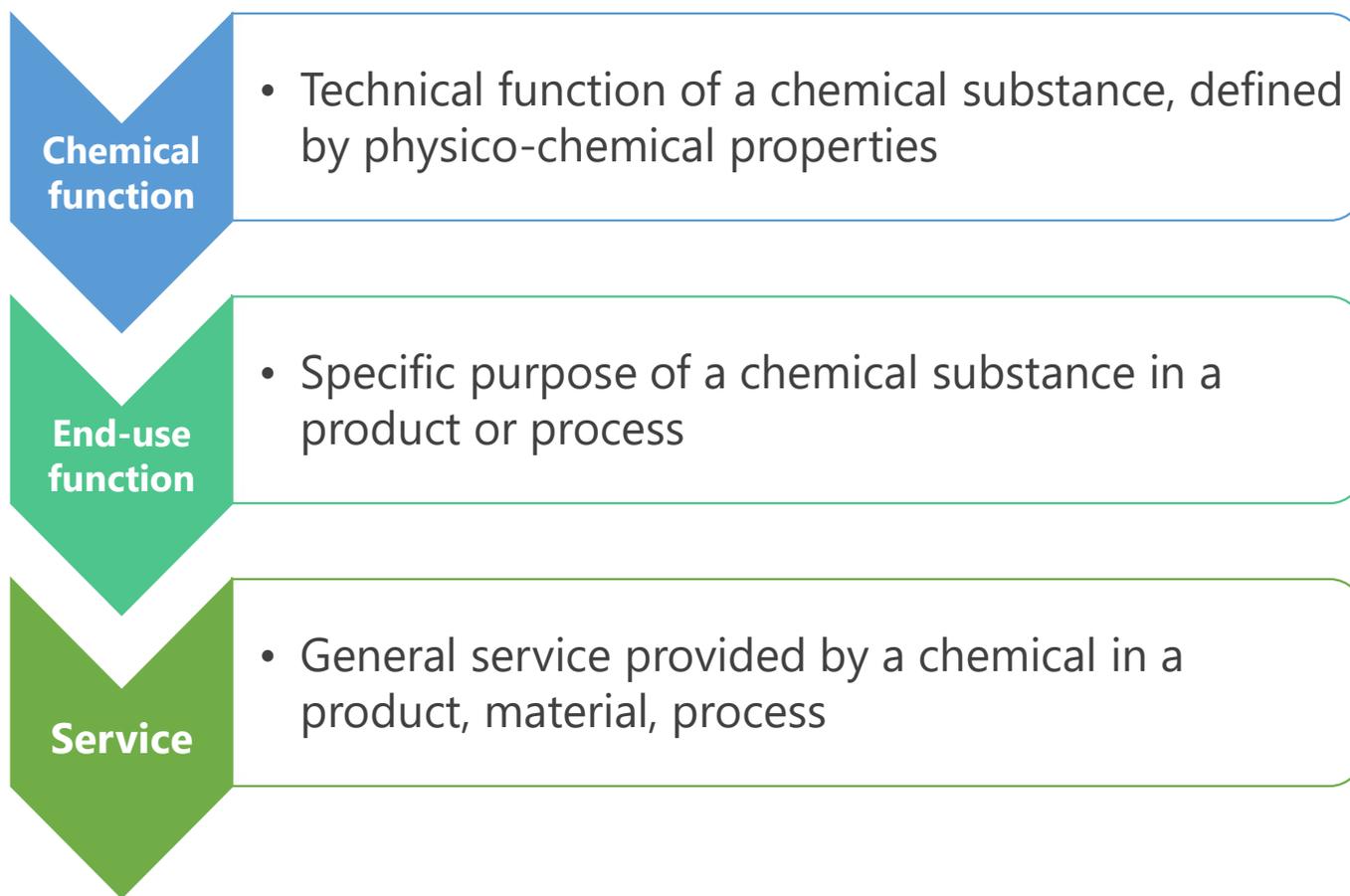
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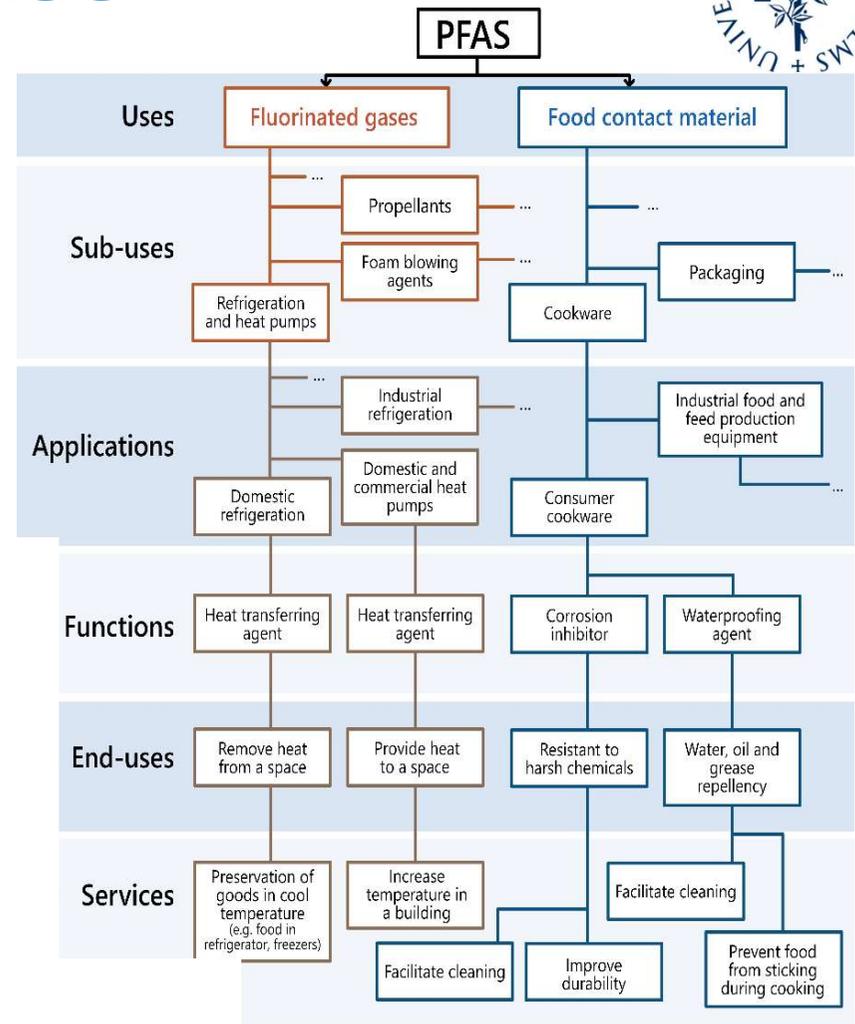
The functional substitution to define the use of a substance



Overview of the database



- Technical function determined based on OECD guidance on harmonized use categories
- End-use and service determined based on common sense



Uses and functions of PFAS



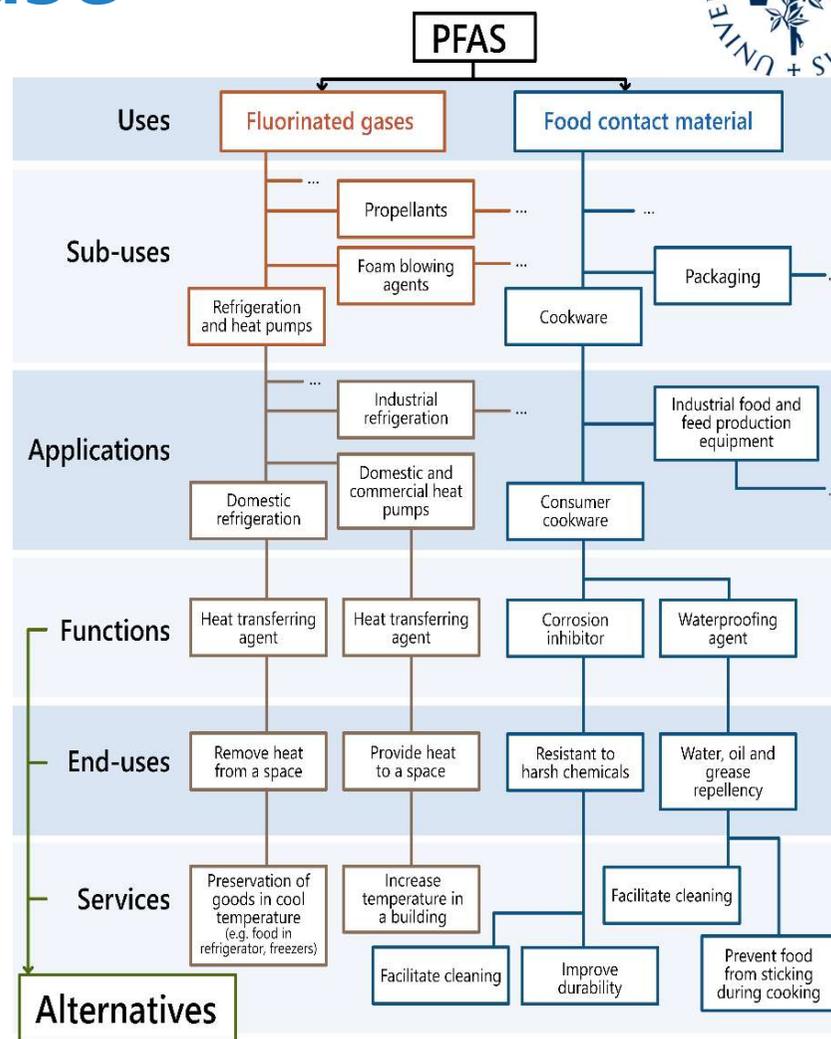
- 18 use categories of PFAS included in the database
- Waterproofing agent, heat stabilizer and corrosion inhibitor are the most common technical functions
- Mainly for enhancing durability

Use categories	Sub-uses	Applications	Technical functions	End-use functions	Services
Active pharmaceutical ingredients	2	14	1	24	21
Biocides	1	4	1	4	4
Building and construction products	9	17	14	18	30
Consumer mixtures	7	15	7	15	12
Cosmetic products	5	32	9	12	6
Electronics and semiconductors sector	3	29	17	22	37
Energy sector	9	19	17	19	24
Firefighting foams	1	5	1	1	3
Fluorinated gases	7	29	8	14	27
Food contact materials	2	4	4	4	9
Industrial production	8	28	12	18	11
Lubricants	3	42	11	13	19
Medical products	6	21	14	18	29
Metal plating and metal products manufacture	2	4	8	10	14
Petroleum and mining	2	9	10	13	15
Plant Protection Products	1	6	3	7	5
Textile, upholstery, leather, apparel, and carpets	7	20	11	15	21
Transport sector	10	27	16	24	45
Grand Total	85	325	39	131	201

Overview of the database



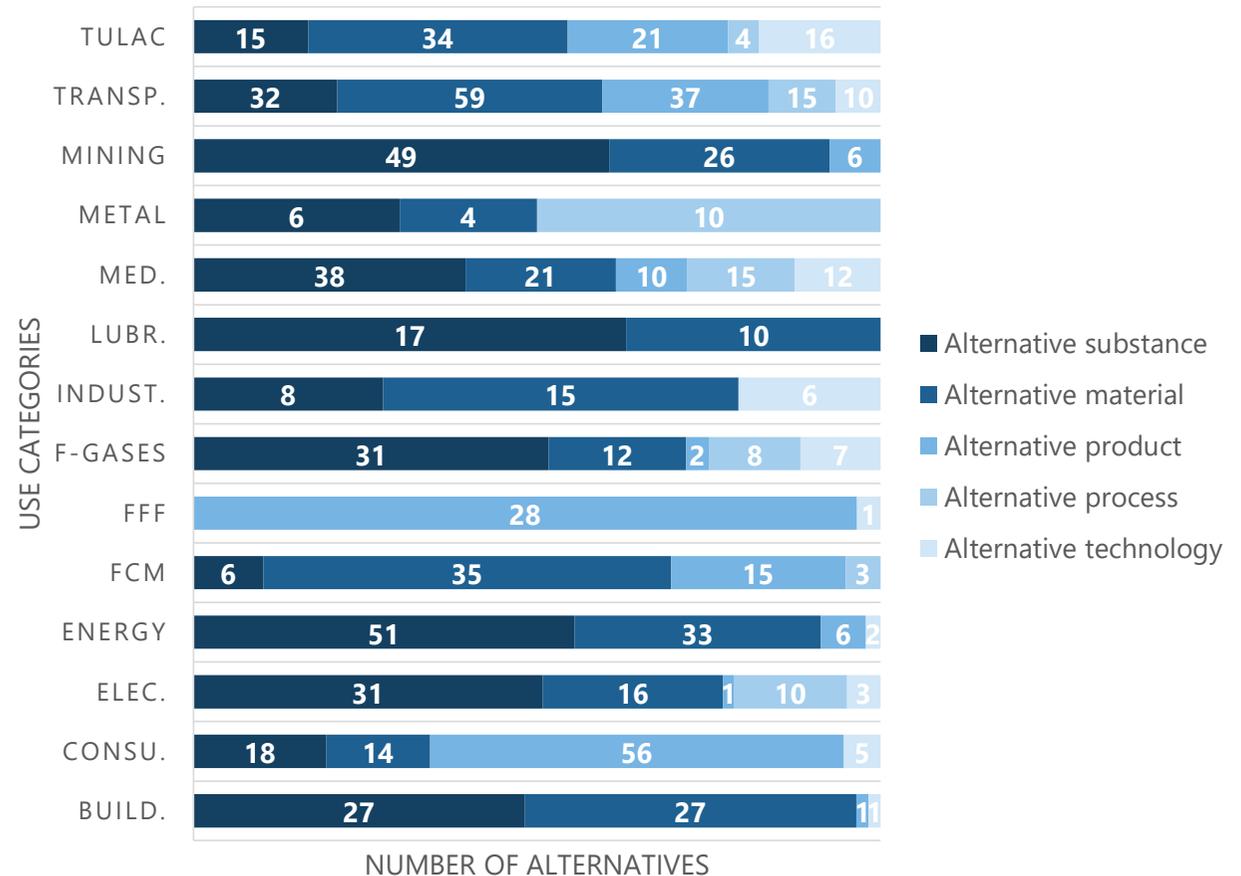
- Alternatives identified based on the REACH restriction and ChemSec MarketPlace



Number and types of alternatives to PFAS



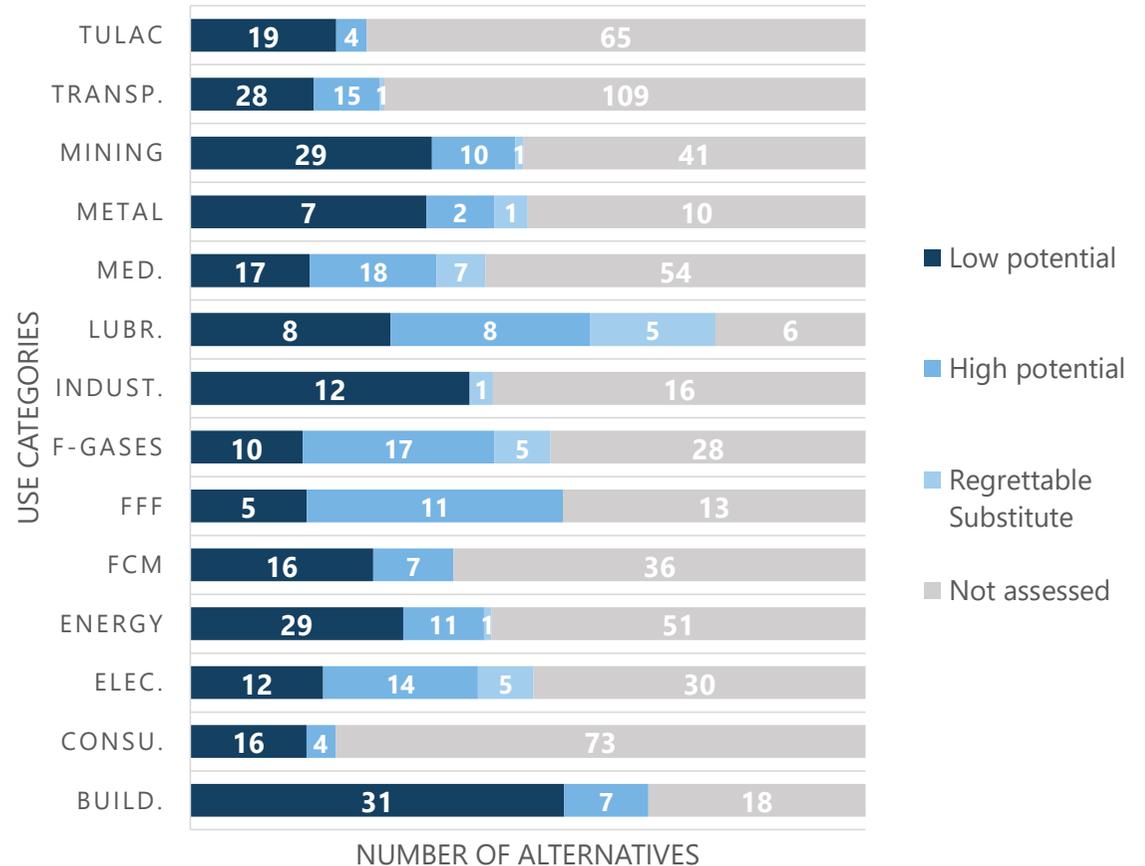
- Database includes 532 different potential alternatives across 15 use categories
- No alternative found for 83 applications (mainly for industrial production)



Safety of alternatives to PFAS

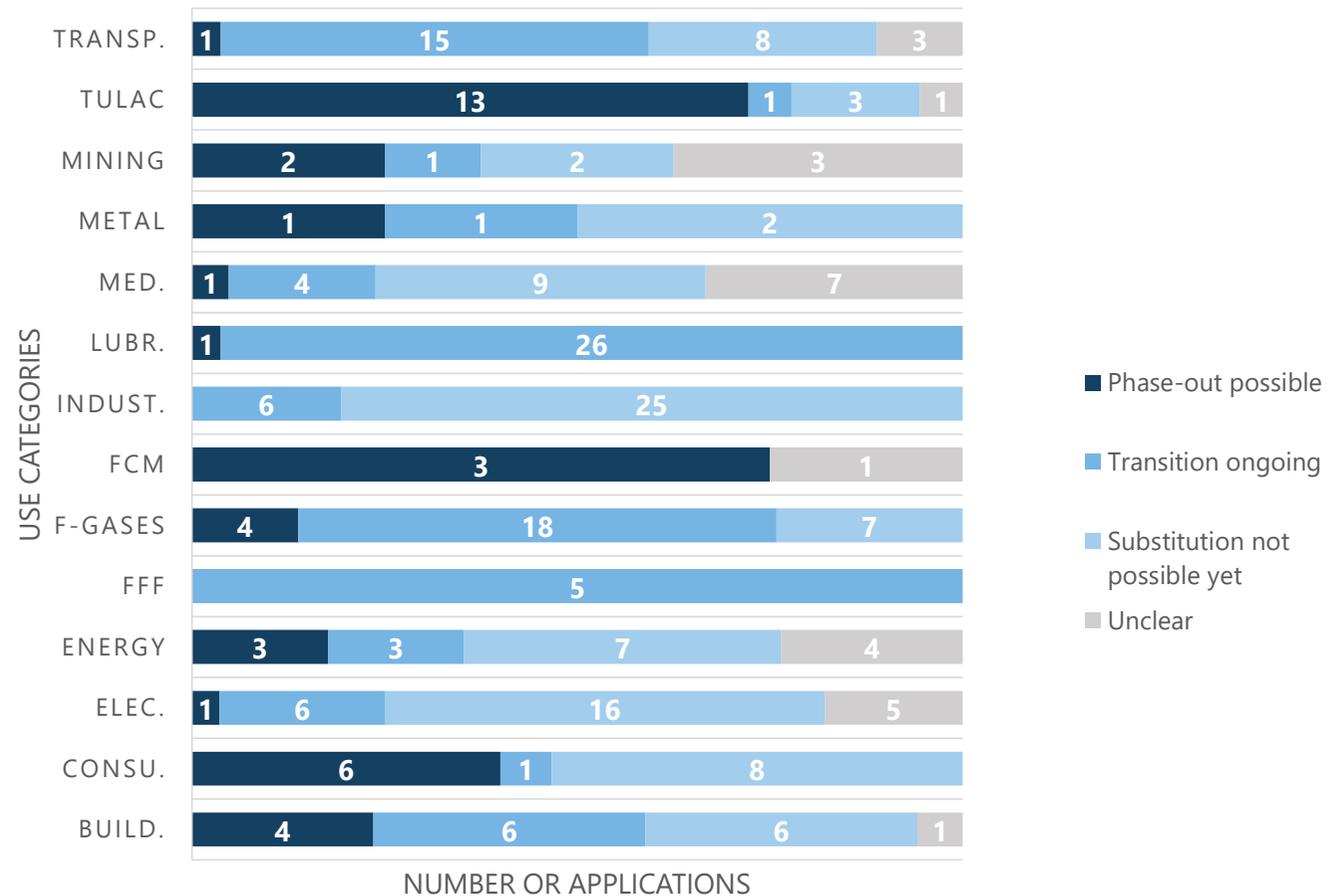


- Evaluation based on the Substitution Support Portal (https://www.subsportplus.eu/subsportplus/EN/Home/Home_node.html)
- Possible only for alternatives identified by a CAS number (i.e. 36%)



Are the alternatives suitable and available?

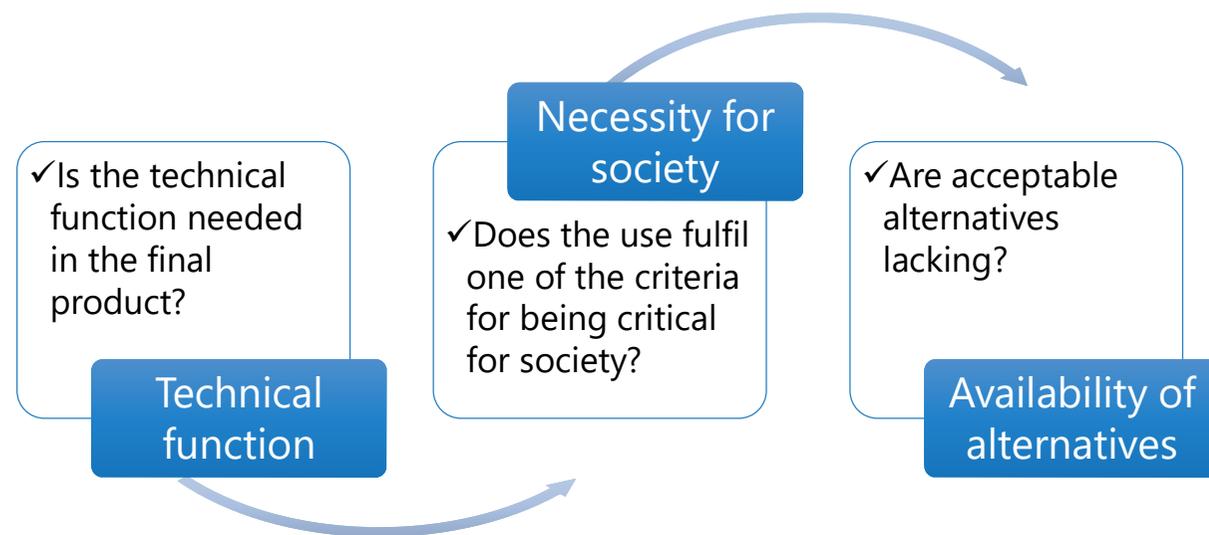
- Overall, no suitable alternatives available for ~25% of PFAS applications
- Further work still needed for a proper assessment of alternatives



Are uses of PFAS essential?

- Information in the database useful for evaluation of the need for the technical function
- **Based on availability of alternatives**, ~25% of uses of PFAS could be considered non-essential

Framework for assessment of essentiality



European Commission, 2024

https://environment.ec.europa.eu/publications/communication-essential-uses-chemicals_en

An example to go further

Fluorinated gases

Refrigeration and heat pumps



Foam blowing agents



Solvent



Fire suppressant

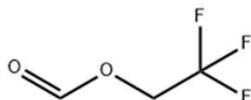
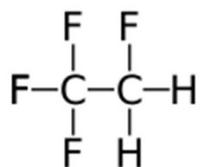


Cover gases

Propellant



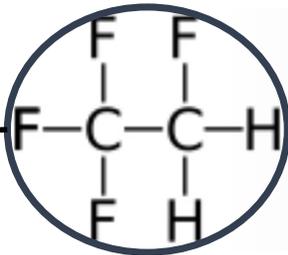
An example to go further



Product	Chemical function	End use function	Service
Rigid polyurethane foam	Foamant	Improve extension of the foam	Ensure insulation of building
Extruded polystyrene (XPS) foams	Foamant	Improve extension of the foam	Ensure insulation of building

An example to go further

Chemical function



End-use function



Service function



Potential alternatives substances

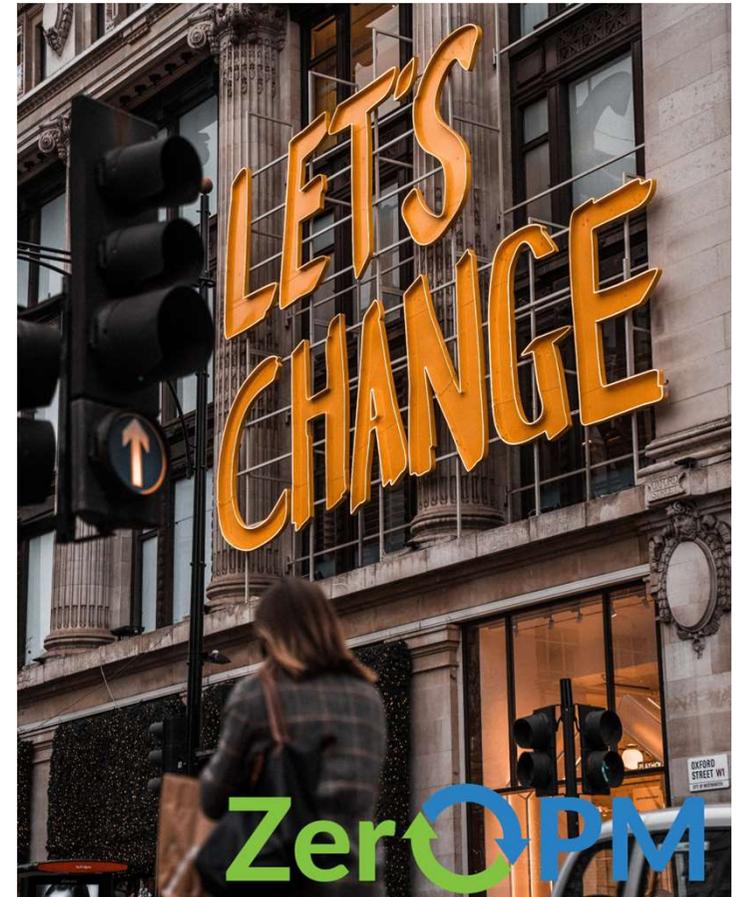
- Pentane
- Cyclopentane
- Isopentane
- Methyl formiate

Potential alternatives materials

- Fiberglass
- Rockwool
- Extended polystyrene
- Cellulose
- hemp concrete
- expanded cork
- high density wood fibers
- sheep wool
- Recycled textile

Key messages

- Data in the database useful as a first step for substitution of PFAS
- Full alternatives assessment is still needed
- Important to consider different types of alternatives to prevent regrettable substitution
- Type of alternatives being evaluated may influence the criteria to be considered



For more information



Access to the alternatives database

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Zer◻PM



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