National Institute for Public Health and the Environment
Ministry of Health, Welfare and Sport

baua: Bundesanstalt für Arbeitsschutz und Arbeitsmedizin

KEMI Swedish Chemicals Agency

NORWEGIAN ENVIRONMENT AGENCY

Ministry of Environment and Food of Denmark
Environmental Protection Agency

Summary page:
2nd Stakeholder Consultation on a Restriction for PFAS

I. Reasons and aims of this analysis

Update: The submission period was extended from the 19th of September to the 17th of October 2021!

The competent authorities for REACH of the Netherlands, Germany, Denmark, Sweden and Norway are currently preparing a REACH Annex XV Restriction Dossier for the group of PFAS (per- and polyfluoroalkyl substances) described below (as defined under Section II. Substances) since all these substances are considered to be persistent.

The consequences of this persistence include that the presence of these substances in the environment is practically irreversible, and pose an unacceptable risk to the environment and humans. All uses of PFAS (professional and industrial uses, consumer uses of mixtures and articles) result in emissions into the environment and contribute to the overall concentrations of PFAS in the environment. Many members of this group already occur ubiquitously in the environment and contaminate the ground- and untreated water due to their high mobility. In addition, some of these substances accumulate in biota and/or are suspected to be toxic.

In view of these properties, the above mentioned competent authorities for REACH are considering proposing EU-wide measures covering all PFAS (as defined under Section II. Substances) to reduce those risks.

This questionnaire is intended to provide you/the respondents with the current overview the five authorities have on the different uses of PFAS. By checking the presented data and providing feedback you/the respondents can ensure that the correct information is used for the assessment and preparation of a REACH Annex XV Restriction Dossier. Furthermore, you/the respondents can provide the authorities with currently still lacking information. EEA tonnages & emissions presented depict the European perspective, which the authorities created from the gathered information. If tonnages or emissions are challenged, please do so at European level, not at individual company level. For alternatives (and transition costs) this is slightly different and individual companies likely have valuable information.

I. Reasons and aims of this analysis

General:

The purpose of the 'investigation report summaries' (download is possible on the next page) is to present our current knowledge and understanding regarding uses of PFAS with a focus on use tonnages, emissions, alternatives and substitution costs, etc. The data are important for both risk assessment and the socio economic analysis (SEA).
The investigation report summaries have been prepared based on more detailed PFAS use investigations. It should be noted that these investigation report summaries should not be considered to be equivalent to the Annex XV restriction report, which is in a preparation phase.
Presented data reflect the current knowledge and during the project new data might become available. It is not guaranteed that the information presented here will be used in the Annex XV restriction report or in the presented way. For instance: Presented quantities or costs could be higher or lower.
The information provided is largely of a general nature and is not intended to address the specific circumstances of any particular individual or entity. Further, the information is not professional or legal advice.
In case respondents fill out the survey several times, only the latest entry will be considered.

Scope:
This survey is intended to provide an opportunity for stakeholders to confirm the understanding of the five countries prepararing the restriction proposal, or provide updated information, on PFAS uses, including tonnages, emissions, alternatives and transition costs. Information can also be valuable, if it confirms estimates that are currently marked as uncertain by the five countries.
This survey is not intended as an opportunity to provide feedback on the essential use concept.
This survey is not intended as an opportunity to provide feedback on the (chemical) scope of the proposed restriction.
The use of PFAS in fire fighting foams is not part of this call for evidence. ECHA is preparing a separate Annex XV restriction dossier on this use.
Stakeholders are invited to add information on uses not mentioned in the report summaries under section A (general questions).

Public sources / literature references:
Presented numbers (i.a. tonnages & emissions) represent the situation in the European Economic Area (EEA). If you have a different view, please provide this information on EEA level with reference to public sources.
In case transition times are applicable due to substitution, please refer to the respective legal text where possible. In instances where the information presented in the investigation report summaries is challenged, but no reference to literature or public sources are made to justify such challenges, we are unlikely to be able to take the comments into account.

Others:
PFAS tonnages for the described uses cannot be added up for a full tonnage overview as this might lead to double counting. In case no information is available, the authorities will follow a reasonable worst-case approach when estimating emissions to the environment. Concerning the presented summaries, the authorities from the five countries do not accept any liability with regard to the use that may be made of the information contained. Use of the information in these summaries remains the sole responsibility of the reader. Although, the information provided in the summaries has been prepared with the utmost care, possible errors or omissions cannot be excluded. The authorities from the five countries do not accept any liability with regards to any such errors or omissions.

II. PFAS in scope

As indicated by the name, per- and polyfluoroalkyl substances (PFASs) comprise a group of organic substances containing alkyl groups on which all or many of the hydrogen atoms have been replaced with

fluorine as structural fragments.

PFAS in the scope of this call for evidence have the following structural formula:

X-(-CF_2-)n-X' with n ≥ 1 and X, X' not being H (thus including X-CF_3) meaning fluorinated substances that contain at least one aliphatic carbon atom that is both, saturated and fully fluorinated, i.e. any chemical with at least one perfluorinated methyl group (-CF_3) or at least one perfluorinated methylene group (-CF_2-), including branched fluoroalkyl groups and substances containing ether linkages, fluoropolymers and side chain fluorinated polymers.

Although all PFAS will be considered for regulation, a non-exhaustive list of the most frequently used substances and substance groups may be found in the supplementary document accompanying this questionnaire and consultation which can be downloaded under the following link: Supplementary document.pdf

III. Target group of this questionnaire

Questions are addressed to the whole supply chain including **industry associations, manufacturers, importers, distributors and downstream users**.

Of interest is information on **PFAS** and **alternatives to PFAS.** Both, PFAS as such and PFAS contained in mixtures and articles are of relevance. Alternatives include chemical (non-fluorinated) as well as technical replacements for PFAS.

Please note that this questionnaire consists of 66 pages in total. It will, however, allow you to navigate through blocks of questions depending on your type of information or data. Hence, you will be able to specifically respond to the questions relevant to you. There will be max. 4 pages of questions per use ticked in Section A (general questions).

In the table below, the hyperlinks on the right side will allow you to download summary reports for the different uses for which further information is requested. In some cases a second hyperlink is available. In these cases the lead authority assessing the use already published a summary report on their website.

Use	Hyperlinks to report summaries
Cleaning agents, polishes and waxes (non-industrial uses)	Report summary cleaning agents polishes waxes july 2021.pdf
Cosmetics	Report summary cosmetics july 2021.pdf
Food contact materials & packaging	Report summary food contact materials and packaging july 2021.pdf
Lubricants	Report summary lubricants july 2021.pdf
Construction products	Report summary construction july 2021.pdf
Medical devices	Report summary medical devices july 2021.pdf
Medicinal products	Report summary medicinal products july 2021.pdf
Metal plating & manufacturing of metal products	Report summary metal plating and manufacturing of metal products july 2021.pdf
PFAS production (manufacturing)	Report summary PFAS and PFAS polymer production july 2021.pdf

Ski treatment	Report summary ski treatment july 2021.pdf PFAS in the treatment of skis - use, emissions and alternatives
TULAC (textiles, upholstery, leather, apparel and carpets)	Report summary TULAC july 2021.pdf
Petroleum & mining	Report summary petroleum and mining july 2021.pdf PFAS in mining and petroleum industry – use, emissions and alternatives
F-gas uses	Report summary F gas uses july 2021.pdf Application of Fluorinated Gases (F-Gases) in the European Economic Area
Electronics & energy	Report summary electronics and energy july 2021.pdf
Transportation	Report summary transportation july 2021.pdf
Waste	Report summary waste july 2021.pdf

IV. Information on institute/organisation/person & data protection rights

Information on institute/organisation/person & data protection rights can be downloaded via the following link: GDPR.pdf

Fields marked with * on this page are mandatory fields.

PERMISSION FOR INFORMATION PURPOSES: I agree to the personal data I provide in the present survey, including my name and my e-mail address, to be collected, processed and stored for potential follow-up questions regarding this survey by the service provider of the Federal Institute for Occupational Safety and Health (BAuA), namely Webropol Deutschland GmbH, and to these being subsequently stored in the database of the Federal Office for Chemicals.
*

Yes

Information on institute/organisation/person

Name	Jean-Luc
Surname	Wietor
Name of institute/organisation	European Environmental Bureau
E-Mail	jean-luc.wietor@eeb.org

Can we contact you with follow-up questions? *

Yes

Note on Confidentiality of information and data

I understand that it is my responsibility not to include confidential information in responses to general comments and in any responses to requests for specific information (e.g. company name, properties, assets, costs etc.). The competent authorities for REACH will not be held liable for any damages caused.
*

Yes

I understand that it is my responsibility to mark confidential data and attachments as confidential. *

Yes

V. Questions - Section A - General questions

For which use would you like to submit information? Please select all uses on which you would like to provide information.

Food contact materials & packaging
Construction products
Medical devices
PFAS production (manufacturing)
Ski treatment
TULAC (textiles, upholstery, leather, apparel and carpets)
F-gases
Electronics & energy
Waste

Are certain uses of PFAS missing in the categories above?

1) Fire-fighting foams. Likely all covered by PFHxA restriction.
2) Fire protection applications (non-foam), e.g. Novec 1230 by 3M (EC 436-710-6).

V. Questions - Section B - Cleaning agents, polishes & waxes

(non-industrial uses)
Questions in relation to the use (mainly for industry associations)

The following linked information presents the current picture: Report summary cleaning agents polishes waxes july 2021.pdf

In the tables presented on this page and the following, '?' in the cells show that the authorities do not have any information available. Input to fill these gaps is highly appreciated.

Sub-Use	Tonnage (tonnes/PFAS) per year in the EEA	Expected trend (--/-/0/+/++)[1]	Emissions/year in EEA[2] (tonnes/PFAS)
Cleaners (for glass, metal, ceramic, carpet and upholstery)	?	?	?
Aftermarket carpet care	?	?	?
Dishwashing products (rinse aids)	?	?	?
Dry cleaning products	?	?	?
Waxes and polishes (for i.e. furniture, floors and cars)	?	?	?
Windshield wiper fluids	?	?	?
Windshield treatments (for automobiles)	?	?	?
Rain-repellent fluids	?	?	?

[1] -- = strong decrease, - = decrease, + = increase, ++ = strong increase, 0 = neutral

[2] Emissions relate to mixture/article production and mixture/article use. They do not include PFAS production and the
waste stage of the articles. These emissions are covered in a separate section.

V. Questions - Section C - Cleaning agents, polishes & waxes
(non-industrial uses)
Questions in relation to alternatives (mainly for individual companies)

Sub-Use	Non-PFAS alternatives
Cleaners (for glass, metal, ceramic, carpet and upholstery)	- hydrocarbon or silicone based surfactants - siloxane gemini surfactants
Aftermarket carpet care	- silicone dioxide
Dishwashing products (rinse aids)	?
Dry cleaning products	?
Waxes and polishes (for i.e. furniture, floors and cars)	- carnauba wax - nonfluorinated non-ionic or anionic surfactants
Windshield wiper fluids	- non fluorinated surfactants (e.g. sodium dioctyl sulfosuccinate)
Windshield treatments (for automobiles)	- polydimethylsiloxane
Rain-repellent fluids	?

V. Questions - Section D - Cleaning agents, polishes & waxes (non-industrial uses)

Questions in relation to impact of legislative measures (for companies and industry associations)

V. Questions - Section B - Cosmetics

Questions in relation to the use (mainly for industry associations)

The following linked information presents the current picture: Report summary cosmetics july 2021.pdf

In the tables presented on this page and the following, '?' in the cells show that the authorities do not have any information available. Input to fill these gaps is highly appreciated.

Sub-Use	Tonnage (tonnes F) per year in the EEA[1]	Expected trend (--/-/0/+/++)[2]	TF Emission[3]/year EEA (tonnes F)	EOF Emissions[4]/year in EEA[5] (tonnes F)
Skin Care	8.2	0	6.2	0.009
Toiletries	0.6	0	0.5	0.3
Hair Care	1	0	0.9	0.5
Perfumes and Fragrances	0	0	0	0
Decorative Cosmetics	1.2	0	0.7	0.2

[1] Based on the total fluorine (TF) measurements. Quantities PFAS/year are obtained by using a conversion factor of
1.4-2.0.

[2] -- = strong decrease, - = decrease, + = increase, ++ = strong increase, 0 = neutral

[3] Emissions to wastewater based on the total fluorine (TF) measurements.

[4] Emissions to wastewater based on total extractable organic fluorine (EOF) measurements.

[5] Emissions relate to mixture/article use. They do not include PFAS production and the waste stage of the articles. These emissions are covered in a separate section. Also note that emissions do not include mixture/article production..

V. Questions - Section C - Cosmetics

Questions in relation to alternatives (mainly for individual companies)

Sub-Use	Non-PFAS alternatives[1]
Skin care	?
Toiletries	?
Hair Care	?
Perfumes and fragrances	?

Decorative cosmetics	?

[1] Based on the information gathered so far, the authorities conclude that PFAS can be replaced by other ingredients and do not have unique functions. One reason is that there are far more non-PFAS cosmetic products within the same product categories as the PFAS containing products.

V. Questions - Section D - Cosmetics

Questions in relation to impact of legislative measures (for companies and industry associations)

V. Questions - Section E - Cosmetics

Specific questions for the use

V. Questions - Section B - Food contact materials & packaging

Questions in relation to the use (mainly for industry associations)

The following linked information presents the current picture: Report summary food contact materials and packaging july 2021.pdf

In the tables presented on this page and the following, '?' in the cells show that the authorities do not have any information available. Input to fill these gaps is highly appreciated.

Sub-Use	**Tonnage (tonnes/PFAS) per year in the EEA** **PFAS solely polymers in table**	**Expected trend (--/-/0/+/++)[1]**	**Emissions/year in EEA[2] (tonnes/PFAS)**
Packaging	Product: 41,351,000 (paper and board) Product: 20,500,000 (plastic packaging) PFAS: 827 - 4,962 (in paper and board) PFAS: ? (for plastic packaging)	+ (3%)	124 - 871
Cookware	Product: ? PFAS: 3,500 (Plastic Europe, AFW, 2017)	+ (5%)	1,633 - 4,716 (mainly recoating emissions)
Industrial applications	Product: ? PFAS: 3,000[3] (Plastic Europe, AFW, 2017)	++ (10 - 20%)	

[1] -- = strong decrease, - = decrease, + = increase, ++ = strong increase, 0 = neutral

[2] Emissions relate to mixture/article production and mixture/article use. They do not include PFAS production and the waste
stage of the articles. These emissions are covered in a separate section.

[3] Including pharmaceuticals (could not be disaggregated).

Do you have information that indicates that the information provided on the tonnage should be adjusted?

No

Do you have information that indicates that the information provided on the emissions should be adjusted?

Yes

Please specify and/or refer to literature/public sources.

A factor of 6 between used tonnage and emissions (e.g. 827 vs. 124) raises the question: what happens to the rest? It is unlikely that stocks of these materials in the use phase are increasing; in other words: production and emissions from end-of-life will be roughly equal, even if the latter are likely substantially delayed in the case of landfills.
Even where there are numerical uncertainties, the mass balance (Lavoisier) must be respected for a convincing dossier.
Incineration of household waste (ca. 50% in the EU) occurs around 850 °C, a temperature too low to lead to stoichiometric formation of inorganic fluoride.
Combustion products from e.g. PTFE at 850 °C are largely CF4, CHF3 and other potent and long-lived GHGs (see García 2007, Huber 2009 and US EPA 2020).
Radical mechanisms postulated in Ellis 2001 hint to similar decomposition pathways from other PFAS.
All documents are available from: https://tinyurl.com/4huwfcey
(EEB's document library)

Do you have information that indicates that the information provided on the expected trend should be adjusted?

Yes

Please specify and/or refer to literature/public sources.

The quantitative trend information is accompanied by numerical information (e.g. 5%). Does this figure refer to annual growth estimates? If so, for which period? Infinite growth in a finite system is not a realistic assumption, certainly not in a mature technology.

Do you have information on risk management measures to minimize the use, human exposure and emissions to the environment for your application of PFAS?

No

V. Questions - Section C - Food contact material & packaging

Questions in relation to alternatives (mainly for individual companies)

Sub-Use	Non-PFAS alternatives
Packaging	- natural greaseproof paper - vegetable parchment - clay coatings - silicone - biopolymers (e.g. chitosan, starch, cellulose, polyvinyl alcohol, bioplastics such as polylactic acid (PLA), biowaxes) - synthesis plastics (e.g. low-density polyethylene (LDPE), linear low-density polyethylene (LLDPE), high density polyethylene (HDPE), polypropylene (PE), ethylene vinyl alcohol (EVOH), polyvinyl alcohol (PVOH), polyvinylidene chloride (PVDC), polyethylene terephthalate (PET)) - microfibrillar cellulose (MFC), cellulose nanofibrils (CNFs), cellulose nanocrystals (CNCs) - aqueous dispersions of co-polymers (e.g. styrene acrylic emulsion (SAE)) - aqueous dispersions of waxes (e.g. TopScreen) - water soluble hydroxyethylcellulose (HEC) - alkyl succinic anhydride (ASA), alkyl ketene dimer (AKD) - aluminium foil - lamination using impermeable barriers - other plant fibres (miscanthus, etc.) - bitumen coating - re-usable materials

Consumer cookware	- 'ceramic' coatings (sol-gel) as replacement of coating material - silicone coatings as replacement of coating material - silicone cookware (not coated metal) as alternative base material, uncoated - superhydrophobic coatings and hydrophobic coatings as replacement of coating material (Nanoscopic layer which is able to resist water. They are made from different materials like zinc oxide polystyrene, precipitated calcium carbonate, carbon nano-tube substances, manganese oxide polystyrene.) - enamelled cast iron / seasoned cast iron as alternative base material and non-stick coating - full ceramic cookware (not just coated) as alternative base material - carbon steel as alternative base material, uncoated - anodized aluminium coating as alternative base material, may be coated - stainless steel as alternative base material, uncoated - copper as alternative base material, uncoated
Industrial applications	- stainless steel - ceramic coatings - silicone and silicone coatings - synthetic rubbers and similar compounds (nitrile rubber, ethylene propylene rubber, neoprene, PES (polyethersulfone))

Do you actively work on finding alternatives?

Yes

Do you have information on additional alternatives for any of the described applications that have not been disclosed in the attached information?

The background document is technically incorrect and out of date:
1) section 2.1, 1st bullet point: PFOS sulphonamides are not telomeric, were phased out 20 years ago and are not registered any more, and therefore not in legal use.
2) No 8:2 diPAPs are registered, and they are banned by REACH as they are PFOA-related.
3) Practical analyses (e.g. Chemtrust and Arnika report) show pervasive presence of 6:2 FTOH, a clear marker of C6 fluorotelomer chemistry. These substances are all covered by the restriction of PFHxA.
4) German FCM approvals (BfR's annex XXXVI, available from EEB's library: https://tinyurl.com/tdk2bycc) show that modern substances are based on 6:2-FTOH (see (3)) or on on pf-polyethers (overlooked in the background document). The NL Warenwet list is outdated by at least 20 years.
5) bullet point 6: the sidechains (6:2 FTOH) are POLYfluorinated
6) In table 1, relevant processing aids such as ADONA (EC 480-310-4), C6O4 (EC 682-239-6) and EC 700-323-3 are missing.

V. Questions - Section D - Food contact material & packaging

Questions in relation to impact of legislative measures (for companies and industry associations)

What is the economic impact (in euro) and social impact (e.g. jobs) on your business/company if the use of PFAS is prohibited?

a) In 3 years.

EEB is not impacted, but we would like to stress that responses will likely be dominated by negatively impacted companies, not by those who benefit from a restriction.

If available, please proivde data on (PFAS impurities in) polymer production aids emission during the production of consumer cookware & industrial applications.

The polymer production aids are mostly PFAS, not only their impurities.
Consider substances suchas Gen X (EC 700-242-3), ADONA (EC 480-310-4), C6O4 (EC 682-239-6), diglycol acetate EC 700-323-3.

If available, please provide information on the use of fluorinated gas or fluorinated processing aids in plastic packaging production (food as well as non-food packaging).

Consider substances such as Gen X (EC 700-242-3), ADONA (EC 480-310-4), C6O4 (EC 682-239-6), diglycol acetate EC 700-323-3.

V. Questions - Section B - Lubricants

Questions in relation to the use (mainly for industry associations)

The following linked information presents the current picture: Report summary lubricants july 2021.pdf

In the tables presented on this page and the following, '?' in the cells show that the authorities do not have any information available. Input to fill these gaps is highly appreciated.

Sub-Use	Tonnage (tonnes/PFAS) per year in the EEA	Expected trend (--/-/0/+/++)[1]	Emissions/year in EEA[2] (tonnes/PFAS)
Formulation of lubricants	< 3,000	+ (5% up to 2030)	in soil, surface water and air: 50 in waste stage: 40
In-use stage (sealed articles)	< 3,000	+	80
In-use stage (open applications)	100	+	90

[1] -- = strong decrease, - = decrease, + = increase, ++ = strong increase, 0 = neutral

[2] Emissions relate to mixture/article production and mixture/article use. They do not include PFAS production and only for

the formulation of lubricants also the waste stage of the articles. The emissions for PFAS production and the waste stage
are also covered in a separate section.

V. Questions - Section C - Lubricants

Questions in relation to alternatives (mainly for individual companies)

Sub-Use	Non-PFAS alternatives
PTFE (micropowder)	- graphite - amorphous silica - molybdenum disulphide - boron nitride, other inorganics (e.g. layer building zinc phosphates) - water-based phenolic-melamine gold lacquer' alternative (still in R&D phase)
PTFE-thickened silicone oil for specific applications	- polyurea
High-bearing aromatic thermosetting polyester (ATSP) coating	- graphene

V. Questions - Section D - Lubricants

Questions in relation to impact of legislative measures (for companies and industry associations)

V. Questions - Section B - Construction products

Questions in relation to the use (mainly for industry associations)

The following linked information presents the current picture: Report summary construction products july 2021.pdf

In the tables presented on this page and the following, '?' in the cells show that the authorities do not have any information available. Input to fill these gaps is highly appreciated.

Sub-Use		Tonnage (tonnes/PFAS) per year in the EEA	Expected trend (--/-/0/+/++)[1]	Emissions/year in EEA[2] (tonnes/PFAS)
Polymeric PFAS	Formulation of articles and commercial construction mixtures	7,390	++ (5 - 8% for PTFE, PVDF, EFTE until 2030)	in soil, surface water and air: 330 in waste stage: 170
	In-use stage (outdoor articles)	3,270		in soil, surface water and air: 212
	In-use stage (indoor applications)	3,270		in soil, surface water and air: 2
	In-use stage (outdoor mixtures)	164		in soil, surface water and air: 9

	In-use stage (indoor mixtures)	150		in soil, surface water and air: 0.1
Non-polymeric PFAS	Formulation of articles and commercial construction mixtures	10,900	+ (1% for 2020 -2050)	in soil, surface water and air: 273 in waste stage: 163
	Use of processing aids	3,700		in soil, surface water and air: 5 in waste stage: 3,695
	In-use stage (outdoor articles)	1,712		in soil, surface water and air: 110
	In-use stage (indoor applications)	1,712		in soil, surface water and air: 1
	In-use stage (outdoor mixtures)	1,420		in soil, surface water and air: 91
	In-use stage (indoor mixtures)	1,502		in soil, surface water and air: 0.75

[1] -- = strong decrease, - = decrease, + = increase, ++ = strong increase, 0 = neutral

[2] Emissions relate to mixture/article production and mixture/article use. They do not include PFAS production and only in some cases the waste stage of the articles. The emissions for PFAS production and the waste stage are also covered in a separate section.

V. Questions - Section C - Construction products

Questions in relation to alternatives (mainly for individual companies)

Sub-Use	Non-PFAS alternatives
Thermal insultation applications	- polyisocyanurate - phenolic thermal product
Processing aids in the production of construction products	? (only confidential information)
Architectural fabrics	- cotton and other natural fibres - polyamid (nylon) - polyester - fiberglass - aramid (Kevlar, Twaron) - carbon fibres
Fluoropolymer tube lining	- polypropylene - silicone - PVC
Paints and coatings	- polyurethane - polyester powder - wax emulsions - silicones/silanes/polysiloxanes - hydrocarbon polymer technologies

Coating additives	- hydrocarbon and silicone-based surfactants - short chain, polyether-modified siloxanes - low molecular weight polyether-modified siloxanes - siloxane multi-functional surfactants - alkoxylates (silicone and solvent-free)
Superhydrophobic coatings	- polymeric matrix (the binder) added to hydrophobic nanoparticles (the filler)
Wood primer and inks	- sulfosuccinates (e.g. sodium salt of di-(2-ethylhexyl) sulfosuccinate
Rust protection systems, marine paints,resins, printing inks and coatings in electrical applications	- propylated napthalenes - propylated biphenyls

Do you have information on additional alternatives for any of the described applications that have not been disclosed in the attached information?

The first item in the list, on thermal insulation, is ambiguous. Thermal insulation foams are normally not made of any PFAS, not least because fluoropolymers are difficult to process, expensive, and do not offer advantages in thermal conductivity.
However, PFAS (notably F-gases such as 1233zd (marketed by Arkema as Forane(R)) are used as blowing agents to make foams, especially for on-site spray foams.
However, fluorine-free alternatives that can be used in broad application spectra have been on the market for many years, ever since the phase-out of HCFCs and CFCs.
A comprehensive report by Germany's GIZ and BMZ from 2009 is available here: https://www.ctc-n.org/sites/www.ctc-n.org/files/resources/giz2009-en-natural-foam-blowing-agents.pdf

V. Questions - Section D - Construction products
Questions in relation to impact of legislative measures (for companies and industry associations)
V. Questions - Section B - Medical devices
Questions in relation to the use (mainly for industry associations)

The following linked information presents the current picture: Report summary medical devices july 2021.pdf

In the tables presented on this page and the following, '?' in the cells show that the authorities do not have any information available. Input to fill these gaps is highly appreciated.

Sub-Use[1]	Tonnage (tonnes/PFAS) per year in the EEA	Expected trend (--/-/0/+/++)[2]	Emissions/year in EEA[3] (tonnes/PFAS)
Anesthetics	2 - 1,000	+	~ 2 - 1,000
Contrast media	2 - 100	?	~ 2 - 100
Propellants	160 - 400	?	~ 160 - 400
MDI incl. F-gases	24,000 - 43,000	?	~ 4,200

Medical devices incl. packaging (mainly polymers)	3,700 - 14,000	?	90

[1] Contrast media, propellants and F-gases are mentioned here as medical devices.

[2] -- = strong decrease, - = decrease, + = increase, ++ = strong increase, 0 = neutral

[3] Emissions relate to mixture/article production and mixture/article use. They do not include PFAS production and the waste
stage of the articles. These emissions are covered in a separate section.

Do you have information that indicates that the information provided on the emissions should be adjusted?

Yes

Please specify and/or refer to literature/public sources.

Regarding the last sub-use category: medical devices incl. packaging are usually incinerated after use, especially where they are contaminated with bodily fluids, constituting a biohazard. Like municipal waste, clinical waste is generally not incinerated at temperatures converting organic fluoride (i.e. PFAS) into inorganic fluoride - see our comments in the section on waste for concepts and literature references.
The highly defective mass balance (what happens to the 3,610-13,910 unaccounted tons of PFAS?) means that further data or assumptions are needed.

V. Questions - Section C - Medical devices

Questions in relation to alternatives (mainly for individual companies)

Are in your view non-PFAS alternatives technically feasible in your product(s)/processes?

Yes

Please specify why.

Although we do not produce or handle medical devices ourselves at EEB, we would like to bring to your attention our contribution to question 5 of the public consultation on the draft SEAC opinion of the restriction proposal on PFHxA, its salts and related substances.

Do you have information on alternatives for any of the described applications in the attached information?

Although propellants of inhalers are acknowledged for their use and emissions of GHGs, little information is provided on alternatives.
A useful assessment of costs and benefits was published a few years ago: Wilkinson et al. 2018 http://dx.doi.org/10.1136/bmjopen-2018-028763

V. Questions - Section D - Medical devices
Questions in relation to impact of legislative measures (for companies and industry associations)
V. Questions - Section E - Medical devices
Specific questions for the use
V. Questions - Section B - Medicinal Products
Questions in relation to the use (mainly for industry associations)

The following linked information presents the current picture: Report summary medicinal products july 2021.pdf

In the tables presented on this page and the following, '?' in the cells show that the authorities do not have any information available. Input to fill these gaps is highly appreciated.

Sub-Use	Tonnage (tonnes/PFAS) per year in the EEA	Expected trend (--/-/0/+/++)[1]	Emissions/year in EEA[2] (tonnes/PFAS)
Medicines (human pharmaceuticals)	> 500[3]	+	> 500[3]
Medicines (veterinary pharmaceuticals)	?	?	?
Pharmaceutical intermediates[3]	8,200 (ECHA)	?	?

[1] -- = strong decrease, - = decrease, + = increase, ++ = strong increase, 0 = neutral

[2] Emissions relate to mixture/article production and mixture/article use. They do not include PFAS production and the waste
stage of the articles. These emissions are covered in a separate section.

[3] The whole molecule/API is counted in this calculation.

V. Questions - Section C - Medicinal Products
Questions in relation to alternatives (mainly for individual companies)
V. Questions - Section D - Medicinal Products
Questions in relation to impact of legislative measures

(for companies and industry associations)

V. Questions - Section E - Medicinal Products

Specific questions for the use

V. Questions - Section B - Metal plating & manufacturing of metal products

Questions in relation to the use (mainly for industry associations)

The following linked information presents the current picture: Report summary metal plating and manufacturing of metal products july 2021.pdf

In the tables presented on this page and the following, '?' in the cells show that the authorities do not have any information available. Input to fill these gaps is highly appreciated.

Sub-Use	Tonnage (tonnes/PFAS) per year in the EEA	Expected trend (--/-/0/+/++)[1]	Emissions/year in EEA[2] (tonnes/PFAS)
Metal plating	2 - 57 (6:2 FTS in chrome plating)	-	11.4 (6:2 FTS in chrome plating)
Manufacture of metal products	960 (fluoropolymers)	0	?

[1] -- = strong decrease, - = decrease, + = increase, ++ = strong increase, 0 = neutral

[2] Emissions relate to mixture/article production and mixture/article use. They do not include PFAS production and the waste
stage of the articles. These emissions are covered in a separate section.

V. Questions - Section C - Metal plating & manufacturing of metal products

Questions in relation to alternatives (mainly for individual companies)

Sub-Use	Non-PFAS alternatives

Metal plating (here specifically chrome plating)	- alkane sulfonates - amines, C12-C14 alkyl, ethoxylated - oleo amine ethoxylates (e.g. mixtures with (Z)-octadec-9-enylamine, ethoxylated) - 3-[dodecyl(dimethyl) ammonio]propan-1-sulfonate (mixture with 3-hydroxypropane-1- sulfonic acid and amines, coco alkyldimethyl, N-oxides) - paraffin oils, sulfochlorinated, saponified - isodecanol, ethoxylated - chromium (III) plating - add-on air pollution control devices (e.g. packed bed scrubbers) - thermal spraying (e.g. high velocity oxygen fuel process) - physical vapour deposition - case hardening process (e.g. plasma nitriding) - laser metal deposition - anhydrous ionic liquids based on chromium (III)salts - closed coating reactors - nickel-based coatings - sulfonation of plastics with sulfur trioxide in the gas phase - acidic permanganate solutions, nitric acid and trichloroacetic acid mixtures
Manufacture of metal products	?

V. Questions - Section D - Metal plating & manufacturing of metal products

Questions in relation to impact of legislative measures (for companies and industry associations)

V. Questions - Section E - Metal plating & manufacturing of metal products

Specific questions for the use

V. Questions - Section B - PFAS production (manufacturing)

Questions in relation to the use (mainly for industry associations)

The following linked information presents the current picture: Report summary production july 2021.pdf

In the tables presented on this page and the following, '?' in the cells show that the authorities do not have any information available. Input to fill these gaps is highly appreciated.

Sub-Use	Tonnage (tonnes/PFAS) per year in the EEA	Expected trend (--/-/0/+/++)[1]	Emissions/year in EEA[2] (tonnes/PFAS)
Fluoropolymers	Produced: 49,458 - 101,763 Imported: 36,148 (Eurostat) Exported: 28,718 (Eurostat)	+ (stakeholder)	in air: 10 - 20 in water: 3 - 6

F-gas	Produced: 13,600 - 52,800 Imported: 84,284 (Literature) Exported: 10,371 (Eurostat)	0 (stakeholder)	in air: 280 - 1,086 in water: 0.6 - 2.3
Remaining PFAS	Produced: 53,902 - 118,051 Imported: 103,586 (Eurostat) Exported: 131,866 (Eurostat)	+ (stakeholder)	in air: 11 - 24 in water: 3 - 7

[1] -- = strong decrease, - = decrease, + = increase, ++ = strong increase, 0 = neutral

[2] Emissions only relate to PFAS production. They do not include mixture/article production, mixture/article use and the
waste stage of the articles. These emissions are covered in the other sections of this survey.

Do you have information that indicates that the information provided on the tonnage should be adjusted?

Yes

Please specify and/or refer to literature/public sources.

The "remaining PFAS" currently still in legal use are mostly of 3 categories: PF-ethers, C4 and C6. The C6 substances are in scope of the restriction proposal on PFHxA, its salts and related substances, including for manufacturing aspects. In many such applications (paper, TULAC, electronics, ski...) PFAS are being replaced or will be replaced by other substances than PFAS.
The C6 substances being a large part of the remaining PFAS, a trend "-" would make more sense, despite the often indiscriminate derogations in the said restriction proposal.
We assume that illegal imports (e.g. articles treated with C8 chemistry) are not meant here.

V. Questions - Section C - PFAS production (manufacturing)
Questions in relation to alternatives (mainly for individual companies)
V. Questions - Section D - PFAS production (manufacturing)
Questions in relation to impact of legislative measures
(for companies and industry associations)
V. Questions - Section E - PFAS production (manufacturing)
Specific questions for the use
V. Questions - Section B - Ski treatment
Questions in relation to the use (mainly for industry associations)

The following linked information presents the current picture: Report summary ski treatment july 2021.pdf

Additionally, the Norwegian Environment Agency also published a short version of the report. This version can be accessed via the following link: PFAS in the treatment of skis - Use, Emissions and Alternatives

In the tables presented on this page and the following, '?' in the cells show that the authorities do not have any information available. Input to fill these gaps is highly appreciated.

Sub-Use	Tonnage (tonnes/PFAS) per year in the EEA	Expected trend (--/-/0/+/++)[1]	Emissions/year in EEA[2] (tonnes/PFAS)
Ski wax	1.64	-	in soil: 0.452 in surface water: 0.452 in air: 0.041 in waste stage: 0.695

[1] -- = strong decrease, - = decrease, + = increase, ++ = strong increase, 0 = neutral

[2] Emissions relate to mixture/article production and mixture/article use. They do not include PFAS production. The
emissions for PFAS production and the waste stage are also covered in a separate section.

Do you have information that indicates that the information provided on the emissions should be adjusted?

Yes

Please specify and/or refer to literature/public sources.

(regrettably it is not possible to provide a comment here by clicking "no", although explicitly confirming the proposal would be a constructive way to comment)
Thank you for providing an emission estimate with a plausible mass balance.

Do you have information that indicates that the information provided on the expected trend should be adjusted?

Yes

Please specify and/or refer to literature/public sources.

This trend should probably be readjusted to "--", for two reasons:
1) the International Ski Federation FIS has banned all PFAS in professional competitions (https://www.fis-ski.com/en/ski-jumping/ski-jumping-news-multimedia/news/2020-21/ski-wax-only-without-fluorine). It is to be expected that amateur sports will also follow, although public awareness (and thus pressure) is probably much lower.
2) The only active ingredient currently registered in the EU is likely EC 432-570-5, which is in scope of the restriction on PFHxA and related substances. Of course, given the small total volume, it is not unlikely that other active substances are produced or imported in amounts below 1 t/y, thus escating REACH registration. Although a restriction does not mean that use will effectively cease completely, there is a high probability that volumes will decrease dramatically linked to legality issues.

V. Questions - Section C - Ski treatment
Questions in relation to alternatives (mainly for individual companies)

Sub-Use		Non-PFAS alternatives
Ski wax	Fluorine-free waxes	- hydrocarbon and paraffin waxes - siloxanes (but they are subject to environmental concerns) - nanoparticle-based waxes are being developed.
	Alterations to the ski itself	- a modified microstructure of the ski base - improved performance of the polyethylene of the ski - heating the base to obtain a better glide - controlling the vibrations of the ski

V. Questions - Section D - Ski treatment
Questions in relation to impact of legislative measures (for companies and industry associations)

What is the economic impact (in euro) and social impact (e.g. jobs) on your business/company if the use of PFAS is prohibited?

a) In 3 years.

As mentioned before, this question is possibly without major practical substance, as ski waxes currently on the market are likely mostly covered by the restriction on PFHxA and related substances.

V. Questions - Section E - Ski treatment
Specific questions for the use
V. Questions - Section B - TULAC (textiles, upholstery, leather, apparel and carpets)
Questions in relation to the use (mainly for industry associations)

The following linked information presents the current picture: Report summary TULAC july 2021.pdf

In the tables presented on this page and the following, '?' in the cells show that the authorities do not have any information available. Input to fill these gaps is highly appreciated.

Sub-Use	Tonnage (tonnes/PFAS) per year in the EEA Low/High	Expected trend (--/-/0/+/++)[1]	Emissions/year in EEA[2] (tonnes/PFAS) Low/High
Home textiles	6,230/27,368	++	?
Consumer apparel	8,161/47,148	++	?
Professional apparel	5,220/20,044	++	?
Technical textiles	6,201/26,541	++	?
Medical applications	331/1,095	++	?
Leather	?	++	?
Other	15,041/20,496	++	?
Total	**41,184/142,692**	**++**	**4,933/18,103**

[1] -- = strong decrease, - = decrease, + = increase, ++ = strong increase, 0 = neutral

[2] Emissions relate to mixture/article production and mixture/article use. They do not include PFAS production and the waste
stage of the articles. These emissions are covered in a separate section.

Do you have information that indicates that the information provided on the expected trend should be adjusted?

Yes

Please specify and/or refer to literature/public sources.

The summary report correctly identifies decreases in the consumer garment (=outdoor) sector.
However, the logic behind the overall "++" rating is difficult to follow.
1) The increase (not even "strong increase") mentioned for outdoor textiles in the background document, section 5, is not explained, backed-up, nor obvious.
2) PPE not related to medical applications (e.g. against heat, cuts or dust, i.e. "professional apparel") have not grown as a result of the Covid crisis.
3) Some medical PPE has increased because of the Covid crisis, but should not be expected to keep growing at similar rates, unless the health crisis is expected to worsen substantially. Therefore this sector (anyway minor in terms of volume) would rather have a "0" or "-" rating.
4) A major application of PFAS is for contact with bodily fluids, e.g. in surgical gowns. Whereas facemasks have definitely become more popular in the Covid crisis, they do not have a PFAS treatment. Why would surgical gowns have grown?

V. Questions - Section C - TULAC (textiles, upholstery, leather, apparel and carpets)

Questions in relation to alternatives (mainly for individual companies)

Sub-Use		Non-PFAS alternatives
Home textiles	Carpets and rugs	- non-ionic polymer - ester compounds - hydrocarbon compounds, - organic solvent and water
	Curtains	- no specific substances found, see general textile (FF)
	Upholstery (e.g. fabrics for soft-furnishings, including large furniture items)	- hydrotreated heavy naphtha (petroleum) - non-ionic polymer, ester compound, hydrocarbon compound, organic solvent and water
Consumer apparel	Outdoor wear	- non-ionic polymer - ester compounds - hydrocarbon compounds - organic solvent and water - mixture of linear and branched hydrocarbons
	Indoor wear	?
	Sports wear	?
	Footwear	?
Professional apparel	Professional sports wear and footwear	?
	PPE for industrial applications e.g. for chemical workers, fire-fighters, O&G workers, law enforcement and military forces	
Technical textiles	Outdoor technical textiles e.g. canvas, awnings, tarps, tents, bags, sails, rope, umbrellas	?
	Medical applications "non-woven", e.g. surgical drapes, gowns, curtains	
	High performance membranes e.g. automotive and medical	

Textile in general (multiple sub-category uses)		- paraffin - non-ionic polymer - ester compounds - alcohols, C12-16, ethoxylated (>5-15 EO) - hydrocarbon polymer dispersion - aqueous preparation of polymer waxes - paraffin oils and a fat modified melamine resin - dispersion of paraffin wax and acrylic copolymer - paraffin oils and a fat modified melamine resin and blocked polyisocyanates - dispersion of paraffin oils and a fat modified melamine resin - naphtha (petroleum), hydrotreated heavy, - modified wax dispersion - (bee-) wax - carnauba wax - acrylate copolymer - dispersion of fat-modified chemicals and paraffin - plant seed oil, bio based product - acrylic polymer and paraffin dispersion - acrylic polymer and silicone reactive dispersion - acrylic polymer, reactive silicone and paraffin dispersion - functionalised polymers/waxes, cationic - emulsifier-free paraffin wax - emulsion containing aluminum - acrylic polymer and dispersion of fatty derivatives - polyethylene oxide mono-C12-16-alkyl ether - aminofunctional PDMS - sodium methylsiliconate water - potassium methylsiliconate - isobutyltrimethoxy silane - octylsilane - hexyltriethoxysilane - blend of n-octyltriethoxysilane and reactive silicone, octyltrimethoxysilane-based - methoxy terminated silsesquixanes - emulsion of polydimethylsiloxane - cationic polysiloxane and polyester - polysiloxane - mixtures of silicones and stearamidomethyl pyridine chloride, sometimes together with carbamide (urea) and melamine resins - aminofunctional polysiloxanes - water-based silicone emulsion - solvent-dilutable silicone solution - siloxane dispersion with modified polyamide, - acrylic polymer and silicone reactive dispersion - dodecamethyl pentasiloxane (PDMS)

		- aqueous, solvent free dendrimers - anionic dispersion of an aliphatic polyether urethane - polyurethane emulsion, water-based - anionic dispersion of a matt polyether polyurethane, water-based, solvent free - anionic dispersion of an aliphatic polycarbonate urethane - plasma based nano-coating, molecularly attached hydrophobic 'whiskers' attached to individual fibres, uses a hydrocarbon polymer
Leather	Leather in general	- hybrid (silicone/hydrocarbon) - solvent-dilutable silicone solution - water-based silicone emulsion
Other	Home fabric treatments (sprays)	- alkyl polysiloxane solution

Do you have information on additional alternatives for any of the described applications that have not been disclosed in the attached information?

The PTFE membrane often used in outdoor textiles (class 2 in the background document) has been replaced by several industrial actors (including, but not limited to Jack Wolfskin, Fjällräven and Vaude) by fluorine-free, e.g. polyurethane membranes. See EEB's recent scorecard for technical details: https://tinyurl.com/f2w9s55r.

V. Questions - Section D - TULAC (textiles, upholstery, leather, apparel and carpets)

Questions in relation to impact of legislative measures (for companies and industry associations)

V. Questions - Section E - TULAC (textiles, upholstery, leather, apparel and carpets)

Specific questions for the use

The calculations in the summary report are based on data from the previous Call for Evidence. Based on your expertise/knowledge, are also imported TULAC (textiles, upholstery, leather, apparel, carpets) articles covered sufficiently?

Yes

V. Questions - Section B - Petroleum & mining

Questions in relation to the use (mainly for industry associations)

The following linked information presents the current picture: Report summary petroleum and mining july 2021.pdf

Additionally, the Norwegian Environment Agency also published a short version of the report. This version can be accessed via the following link:PFAS in mining and petroleum industry – use, emissions and alternatives

In the tables presented on this page and the following, '?' in the cells show that the authorities do not have any information available. Input to fill these gaps is highly appreciated.

Sub-Use	Quantity of product used (t)	Tonnage (tonnes/PFAS) per year in the EEA	Expected trend (--/-/0/+/++)[1]	Emissions/year in EEA[2] (tonnes/PFAS)
Water and gas traces	1	1	0[3]	in soil: 0 - 0.005 in water: 0.020 - 0.025 in marine water: 0 - 0.110 in air: 0.025 - 0.070 in waste stage: 0.020 - 0.145
Drilling/Production chemicals	170	3 - 8	0[3]	in soil: 0 - 0.045 in water: 0.070 - 0.210 in marine water: 0.020 - 0.760 in air: 0.085 - 0.635 in waste stage: 0.015 - 0.230
Fluoropolymers (all) Low scenario[4]	3,500 - 7,500.5	0.004 - 0.008 monomeric PFAS	0[3]	in soil: < 0.001 in water: < 0.001 in marine water: < 0.001 in air: 0.001 - 0.002 in waste stage: 0.001 - 0.003
Fluoropolymers (all) High scenario[5]	3,500 - 7,500.5	0,9 - 1,9 monomeric PFAS	0[3]	in soil: 0 .020 - 0.045 in water: 0.003 - 0.006 in marine water: 0.020 - 0.040 in air: 0.270 - 0.580 in waste stage: 0.310 - 0.670

[1] -- = strong decrease, - = decrease, + = increase, ++ = strong increase, 0 = neutral

[2] Emissions relate to mixture/article production and mixture/article use. They do not include PFAS production.

[3] Conservative annual growth of 1%.

[4] 1 ppm monomeric PFAS in fluoropolymers (Lohmann et al., 2020).

[5] 0-2000 ppm monomeric PFAS in fluoropolymers (Ökopol 2014 and used in PFOA restriction).

V. Questions - Section C - Petroleum & mining

Questions in relation to alternatives (mainly for individual companies)

Sub-Use	Non-PFAS alternatives
Water and gas tracers	- radioactive tracers - noble gas isotopic tracer - xenon - radiolabelled compounds
Drilling and production (antifoaming)	- polydimethylsiloxane (PMDS) oils - ethyl siloxanes - polypropylene glycol - naphthalene/1,2,4-trimethylbenzene based products - dipropylene glycol monomethyl ether - 2,6-dimethylheptan-4-one.
Fluoropolymers	- steel - other metal alloys - non-metal materials (ceramic or epoxy based) - cross-linked polyethylene (XL PE) - polyamides such as ethylene propylene diene (EPDM) - hydrogenated nitrile Rubber (HNBR) - polyether ether ketone (PEEK)

V. Questions - Section D - Petroleum & mining

Questions in relation to impact of legislative measures (for companies and industry associations)

V. Questions - Section E - Petroleum & mining

Specific questions for the use

V. Questions - Section B - F-gas uses

Questions in relation to the use (mainly for industry associations)

The following linked information presents the current picture: Report summary F gas uses july 2021.pdf

Additionally, the Norwegian Environment Agency also published a short version of the report. This version can be accessed via the following link: Application of Fluorinated Gases (F-Gases) in the European Economic Area

In the tables presented on this page and the following, '?' in the cells show that the authorities do not have any information available. Input to fill these gaps is highly appreciated.

Sub-Use	Tonnage (tonnes/PFAS) per year in the EEA	Expected trend (--/-/0/+/++)[1]	Emissions/year in EEA[2] (tonnes/PFAS)[3] all emissions to air for F-gases

Domestic refrigeration	122	0	17
Commercial refrigeration	7,915	+	9,547
Industrial refrigeration	2,360	-	3,680
Transport refrigeration	1,010	0	1,341
Mobile air conditioning	5,221	++	11,726
Stationary air conditioning and heat pumps	7,465	++	7,458
Foam blowing agent (closed cell)	4,940	+	4,186
Foam blowing agent (open cell)	271	0	1,074
Fire protection	863	0	703
Propellants (non-MDI)	504	-	701
Solvents	?	0	> 11
Cover gas for magnesium casting	?	+	> 23
Other	?	?	35

[1] -- = strong decrease, - = decrease, + = increase, ++ = strong increase, 0 = neutral

[2] Emissions relate to mixture/article production and mixture/article use. They do not include PFAS production and the waste
stage of the articles. These emissions are covered in a separate section.

[3] Due to large tonnages in stock, emissions can be higher than annual tonnage.

V. Questions - Section C - F-gas uses

Questions in relation to alternatives (mainly for individual companies)

Sub-Use	Non-PFAS alternatives
Domestic refrigeration	- iso-butane - propane (not in-kind refrigeration cycles)
Commercial refrigeration	- CO_2 - isobutane - propane
Industrial refrigeration	- CO_2 - ammonia - n-butane
Transport refrigeration	- CO_2 - ammonia - CO_2 with N_2 as direct coolant - propane (not in-kind: advanced cool box storage)
Mobile air conditioning	- CO_2 - propane
Stationary air conditioning and heat pumps	- CO_2 - ammonia - propane

Foam blowing agent (closed cell)	Depending on the specific application: - cyclopentane - iso-pentane - n-pentane - isobutane - n-butane - 2-chloropropane - dimethyl ether (DME)
Foam blowing agent (open cell)	- methyl formate - methylal - CO_2 / methyl formate - CO_2 (water) - CO_2 (liquid) - CO_2 / ethanol - water blown foams
Fire protection	- inert gases (nitrogen and argon) - CO_2 - water mist technologies - inert gas generators - fine solid particle technology - dry chemical agents - water and aqueous salt solutions
Propellants (non-MDI)	Compressed gases: - air - nitrogen - nitrous oxide - CO_2
	Liquefied gases: - butane - propane - isobutane - dimethyl ether
	Not-in-kind alternatives: - trigger sprays - finger pumps - squeeze bottles - non-sprayed products including roll-ons - bag-on-valve products

Solvents	Depending on the specific application: - isopropyl alcohol (IPA) - n-Propyl bromide - dichloromethane - trans-1,2-dichloroethylene - trichloroethylene (TCE) - perchloroethylene (PER) - volatile methyl siloxanes - hydrocarbons (hexane, heptane, benzene) - acetone - semi-aqueous / aqueous cleaning - manual cleaning methods (aerosols, brush, trigger spray, liquid immersion, spot cleaning, wipes) - ultrasonic - plasma cleaning - supercritical fluids – CO_2 - no clean fluxes
Cover gas for magnesium casting	- SO_2 - argon - salt fluxes - powdered sulfur

Are in your view the listed non-PFAS alternatives technically feasible in your product(s)/processes?

Yes

Please specify why.

A 2019 UNEP report (https://ozone.unep.org/sites/default/files/2019-04/RTOC-assessment-report-2018_0.pdf) analyses the different refrigerant gases and their usefulness in the different cooling and heat pump systems. The report concludes that CO2, ammonia and hydrocarbons have a very broad spectrum of application. Higher training needs are mentioned (which may be regarded as positive or negative); on the other hand training for the safe recuperation of F-gases will become easier.

Do you have information on additional alternatives for any of the described applications that have not been disclosed in the attached information?

As useful summary of available technologies and recent advances we would like to recommend the following website: https://cooltechnologies.org/
Further fluorine-free refrigerants missing from the list include water and cyclopentane (only mentioned as a blowing agent).

V. Questions - Section D - F-gas uses

Questions in relation to impact of legislative measures (for companies and industry associations)

V. Questions - Section E - F-gas uses

Specific questions for the use

V. Questions - Section B - Electronics & energy

Questions in relation to the use (mainly for industry associations)

The following linked information presents the current picture: Report summary electronics and energy july 2021.pdf

In the tables presented on this page and the following, '?' in the cells show that the authorities do not have any information available. Input to fill these gaps is highly appreciated.

Sub-Use	Tonnage (tonnes/PFAS) per year in the EEA	Expected trend (--/-/0/+/++)[1]	Emissions/year in EEA (tonnes/PFAS)
Electronics industry and semiconductor	Non-Polymers: 1,200 Polymers: 3,100 Total: 4,300	++	Production: 700 Use: 20 Recycling / waste: 900
Semiconductor	Non-Polymers: 85 Polymers: 1,400 Total: 1,485	++	
Energy industry	Non-Polymers: 250 Polymers: 1,200 Total: 1,450	++	Production: 40 Use: 1 Recycling / waste: > 24
Batteries	Polymers: 15,000	++	Production: ? Use: ? Recycling: ?

[1] -- = strong decrease, - = decrease, + = increase, ++ = strong increase, 0 = neutral

Do you have information that indicates that the information provided on the emissions should be adjusted?

Yes

Please specify and/or refer to literature/public sources.

The emissions of the different sectors are again much lower than the used tonnages. As always, it is unclear what happens to the missing tonnage - especially as recycling is low in this area.
Fluorinated technology is a mature technology, therefore outflows from the use phase should be roughly equal to the inflows.
What happens to the missing tonnage? Realistic assumptions are fine, not providing any scenario is not.

V. Questions - Section C - Electronics & energy

Questions in relation to alternatives (mainly for individual companies)

Sub-Use	Non-PFAS alternatives
Electronics industry and semiconductor	For fluoroelastomers in sealing: ethylene propylene diene monomer (EPDM) and silicone rubbers For wire insulation: ilicone materials Polyetheretherketone (PEEK) For photolithography (hard and not for all applications): hydrocarbon-based greases, Molybdenum disulfide, graphite
Energy industry	For fluoropolymer-based backsheets for photovoltaic cells polyolefin could be an alternative. Other fluorine free backsheets made of polyethylene terephthalate (PET) and/or ethylene vinyl acetate (EVA) can/are also used For cables: Mica and EPDM For seals: Hydrocarbon elastomers For batteries :Solid-state batteries For fuel cells: For PEM membranes: Hydrocarbon membrane and sulphonated polyetheretherketone (PEEK) Reinforcement material as alternative to PTFE: Electrospun polybenzimidazole-type materials For sealings: Some elastomers without fluorine exist and could potentially be used in the future for the Membrane Electrodes Assembly (MEA) function For immersion cooling: Synthetic oil

What is the specific application/functionality of PFAS in your product(s)/processes?

EEB is not involved in the production or processing of PFAS.
We would like to point to our submission into the Public Consultation on the SEAC draft opinion of the PFHxA restriction, answer to question 3 for further information on the use of PFAS in electronics.

Are there legal approval schemes for your product(s)/processes, which have to be taken into account in case PFAS alternatives will be used?

Yes

Please specify and/or refer to literature/public sources.

We would like to highlight that some of the materials in this section are at the same time construction materials and that there may be an overlap between categories.

Do you have information on additional alternatives for any of the described applications that have not been disclosed in the attached information?

Typical backsheets of PV cells are made of PVB, not mentioned here.
Cable insulation can be made from polyolefins and PVC, to name some classic alternatives.

V. Questions - Section D - Electronics & energy
Questions in relation to impact of legislative measures (for companies and industry associations)
V. Questions - Section E - Electronics & energy
Specific questions for the use
V. Questions - Section B - Transportation
Questions in relation to the use (mainly for industry associations)

The following linked information presents the current picture: Report summary transportation july 2021.pdf

In the tables presented on this page and the following, '?' in the cells show that the authorities do not have any information available. Input to fill these gaps is highly appreciated.

Sub-Use	Tonnage (tonnes/PFAS) per year in the EEA	Expected trend (--/-/0 /+/++)[1]	Emissions/year in EEA[2] (tonnes/PFAS)

Body-, hull and fuselage construction		?	0	?
Sealing applications		111,104 (fluoroelastomers in road transportation vehicles)	0	?
Lubrication		?	0	?
Hydraulic fluids		?	0	?
Electrical engineering and information technology		?	++	?
Coating and finishings (incl. textiles, interiors and related applications, e.g. coating of trim materials)		?	+	?
HVACR systems (heating, ventilation, air conditioning and refrigeration)	F-gases in road transportation vehicles	184,130	+	9,000
	F-gases in systems in trains/ships/aircrafts	?	+	?
	F-gases in systems for transport refrigeration	10,926	+	495.8
Health protection and lifesaving equipment (incl. firefighting, life vests, life rafts, airbags, …)		?	+	?

[1] -- = strong decrease, - = decrease, + = increase, ++ = strong increase, 0 = neutral

[2] Emissions relate to mixture/article production and mixture/article use. They do not include PFAS production and the waste
stage of the articles. These emissions are covered in a separate section.

V. Questions - Section C - Transportation

Questions in relation to alternatives (mainly for individual companies)

Sub-Use	Non-PFAS alternatives
Body-, hull and fuselage construction	?
Sealing applications	?
Lubrication	?
Hydraulic fluids	?
Electrical engineering and information technology	?
Coating and finishings (incl. textiles, interiors and related appliactions, e.g. coating of trim materials)	- silicone based chemicals - sulfosuccinates - propylated aromatics - fatty alcohol polyglycol ether sulphates - alkyl acrylates - polyurethanes and -acrylics

HVACR systems (heating, ventilation, air conditioning and refrigeration)	- air - water - ethylene glycol - mineral oils - silicone oils - alcohols - natural gases: HC-600 (n-butane), R-717 (Ammonia), R-744 (CO_2)
Health protection and lifesaving equipment (incl. firefighting, life vests, life rafts, airbags, …)	?

V. Questions - Section D - Transportation

Questions in relation to impact of legislative measures (for companies and industry associations)

V. Questions - Section E - Transportation

Specific questions for the use

For this restricton proposal the assessment of the transportation sector encompassess: road traffic, ships, trains and aircrafts. We identified the following applications of PFAS in the transportation sector:

1.) Body-, hull and fuselage construction
2.) Sealing applications
3.) Lubrication
4.) Hydraulic fluids
5.) Electrical engineering and information technology
6.) Coating and finishings (incl. textiles, interiors, and related applications e.g. coating of road signs)
7.) HVACR systems (heating, ventilation, air conditioning and refrigeration)
8.) Health protection and life saving equipment (incl. fire prevention and fire fighting)

V. Questions - Section B - Waste

Questions in relation to the use (mainly for industry associations)

The following linked information presents the current picture: Report summary waste july 2021.pdf

In the tables presented on this page and the following, '?' in the cells show that the authorities do not have any information available. Input to fill these gaps is highly appreciated.

Sub-Use	Tonnage (tonnes/PFAS) per year in the EEA	Expected trend (--/-/0/+/++)[1]	Emissions/year in EEA[2] (tonnes/PFAS)
Textiles/TULAC	43,605	++	WWTP: 3.5 (median)
Food contact material (paper & board)	2,894	+	Landfill: 1.8 (median)

End-of-life-vehicles (ELV)	2,219	+	Incineration: Flue gas: ? Bottom ash: 0.03 Fly ash: 0.05
Waste electrical and electronic equipment (WEEE)	?	++	
Sewage sludge	0.404	?	0.3

[1] -- = strong decrease, - = decrease, + = increase, ++ = strong increase, 0 = neutral

[2] Emissions only relate to the waste stage. They do not include mixture/article production, mixture/article use and PFAS production. These emissions are covered in the other sections of this survey.

Do you have information that indicates that the information provided on the emissions should be adjusted?

Yes

Please specify and/or refer to literature/public sources.

As explained in other sections (e.g. FCM and packaging), incineration of household waste occurs typically at 850 °C with a residence time of 2 s (WI BREF and related monitoring data, available on BATIS). The fluorine in the waste stream (e.g. 43,000 t/y in TULAC) will end up in either the bottom/fly ash or the flue gas. Fluorine can end up as inorganic fluorine (highly poisonous HF gas or, under basic conditions, a fluoride salt such as CaF2); however temperatures well above 1000 °C are required for this transformation to be quantitative.
Combustion products from e.g. PTFE at 850 °C are largely CF4, CHF3 and other potent and long-lived GHGs (see García 2007, Huber 2009 and US EPA 2020).
Radical mechanisms postulated in Ellis 2001 hint to similar decomposition pathways from other PFAS.
All documents are available from: https://tinyurl.com/4huwfcey
(EEB's document library)
It is important that the mass balance (i.e. Lavoisier's principle) is respected in the Annex XV dossier.

V. Questions - Section E - Waste

Specific questions for the use

If available, please provide data on PFAS (or total F) measurements in flue gas, fly ash or bottom ash from waste incinerators (Energy from Waste installations, cement kilns, hazardous waste incinerator etc.).

Several papers have discussed the issue; however without reaching a meaningful conclusion on the fate of the fluorine.
Taylor 2014 (doi.org/10.1016/j.chemosphere.2014.02.037) describes combustion at 1000 °C, i.e. unrealistically high temperatures for a municipal waste incinerator (MWI), and report some formation of HF and no formation of PFOA (which would not be an expected combustion product anyway).
Yamada 2005 (doi:10.1016/j.chemosphere.2005.03.025) reaches similar conclusions.
Aleksandrov 2019 (doi.org/10.1016/j.chemosphere.2019.03.191) confirms that none of a small series of PFAS are formed during combustion of PTFE (as expected), without answering the question of the fate of the fluorine.
Wang 2015 (DOI: 10.1021/es506234b) studies the use of Ca(OH)2 to abate the formation of the long-lived potent GHG in MWIs - however Ca(OH)2 is not routinely used in practice. The quasi-quantitative conversion into those GHGs
as the most plausible scenario.

Thank you for your participation!

This is the last page of the survey. Please make sure your information is correct. After clicking on 'Submit', you will not be able to change your entries anymore. The following page however will give you the opportunity to save your answers as PDF document or print them.