

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 preparing 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 $n \geq 1$ 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 (<u>t</u> extiles, <u>u</u> pholstery, <u>l</u> eather, <u>a</u> pparel and <u>c</u> arpets)	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	5.1.2e
Surname	5.1.2e
Name of institute/organisation	The Chemours Company FC, LLC – Advanced Performance Materials segment (Manufacturer of fluoropolymers, PFPE lubricants, side-chain fluorinated polymers and fluorotelomer surfactants). This submission, and information provided, focuses on fluoropolymers (including fluoroelastomers) and this portion of Chemours' portfolio within the scope. In addition, a separate submission from the Chemours Thermal and Specialized Solutions segment will be provided.
E-Mail	5.1.2e@chemours.com

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.

- Cleaning agents, polishes, waxes (non-industrial uses)
- Food contact materials & packaging
- Lubricants
- Construction products
- Medical devices
- PFAS production (manufacturing)
- TULAC (textiles, upholstery, leather, apparel and carpets)
- Petroleum & mining
- Electronics & energy
- Transportation
- Waste

If relevant, please further specify your use (e.g. textiles used in personal protective equipment).

Fluoropolymers have a unique combination of properties no other chemistry has; vital in high-performance electric, fire, weather, temperature & chemical resistance, non-wetting, non-sticking uses.

Are certain uses of PFAS missing in the categories above?

Chemical Processing Industry is missing. Chemours provided detailed information for this industry in the first Call for Evidence, Part V. Questions - Section A; Information on uses.

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)	Expected trend	Emissions/year in EEA ²
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	per year in the EEA	(--/0/+/++) ¹	(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	?

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

Fluorotelomer surfactants used in cleaning agents, polishes, and waxes lower surface tension in aqueous and solvent solutions, enabling wetting and spreading of the solution. Typically, fluorotelomer surfactants are used at levels of 100ppm compared to typical hydrocarbon surfactants (that do not perform as well) which would be used at a percentage level.

The use in aviation glass is a professionally applied coating that is covalently bound. This is a high-performance use that provides high water and oil contact angles and low sliding angles necessary.

Source: <https://bit.ly/3DI5FrH>

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

No

Please specify why.

Non-PFAS alternatives do not provide the technical functionalities required for critical applications such as aviation glass.

Hydrocarbon or silicone-based surfactants as alternatives to fluorotelomer surfactants do not provide the same wetting or leveling performance at low concentrations. A higher concentration or multiple alternatives would be necessary to compare to the performance of fluorotelomer surfactants with a poor balance between performance and cost.

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)	+ (3%)	124 - 871

	PFAS: ? (for plastic packaging)		
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?

Yes

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

5.1.1c

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.

5.1.1c

Source: <https://bit.ly/2YsRd1U>

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

Yes

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

A substantial body of scientific data demonstrates fluoropolymers (FPs) do not pose a significant risk to water quality, human health, or the environment. FPs make specific contributions to several of the UN SDG including but not limited to Targets 3.6, 3.9, 7.3, 9.4, 12.2, 12.4 & 12.5 according to our 3rd party verified methodology, EVOLVE 2030. FPs are critical to this industry, which prioritizes safety as a critical property in their material selection and use. FPs have negligible solubility in water and cannot enter or accumulate in a person's bloodstream. FP meet OECD's criteria for "polymers of low concern," do not present significant toxicity concerns and cannot degrade into other PFAS under normal conditions. Information on safe handling to minimize exposure and risk are within the material Technical Data Sheet and SDS. Industry associations have also published safe handling guides.

Plastics Industry Association: <https://bit.ly/3I7pbkY>

Plastics Europe: <https://bit.ly/3mFpzqH>

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))

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

Fluoropolymers (FPs) have been used for non-stick coatings since the 1950s due to their exceptional thermal resistance properties, chemical inertness, and low surface energy. FPs also provide oil resistance. Food contact articles using FP coatings are primarily cookware, ovenware, bakeware, and small appliances with industrial and consumer uses. The thermal resistance, chemical resistance, and surface properties of FPs impart unparalleled performance to these articles for the benefit of the end user.

Source: <https://bit.ly/3ms0nUh>

Fluoroelastomers are used as additives to improve polyolefin processing. They are effective in eliminating melt fracture, reducing die pressure, reducing die buildup, promoting downgauging initiatives, reducing energy consumption and carbon footprint, reducing downtime, reducing waste, improving quality, and increasing productivity.

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

No

Please specify why.

Non-PFAS alternatives do not provide the technical functionalities required by these applications. The chemical inertness of fluoropolymers (FPs) translates into high durability for the coated article. Coating suppliers and article manufacturers have improved the durability of FP-based coatings over the years; meaning that articles can be used for much longer. Where available, household recycling programs reduce the environmental footprint of cookware articles, including articles made with FP coatings.

For polyolefin processing, there are no practical alternatives to fluoroelastomer processing additives and elimination of fluoroelastomer additive would result in decreased production rates (estimated 30-50%), decreased product quality, increased waste, increased plastic thickness to achieve performance, and increased energy consumption.

Do you have information on the alternatives' risk profile?

Yes

Please describe.

Alternatives must meet both performance and safety (e.g., toxicity) criteria to be deemed suitable. Fluoropolymers (FPs) and PFPE lubricants are used in the production of food contact materials and packaging because they have a combination of properties that uniquely meet thermal, mechanical, and chemical stability requirements. In the absence of these properties, there is a substantial risk of equipment failure that could result in significant downtime. Alternatives, such as waxes and stearates, are added in higher concentrations, require more time to form a nonstick coating on startup, and can have negative interactions with other additives. Through their barrier properties, FP coatings limit the unintended release of potentially harmful substances from the metal substrate they cover. This is especially true and important when cooking acidic food and when using common aluminum substrates.

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.

Monomers, other starting substances, and additives used to produce Chemours fluoropolymers suitable for food contact applications have been assessed for food contact uses and comply with the relevant EU regulations when sold in Europe. Representative Specific Migration Limits (SMLs) for these monomers, additives, and starting substances relevant for Chemours food contact materials and the legal frameworks within the EU in which they comply, were provided as confidential information in Figure 1 of our original Call for Evidence (Section A - Specific Uses_Food Contact Materials (FCM))

Please note, "Coatings that are used in food contact applications need to be cured at a minimum of 315 °C and in most cases 400 °C".

Source: <https://bit.ly/3uKrb5P>

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

Questions in relation to impact of legislative measures

(for companies and industry associations)

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).

Viton(TM) FreeFlow(TM), a fluoroelastomer, is used as a polymer processing (extrusion) aid in a broad range of polyolefin applications, particularly in the manufacturing of polyethylene films to overcome processing limitations of low viscosity resins. In polyolefins extrusion, the flow rate is limited by the onset of surface defects called melt fracture or shark skin and the lip build-up of dead low molecular weight material. To prevent and overcome extrusion instabilities, the addition of a small amount of Viton(TM) FreeFlow(TM) promotes material flow and improves the yield and throughput contributing to energy savings. Viton(TM) FreeFlow(TM) is effective in eliminating melt fracture, reducing die pressure, reducing die buildup, promoting downgauging initiatives, reducing energy consumption and carbon footprint, reducing downtime, reducing waste, improving quality, and increasing productivity.

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.

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.

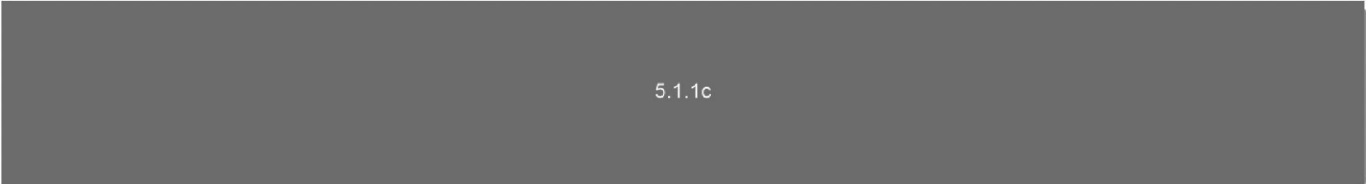


5.1.1c

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.



5.1.1c

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

Yes

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

A substantial body of scientific data demonstrates fluoropolymers (FPs) do not pose a significant risk to water quality, human health, or the environment. FPs make specific contributions to several of the UN SDG including but not limited to Targets 3.6, 3.9, 7.3, 9.4, 12.2, 12.4 & 12.5 according to our 3rd party verified methodology, EVOLVE 2030. FPs are critical to this industry, which prioritizes safety as a critical property in their material selection and use. FPs have negligible solubility in water and cannot enter or accumulate in a person's bloodstream. FP meet OECD's criteria for "polymers of low concern," do not present significant toxicity concerns

and cannot degrade into other PFAS under normal conditions. Information on safe handling to minimize exposure and risk are within the material Technical Data Sheet and SDS. Industry associations have also published safe handling guides.

Plastics Industry Association: <https://bit.ly/3I7pbkY>

Plastics Europe: <https://bit.ly/3mFpzqH>

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

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

The specific functionality for these applications is to provide low coefficient of friction under extreme high and low temperatures (-75C to 400C) where non-PFAS alternatives fail. PFPEs are non-flammable, resistant to chemical attack (chemically inert) and thermally stable while providing sustained lubricity at temperature extremes, such as for use in aerospace, automobiles, industrial applications, and certain medical applications.

Source: <https://bit.ly/3mrD3Gn>

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

No

Please specify why.

Non-PFAS alternatives are not technically feasible to provide lubrication under load in extreme high and low temperatures.

Polymeric Perfluoropolyether (PFPE) lubricants consistently outperform other lubricants while enduring extreme temperatures, harsh chemicals, steam, and moisture, and maintain lubricity at temperatures greater than 400 °C

(752 °F). This combination of properties makes PFPE lubricants unique and ideal for high temperature industrial applications like emergency smoke ventilation fans, corrugated paper machinery, bearings for furnaces and ovens, and plastic injection molding tools (like ejector pins, slides, and folding units). Standard hydrocarbon or traditional synthetic lubricants are unsuitable, and may degrade or burn under these conditions resulting in equipment failures, extended downtime and higher maintenance costs. Below is the functionality PFPE lubricants provide vs non-PFAS alternatives.

5.1.1c

Do you have information on the alternatives' risk profile?

Yes

Please describe.

While we cannot comment on the specific risk profile of any alternatives, alternatives must meet both performance and safety (e.g., toxicity) criteria to be deemed suitable. Perfluoropolyether lubricants are selected and specified because they have a combination of properties that uniquely meet these requirements, which alternatives cannot. There is substantial financial risk for alternatives that do not meet performance requirements, such as thermal, mechanical or chemical stability both in the cost of maintenance, but more importantly, the cost of failure-in-use. Failure-in-use would result in substantial financial loss due to equipment failure and potentially destruction (e.g., motor or bearing lubrication for example). Importantly, failure-in-use may result in harm to workers and the public as well as the environment (e.g., facility fire due to equipment failure).

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.

The West German Federal Institute for Materials Testing's (Bundesanstalt für Materialforschung und -prüfung, short: BAM) Code of practice M 034-1 "List of nonmetallic materials compatible with oxygen" provides a detailed overview.

Annex 2 of this Code of practice outlines the test methods and assessment criteria used by the BAM for evaluating the compatibility of nonmetallic materials for oxygen service. Chemours polymeric perfluoropolyethers (PFPEs) lubricants and greases also meet ASTM D942, a standard test method which determines resistance of lubricating greases to oxidation, which is critical to avoid failure of the lubrication system.

Source: 5.1.1c & information submitted in Chemours first CfE response.

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.

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.

5.1.1c

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.

5.1.1c

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

Yes

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

A substantial body of scientific data demonstrates fluoropolymers (FPs) do not pose a significant risk to water quality, human health, or the environment. FPs make specific contributions to several of the UN SDG including but not limited to Targets 3.6, 3.9, 7.3, 9.4, 12.2, 12.4 & 12.5 according to our 3rd party verified methodology, EVOLVE 2030. FPs are critical to this industry, which prioritizes safety as a critical property in their material selection and use. FP have negligible solubility in water and cannot enter or accumulate in a person's

bloodstream. FP meet OECD's criteria for "polymers of low concern," do not present significant toxicity concerns and cannot degrade into other PFAS under normal conditions. Information on safe handling to minimize exposure and risk are within the material Technical Data Sheet and SDS. Industry associations have also published safe handling guides.

Plastics Industry Association: <https://bit.ly/3I7pbkY>

Plastics Europe: <https://bit.ly/3mFpzqH>

V. Questions - Section C - Construction products

Questions in relation to alternatives (mainly for individual companies)

Sub-Use	Non-PFAS alternatives
Thermal insulation 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 naphthalenes - propylated biphenyls

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

Fluoropolymers are used in construction because they provide weatherability, chemical and temperature resistance, ease of cleaning, flexibility, stability at low weight, low surface energy / friction and no flame

propagation / low smoke generation.

Fluorotelomer surfactants lower surface tension, provide superior wetting power and leveling properties, improve repellency and dirt-pickup resistance in architectural coating applications.

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

No

Please specify why.

Fluoropolymers (FPs) are critical in construction due to their versatility. FP-coated glass fabric roofs and laminated coatings resist UV radiation, water, oil, dirt, corrosion, and impermeability to gases, making them excellent for outdoor and large buildings. Many FPs, like PTFE, are safer, lower maintenance and longer life than alternatives. UV and mold resistance reduces cleaning and maintenance costs, contributing to sustainable design. FPs are critical for insulating and jacketing high-speed data communication cables in floor and ceiling space, as they have excellent chemical resistance and electrical properties, function at service temperatures up to 200°C and provide flame resistance and low smoke generation that contribute to architectural structure safety. Fluorotelomer surfactants reduce surface tension while providing excellent wetting and leveling, oil repellency and chemical resistance. No alternative has this combination.

<https://bit.ly/2ZYSsGI>

Do you have information on the alternatives' risk profile?

Yes

Please describe.

While we cannot comment on the specific risk profile of any alternatives, alternatives must meet both performance and safety (e.g., toxicity) criteria to be deemed suitable. Fluoropolymers are selected and specified because they have a combination of properties that uniquely meet these requirements. Alternatives are not used, because they do not. There is substantial financial risk for alternatives that do not meet performance requirements of for example, flame resistance, photochemical, thermal, mechanical and chemical stability both in the cost of maintenance, but more importantly, the cost of failure-in-use. Failure-in-use would result in substantial financial loss due to equipment failure and potentially destruction (e.g., building damage or failure). Importantly, failure-in-use may result in harm to workers and the public as well as the environment.

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.

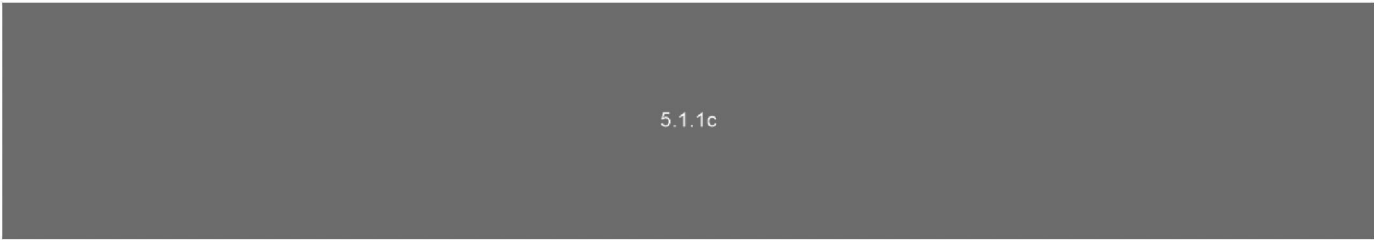
² -- = strong decrease, - = decrease, + = increase, ++ = strong increase, 0 = neutral

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 tonnage should be adjusted?

Yes

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



5.1.1c

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.

5.1.1c

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

Yes

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

High performance fluoropolymers are essential to many medical devices, with safety and efficacy as vital aspects of material selection and use. Health risks are thoroughly assessed before products for medical applications are approved for the market. In addition to premarket clearances and clinical trials; a barrage of tests, such as proving biocompatibility in compliance with international biocompatibility standard ISO 10993, are designed to ensure applications are safe for human uses. Fluoropolymers deliver critical solutions in a segment which demands unique performance criteria including biocompatibility, lubricity, chemical inertness, wide temperature usage, high-purity, and low leachable materials.

Source: <https://bit.ly/3uKpAwO>

V. Questions - Section C - Medical devices

Questions in relation to alternatives (mainly for individual companies)

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

Fluoropolymers (FPs), including fluoroelastomers, and PFPEs provide low surface energy, stability, chemical resistance, non-flammability, and excellent mechanical properties in medical applications, including medical devices. FPs are preferred in the medical industry due to their unique chemical properties such as lubricity, chemical resistance, gas permeation, inertness, tailored porosity, wide temperature usage, low binding to processing equipment, dielectric properties, biocompatibility, and high purity with low extractability. FPs are used in surgically-implantable medical devices, catheters, guide wires, filters and pumps to reduce the risk of failure, replacements, cross-infections, and clogging of medical equipment. PFPEs are used as lubricants and filling liquids in oxygen management systems enabling safe use in hospitals and portable units.

Source: <https://bit.ly/3Ak1KJr>

Source: 5.1.1c

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

No

Please specify why.

Non-PFAS alternatives are not technically feasible since they do not provide the functionalities required in medical applications. Fluoropolymers (FPs) combine biocompatibility, lubricity, chemical inertness, wide temperature usage, and high-purity and low leachable content to enable performance and long lifetime in medical equipment such as surgically implanted medical devices, catheters, guide wires, filters and pumps. In addition, FPs are used as critical parts and perfluoropolyethers (PFPEs) are used as lubricants and filling liquids for vacuum pumps in oxygen management systems to enable safe use and operations of such systems in hospitals and in portable units where other materials of construction are not compatible and do not meet code of practice requirements for safe and reliable use with oxygen.

Source: <https://bit.ly/2Ym8Yjx>

Do you have information on the alternatives' risk profile?

Yes

Please describe.

While we cannot comment on the specific risk profile of any alternatives, alternatives must meet both performance and safety (e.g., toxicity) criteria to be deemed suitable. Fluoropolymers (FPs) are the material of choice in the medical equipment industry, enabling excellent performance and long lifetimes. This reduces risk of failure, replacements, cross-infections, and malfunctioning of medical equipment. No alternatives provide similar technical and material performance, with substantial financial risk when performance requirements (e.g. biological, mechanical and chemical stability) are not met. Failure-in-use may cause medical complications to patients. PFPE lubricants are uniquely suited for medical applications (e.g. ventilators) as they are nonreactive, nonflammable, and safe for use in the presence of both oxygen and aggressive chemicals. Most alternative lubricants would off-gas or vaporize under the same conditions.

Source: <https://bit.ly/3uHYyGu>

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.

US FDA Center for Drug Safety and Radiological Health. 2016. Use of International Standard ISO 10993-1, "Biological evaluation of medical devices – Part 1: Evaluation and testing within a risk management process" <https://bit.ly/3Fpo4Fk> , <https://bit.ly/APMRef9>

Utilizing the European Medical Device Directive (REGULATION (EU) 2017/745 "EU Medical Device Directive" <https://bit.ly/APMRef14>

PlasticsEurope – Fluoropolymer Group "Socio-economic Analysis of the European Fluoropolymer Industry, May 2017 <https://bit.ly/3Dm9IUm>

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

If available, please provide information on market trends for contrast media, propellants, F-gases and/or medical devices.



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	- alkane sulfonates

(here specifically chrome plating)	- 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/+/>+)	Emissions/year in EEA ² (tonnes/PFAS)
Fluoropolymers	Produced: 49,458 - 101,763 Imported: 36,148 (Eurostat) Exported: 28,718 (Eurostat)	+	in air: 10 - 20 in water: 3 - 6
F-gas	Produced: 13,600 - 52,800 Imported: 84,284 (Literature) Exported: 10,371 (Eurostat)	0	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)	+	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.

5.1.1c

The environmental release category (ERC) is a key REACH use descriptor to define the release factors of a chemical substance in a specific use exposure scenario. It is used in various modelling tools to derive environmental exposure estimates. ERC default factors are used to estimate emissions of PFAS in three major life-cycle stages, namely the production stage including manufacture of substances, formulation of mixtures and production of articles, the 'in-use' stage, and the waste stage.

Please indicate if you have information on specific emission values (SPERCs) for (groups of) PFAS, based on measurements and / or model calculations.

Data on specific emissions values, based on accredited measurements, are reported to the Dutch and EU authorities for the manufacture of Chemours fluoropolymers and fluoroelastomers in the Netherlands. The data reported to the authorities should be referenced for continuity. This data requested by the authorities and submitted by Chemours over the past several years will demonstrate emissions reductions over time, based on responsible manufacturing practices deployed by Chemours.

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.

5.1.1c

Do you have information on risk management measures to minimize the use, human exposure and emissions to the environment?

Yes

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

Our Dordrecht site has installed abatement systems to abate both water and air process emissions to the environment. For instance, Chemours uses sophisticated technologies within its processes to recycle polymerization aids (PA) and prevent them from being discharged, thus already capturing and abating more than 99% of all PA used in the GenX technology. Chemours is committed to reducing permitted process emissions to air and water of fluorinated organic compounds at the facility by at least 80 % by 2024 and by 99% or greater by 2030 (using a 2017 base line). Chemours submits annual emission data reports to the competent authorities which provide more detail.

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

Questions in relation to alternatives (mainly for individual companies)

Please explain:

Fluorinated polymers is a broad, generic term that includes Fluoropolymers, Polymeric Perfluoropolyethers and Side-Chain Fluorinated Polymers Ref 1) Polymerization aid (PA) is the term to describe a surfactant, fluorinated or non fluorinated, used in fluoropolymer polymerization (ref 2) Certain, not all, fluoropolymer types can be manufactured without a fluorinated PA (ref 2) A fluorinated PA is required, in certain fluoropolymer types, to achieve properties, such as molecular weight and purity, necessary to meet critical performance requirements for various end use applications (ref 2) In certain cases, in order to meet performance needs, this can only currently be achieved when using fluorinated PA.

Sources:

Ref 1: IEAM 2011, 7(4):513-541. <https://bit.ly/3v7JZMP>

Ref 2: IEAM 2018, 14(3):316-334. <https://bit.ly/2YRZMDv>

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

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.

Given widespread use of fluoropolymers, and lack of acceptable alternatives, there is likely a multi-billion-euro impact in the broader value chain. Negative cross regional impacts such as disrupting long term supply agreements or impact on production assets in other regions, further limiting Europe's access to critical materials, could occur. Assuming no derogations, other regulatory exemptions, or determinations of "essentiality", a prohibition on the use of PFAS, as defined in the July 15, 2021, Registry of Intention, in the fluoropolymers industry could result in greater than €1B revenue losses on an annual basis in the EEA and greater than 500 European jobs could be directly impacted.

Source: <https://bit.ly/3BDIAAX>

Chemours APM business had global net sales of \$1.1B and \$1.3B in 2020 and 2019, respectively, and had net sales in Europe, the Middle East, and Africa of \$202M and \$258M in 2020 and 2019, respectively, reported in its 2020 Annual Report.

b) In 10 years.

Given widespread use of fluoropolymers, and lack of acceptable alternatives, there is likely a multi-billion-euro impact in the broader value chain. Negative cross regional impacts such as disrupting long term supply agreements or impact on production assets in other regions, further limiting Europe's access to critical materials, could occur. Assuming no derogations, other regulatory exemptions, or determinations of "essentiality", a prohibition on the use of PFAS, as defined in the July 15, 2021, Registry of Intention, in the fluoropolymers industry could result in greater than € 1B revenue losses on an annual basis in the EEA and greater than 500 European jobs could be directly impacted.

Source: <https://bit.ly/3BCbLmW>

Chemours APM business had global net sales of \$1.1B and \$1.3B in 2020 and 2019, respectively, and had net sales in Europe, the Middle East, and Africa of \$202M and \$258M in 2020 and 2019, respectively, reported in its 2020 Annual Report.

c) Please explain by providing your calculations.

Net sales numbers as reported in Chemours Annual Report on Form 10-K for the year ended December 31, 2020.

Full time equivalent impact was estimated based on customary minimum support for associated sales.

The definition of PFAS, stated in the July 15, 2021, Registry of Intention, was used without exceptions. It was

assumed the regulatory process would result in no derogations or other regulatory exemptions or determinations of any product use as “essential”.

What is the economic impact (euro) on your business/company, if the following measures will become mandatory? Please make your (indicative) calculations transparent.

a) A maximum concentration of e.g. 0.1% (or less) PFAS is set in mixtures and/or articles.

As this questionnaire defines PFAS broadly, implementing a maximum concentration of 0.1% or less is in essence a ban on the use of PFAS for most applications, including those utilizing fluoropolymers, including fluoroelastomers, and PFPE lubricants. This will remove essential components of the supply chain for vital end products in the EEA. Examples would include: fluoroelastomer O-rings, ion exchange membranes, PFA tubes, LAN cables, and many others.

Fluoropolymers play a critical role in achieving important societal goals such as the Green Deal and are vital to numerous segments of the EU economy because they are safe and have critical performance attributes.

b) Obligation to label your products visibly with "Contains PFAS".

Economic impacts to labels cascade down the value chain and each material supplier would need to ensure compliance with specific mandates and requirements concerning appearance, composition, and content. Fluoropolymers do not pose a significant risk to human health or the environment in their intended use because of their unique characteristics. Adding “Contains PFAS” to fluoropolymer product labels would result in a need for mass label changes without adding benefit to a material handler.

5.1.1c

c) Obligation to report amount of PFAS in use and respective emissions.

Chemours utilizes existing systems to track and report emissions for regulated chemicals and products. Additionally, we currently track emissions of PFAS compounds as part of our Corporate Responsibility Commitment (<https://bit.ly/3v4fYxn>). Based on this ongoing experience, the obligation to report amount of PFAS in use and respective emissions is estimated between 5.1.1c full-time-equivalent employees (FTE) for an EU manufacturing operation. This does not include additional costs to conduct testing and develop and implement additional monitoring and reporting systems.

d) Specific waste management requirements with the obligation to collect, treat or recycle PFAS containing waste separately.

Chemours currently has systems in place to collect, treat or recycle PFAS containing waste at our manufacturing facilities. Off-site management costs including management, transportation and treatment is estimated between

5.1.1c

annually depending on production.

e) In case you are using PFAS polymers: no PFAS processing aids are allowed during polymer production.

Fluoropolymers are specialty performance materials that have a unique combination of performance properties. Fluoropolymers play a critical role in achieving important societal goals such as the Green Deal and are vital to numerous segments of the EU economy because they are safe. PFAS polymerization aids are required, in some fluoropolymer types, to achieve properties necessary to meet critical performance requirements. If these requirements cannot be achieved, high-performance uses in critical applications to society in sectors such as electronics, aerospace, and energy would be severely jeopardized.

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

Specific questions for the use

If available, please provide data on the amount of fluorinated additives used in fluoropolymer production (kg/ton).

For the purposes of this question, Chemours considers the operational definition of “fluorinated additives” to be fluorinated polymerization aids (PAs). Between 5.1.1c of fluorinated PA are used per ton of PFTE, FEP, and PFA, with more than 99% recovered or abated. Reference: US patent (9,732,212 B2).

Chemours produces fluoroelastomers using between 5.1.1c of fluorinated PA per 1000 kg FKM produced. Reference: US patents 6,512,063B2, 6,646,077B1, and 6,774,164B2.

PFPE and Side-Chain fluorinated polymers are not produced with a fluorinated PA.

If available, please provide information on the production of PFAS alternatives.

Fluoropolymers are specialty materials selected and specified because they have a unique combination of performance properties that meet use requirements. Alternatives are not selected, because they do not meet use requirements.

Alternatives to side-chain fluorinated polymer (SCFP) durable water repellent (DWR) textile finishes have been commercially adopted for some textile products where performance criteria have been redefined, eliminating a requirement for oil repellency. For these textile products, non-fluorinated DWR finishes are in use. Chemours' product, Zelan™ R3, a non-fluorinated DWR, was created for these uses.

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.

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)

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	Expected trend (--/-/0/+ /++) ¹	Emissions/year in EEA ² (tonnes/PFAS)
	Low/High		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 on risk management measures to minimize the use, human exposure and emissions to the environment for your application of PFAS?

Yes

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

A substantial body of scientific data demonstrates fluoropolymers (FPs) do not pose a significant risk to water quality, human health, or the environment. FPs make specific contributions to several of the UN SDG including but not limited to Targets 3.6, 3.9, 7.3, 9.4, 12.2, 12.4 & 12.5 according to our 3rd party verified methodology, EVOLVE 2030. FPs are critical to this industry, which prioritizes safety as a critical property in their material selection and use. FP have negligible solubility in water and cannot enter or accumulate in a person's bloodstream. FP meet OECD's criteria for "polymers of low concern," do not present significant toxicity concerns and cannot degrade into other PFAS under normal conditions. Information on safe handling to minimize exposure and risk are within the material Technical Data Sheet and SDS. Industry associations have also published safe handling guides.

Plastics Industry Association: <https://bit.ly/3I7pbkY>

Plastics Europe: <https://bit.ly/3mFpzqH>

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 silsesquioxanes - 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

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

Short-chain fluorotelomer-based side-chain fluorinated polymers (SCFPs) ensure water repellency, oil repellency, stain resistance, dirt pickup resistance, and weatherability in TULAC products. These characteristics are essential for uses in vital applications such as life-saving PPE, medical equipment, and other crucial products. PTFE can be stretched biaxially to produce expanded-PTFE (ePTFE) membranes that retain many of the properties of PTFE resin, like biocompatibility, low dielectric constant and liquid penetration resistance, but can be produced with a tailored pore size. These ePTFE membranes find vital application in everything from medical textiles to ventilator filtration and are especially critical as the demand for these items increased with the COVID-19 pandemic.

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

No

Please specify why.

Hydrocarbon based alternatives are only technically viable for water repellency. Their performance is inferior related to oil repellency, stain resistance, dirt pickup resistance and weatherability, and therefore does not meet acceptable standards for vital applications (such as personal protective equipment) that require the combination of these properties.

Do you have information on the alternatives' risk profile?

Yes

Please describe.

Alternatives must meet both performance and safety (e.g., toxicity) criteria to be suitable. Fluoropolymers or fluorotelomers are selected because they have a combination of properties that specifically meet these requirements and provide unique protection. Failure-in-use may result in harm to workers (e.g., first-responders such as firefighters and workers in potentially harmful conditions who are uniquely protected by garments with PTFE membranes.)

Silicone or polysiloxane polymers are known to be manufactured using methylated cyclic siloxane monomers. Several of them (D4, D5) have been identified as SVHC whereas D6 has also been identified as SVHC because of D4/D5 impurities.

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.

Hazmat suits and chemical protective clothing are subject to a wide range of certifications and performance requirements, including the following standards: NFPA, 1991, 1992, and 1994, and EN 943-1/2.

Source: <https://bit.ly/2WO3I7i>

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

Chemours Teflon EcoElite(TM) (Zelan(TM) R3) finish is a bio-based and non-fluorinated stain repellent technology that repels water and water-based stains equivalent to PFAS products.

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

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).

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

Yes

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

A substantial body of scientific data demonstrates fluoropolymers (FPs) do not pose a significant risk to water quality, human health, or the environment. FPs make specific contributions to several of the UN SDG including but not limited to Targets 3.6, 3.9, 7.3, 9.4, 12.2, 12.4 & 12.5 according to our 3rd party verified methodology, EVOLVE 2030. FPs are critical to this industry, which prioritizes safety as a critical property in their material selection and use. FP have negligible solubility in water and cannot enter or accumulate in a person's bloodstream. FP meet OECD's criteria for "polymers of low concern," do not present significant toxicity concerns and cannot degrade into other PFAS under normal conditions. Information on safe handling to minimize exposure and risk are within the material Technical Data Sheet and SDS. Industry associations have also published safe handling guides.

Plastics Industry Association: <https://bit.ly/3I7pbkY>

Plastics Europe: <https://bit.ly/3mFpzqH>

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)

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

Fluoropolymers, including fluoroelastomers, (FPs) are well-suited for the extreme conditions of mining and oil & gas operations because they can resist a variety of demanding chemical environments and mechanical stresses, are non-stick and yield enhanced flow of liquids, and have unique electrical properties that allow for downsizing of cables used down-hole (e.g. data logging, trace heating and ESP power cables). FPs enable reliable and durable equipment, improving safety and affordability of mining and oil & gas operations. Due to their resilience, fluoroelastomers are used in fuel system sealants, O-rings and field equipment. FPs durability are also critical in downstream uses in rings, valves, and pumps.

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

No

Please specify why.

Non-PFAS alternatives are not technically feasible since they do not provide the functionalities required in the petroleum and mining industry. Fluoropolymers (FPs) combine thermal stability and chemical inertness required for pipes, wires, and equipment to function properly under harsh process conditions encountered in these industries.

Do you have information on the alternatives' risk profile?

Yes

Please describe.

While we cannot comment on the specific risk profile of any alternatives, alternatives must meet both performance and safety (e.g., toxicity) criteria to be deemed suitable. Fluoropolymers are selected and specified because they have a combination of properties that uniquely meet these requirements. Alternatives are not used, because they do not. There is substantial financial risk for alternatives that do not meet performance requirements of for example, thermal, mechanical and chemical stability both in the cost of maintenance and production interruptions, but more importantly, the cost of failure-in-use. Failure-in-use would result in substantial financial loss due to equipment failure and potentially destruction (e.g., loss of containment or fire). Importantly, failure-in-use may result in harm to workers and the public as well as the environment.

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) - methyl formate - methylal - CO ₂ / methyl formate
Foam blowing agent (open cell)	

	- CO₂ (water) - CO₂ (liquid) - CO₂ / ethanol - water blown foams
Fire protection	- inert gases (nitrogen and argon) - CO₂ - 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 - CO₂
	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 – CO₂ - no clean fluxes
Cover gas for magnesium casting	- SO₂ - argon - salt fluxes - powdered sulfur

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 tonnage should be adjusted?

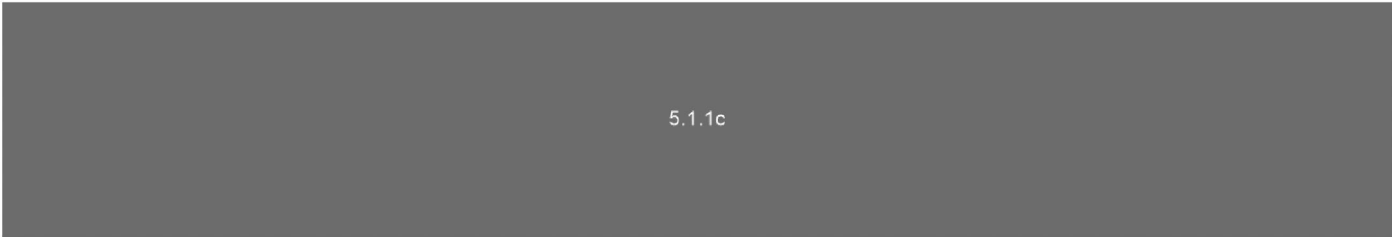
Yes

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

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.



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

Yes

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

A substantial body of scientific data demonstrates fluoropolymers (FPs) do not pose a significant risk to water quality, human health, or the environment. FPs make specific contributions to several of the UN SDG including but not limited to Targets 3.6, 3.9, 7.3, 9.4, 12.2, 12.4 &12.5 according to our 3rd party verified methodology, EVOLVE 2030. FPs are critical to this industry, which prioritizes safety as a critical property in their material selection and use. FP have negligible solubility in water and cannot enter or accumulate in a person's bloodstream. FP meet OECD's criteria for "polymers of low concern," do not present significant toxicity concerns and cannot degrade into other PFAS under normal conditions. Information on safe handling to minimize exposure and risk are within the material Technical Data Sheet and SDS. Industry associations have also published safe handling guides.

Plastics Industry Association: <https://bit.ly/3I7pbkY>
Plastics Europe: <https://bit.ly/3mFpzqH>

V. Questions - Section C - Electronics & energy
Questions in relation to alternatives (mainly for individual companies)

Sub-Use	Non-PFAS alternatives

Sub-Use	Non-PFAS alternatives
Electronics industry and semiconductor	For fluoroelastomers in sealing: ethylene propylene diene monomer (EPDM) and silicone rubbers For wire insulation: silicone 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?

Semiconductors rely on PFAs unique combination of properties to perform as the material of construction for processing equipment, fluid transport, and wafer handling tools due to purity and resistance to chemical attack. Semiconductor manufacturing is extremely intolerant of particulate, chemical, and metal contamination. PFAs prevent contamination, corrosion, and leaching in fluid-handling systems that support critical process fluids throughout fabrication. PF resin and coatings ensure communications equipment (i.e. cell towers, cabling) achieve speeds, capacity, and low latency that 5G requires. Ion-exchange membranes in flow batteries provide ionic resistance, mechanical properties, durability, and chemical stability. PFAs are used in fuel cells for thickness, conductivity, strength, resistance to water uptake, and chemical durability to handle intermittent renewable energy, operate at low temperatures, and tailor electrical output to meet dynamic power requirements.

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

No

Please specify why.

Non-PFAS alternatives are not technically feasible since they do not provide the functionalities (performance) required by these applications as the PFAS products. Fluoropolymers (FP) are chosen when the following combination of properties are required:

- High thermal stability: FP maintain physical, chemical, and electrical properties over extreme temperature ranges.
- Non-flammability and high melting-point. FP have the lowest heat of combustion of all known polymers. FP have the lowest rate of flame spreading, are difficult to ignite, and are self-extinguishing once the supporting flame is removed.
- Inertness to chemical attack and permeation: FP resist virtually all acids, bases, and solvents with very low chemical permeability.
- Low coefficient of friction: FP have the lowest coefficient of friction of any polymer.
- Electrical properties: FP have a low dielectric constant and dissipation factor with high volume and surface resistivity. They also have a very low moisture absorbance

Do you have information on the alternatives' risk profile?

Yes

Please describe.

While we cannot comment on the specific risk profile of any alternatives, alternatives must meet both performance and safety (e.g., toxicity) criteria to be deemed suitable. Fluoropolymers are selected and specified because they have a combination of properties that uniquely meet these requirements. Alternatives are not used, because they do not. There is substantial financial risk for alternatives that do not meet performance requirements of for example, thermal, mechanical and chemical stability both in the cost of maintenance, but more importantly, the cost of failure-in-use. Failure-in-use would result in substantial financial loss due to equipment failure (e.g., loss of connectivity) and potentially destruction (e.g., building damage or failure). Importantly, failure-in-use may result in harm to workers and the public as well as the environment.

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.

Properly processed components produced with fluoropolymer resins are used successfully in applications requiring SEMI F57 (Specification for Polymeric Materials and Components Used in Ultrapure Water and Liquid Chemical Distribution System) and SEMI C90 (Test Method and Specification for Testing Perfluoroalkoxy (PFA) Materials Used in Liquid Chemical Distribution Systems) compliance (<https://bit.ly/3Be1XPG>). As standards evolve for electronics, materials must meet stringent specifications for interface speed and differentiated electrical performance of FPs will be required (<https://pcisig.com/>).

Standards also need to be considered in hydrogen manufacturing and quality required for Fuel Cell applications: ISO 22735 for Hydrogen production by electrolyzer, ISO 14687 for hydrogen fuel quality, <https://bit.ly/2ZVruiU>, and <https://bit.ly/3iAKOsn>

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, ...)	?	+	?
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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 tonnage should be adjusted?

Yes

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

5.1.1c

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.

Fluoropolymers in Transportation Europe CAGR 20-25: 3.7% - 5.1.1c

Fluoroelastomers in Transportation Europe CAGR 20-25: 1.6% - 5.1.1c

PFPE in Transportation Europe CAGR 20-25: 2% - 5.1.1c

Do you have information on risk management measures to minimize the use, human exposure and

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

Yes

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

A substantial body of scientific data demonstrates fluoropolymers (FPs) do not pose a significant risk to water quality, human health, or the environment. FPs make specific contributions to several of the UN SDG including but not limited to Targets 3.6, 3.9, 7.3, 9.4, 12.2, 12.4 & 12.5 according to our 3rd party verified methodology, EVOLVE 2030. FPs are critical to this industry, which prioritizes safety as a critical property in their material selection and use. FP have negligible solubility in water and cannot enter or accumulate in a person's bloodstream. FP meet OECD's criteria for "polymers of low concern," do not present significant toxicity concerns and cannot degrade into other PFAS under normal conditions. Information on safe handling to minimize exposure and risk are within the material Technical Data Sheet and SDS. Industry associations have also published safe handling guides.

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Plastics Europe: <https://bit.ly/3mFpzqH>

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 applications, 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 (CO₂)
Health protection and lifesaving equipment	?

(incl. firefighting, life vests, life rafts, airbags, ...)	
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What is the specific application/functionality of PFAS in your product(s)/processes?

Fluoropolymers (FPs), including fluoroelastomers, and perfluoropolyethers (PFPEs) play a critical role in the transportation industry and are used in many components of cars, trucks, and aircraft. They are critical for high performance over a wide range of harsh operating conditions and contribute to both passenger safety and emission controls. FPs combine thermal stability, chemical resistance, excellent electrical properties, resistance to swelling and permeability and low coefficient of friction. PFPEs are non-flammable, chemically inert and thermally stable while providing excellent lubricity at temperature extremes. Ionomers, specialized fluoropolymers with ionic properties, are used in ion exchange membranes (IEMs) that provide mechanical and chemical stability while delivering high proton conductivity. IEMs are critical components in fuel cells, while other FPs find use in batteries, sensors and circuits that are enabling the evolution of the transportation industry.

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

No

Please specify why.

Non-PFAS alternatives are not technically feasible since they do not provide the functionalities required by the transportation sector. The characteristics of FPs and PFPE lubricants enable functionality in vehicles, airplanes, spacecraft and other modes of transportation that cannot be matched by any current alternative. FPs and PFPEs are typically more expensive than other polymers or lubricants. Their use is typically reserved for applications where alternatives present a major safety risk (i.e. fire or explosion), are not economically viable (i.e. service life at operating conditions) or simply do not meet performance standards. Often, applications and equipment are specifically designed to exploit the unique combination of properties provided by FPs and PFPEs. More information regarding PFPE lubricants is provided in the Lubricants section of Chemours' response.

Do you have information on the alternatives' risk profile?

Yes

Please describe.

While we cannot comment on the specific risk profile of any alternatives, they must meet both performance and safety (e.g., toxicity) criteria to be deemed suitable. Fluoropolymers (FPs), including fluoroelastomers, and PFPEs are selected and specified because they have a combination of properties that uniquely meet these requirements. Alternatives are not used, because they do not. Modern transportation emission standards could not be achieved with alternatives. There is also substantial financial risk for alternatives that do not meet

performance requirements (e.g. thermal, mechanical, and chemical stability) both in the cost of maintenance, but more importantly, the cost of failure-in-use. Failure-in-use could result in substantial financial loss due to equipment failure and potentially destruction (e.g., fire or explosion in oxygen-rich environments). Importantly, failure-in-use may result in harm to vehicle operators, passengers, and the public – as well as the environment.

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.

Vehicles sold in the EU market must meet numerous regulations, including emission standards (<https://bit.ly/3BdHc6H>), EU General Safety Regulations (<https://bit.ly/3mnHQIO>), and Clean Vehicles Directive (<https://bit.ly/3itX5yv>).

Fluoropolymers (FPs) are necessary to meet EURO 6 vehicle emission standards, with Euro 7 expected to be more stringent. 2025 / 2030 targets set out in the CO2 Emission Standards Regulation will be important for battery and fuel cell operated vehicles, both of which require FPs.

ISO standards relevant to FP applications in automotive cables:

ISO 6722: <https://bit.ly/3DdjYhS>

ISO 14572: <https://bit.ly/3FgIS1O>

ISO 19642: <https://bit.ly/3A984n9>

Specifications and standards are vehicle manufacturer (OEM) specific depending on the application and often specify the type of FPs or perfluoropolyether to use. Specific physical and other properties such as sealing properties and permeation or chemical resistance are specified. <https://bit.ly/3lh4tiV>

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 restriction proposal the assessment of the transportation sector encompasses: 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)

Are applications missing in the overview above? If so, please name them. Where possible, refer to literature/public sources.

Fluoropolymers (FPs), including Fluoroelastomers, and perfluoropolyethers (PFPEs) find use in a broad range of applications in the transportation sector. The sites linked below provide a more comprehensive overview of current applications

<https://bit.ly/APMRef26>

<https://bit.ly/3AlboeQ>

<https://bit.ly/APMRef18>

However, it must be pointed out that transportation is undergoing a significant transition to electrification. FPs and PFPEs find unique application as components of lithium-ion batteries, fuel cells and electric motors / powertrains and will play a critical role in the next generation of transportation.

PlasticsEurope: <https://bit.ly/3oKonon>

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.

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.).

There is no statistical difference between baseline PFAS emission levels and PFAS emission levels associated with incineration of polytetrafluoroethylene (PTFE) in a large pilot-scale facility representative of a municipal energy from waste (EfW) plant (<https://bit.ly/3A7HURB>.) Accordingly, municipal EfW combustion of PTFE is not a significant PFAS emission source. When feeding elevated levels of fluorine in the form of PTFE for this testing, the authors noted "The fluorine content in the fly ash could be neglected compared to the HF [in the flue gas prior to control]."

Discharges of total fluorine from a European municipal EfW plant distribute as follows: 83-85% to bottom ash, 13-16% to fly ash, <1% to wastewater, <1% to wastewater treatment sludge, and <1% to atmosphere as cleaned flue gas (<https://bit.ly/2YgWJ7P>). Figures 3.3, 3.4, 8.6, and 8.7 show the high degree to which plants achieve the 1 mg/Nm³ for hydrogen fluoride (HF) emission limit.

If available, please provide information on PFAS recycling.

Out of the 52,000 tonnes of fluoropolymers going into the EU market per year in 2015, 30,000 tonnes stay in use (more than 50%), showing their durability (Plastics Europe – Fluoropolymer Product Group). The largest sources for end-of-life (EOL) fluoropolymers are the chemical industry and EOL vehicles (75% of total FP waste), which ensures the majority of FP waste is goes through a fully controlled waste stream.

Fluoropolymer manufacturers are working with users to recycle and reuse (Pro-K 2018) including: Primary recycling: direct reuse of ground PTFE; Secondary recycling: fluoropolymer thermo-mechanical processing or irradiation to create additives for other plastics; and Upcycling: pyrolysis yielding TFE and HFP monomers (Schlipf 2014: <https://bit.ly/3AaWaJi> Invertec 2017: <https://bit.ly/3uGyrzH>, Pro-K 2018: <https://bit.ly/3Bb7W82>).

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.

Finish