Joint statement on the importance of fluoropolymers for the clean energy transition and the EU's Net Zero Industry

We, the Co-Signatories of this joint statement, represent the key sectors needed to achieve the EU's strategic autonomy and enable the digital and clean energy transitions, including Net Zero technologies[1] that are necessary to reach the EU's climate and energy objectives. **To avoid the dire consequences for the EU's clean technology sectors, with this joint statement on the importance of fluoropolymers for the clean energy and digital transitions and the EU's Net Zero Industry, we call on the ECHA and the European Commission to consider an exemption for fluoropolymers from the universal PFAS restriction**.

Renewable energy technologies, hydrogen and hydrogen-related technologies, batteries and other flexibility solutions for the energy system, refrigeration, air conditioning and heat pumps, CCUS[2], zero emission vehicles as well as the associated infrastructure, and aerospace sectors are essential to decarbonise the EU economy, to ensure the needed reliable energy supply while decreasing dependency from imported oil and gas. These net zero technologies are also reliant of the upstream value chain, such as semiconductors, machinery and equipment, and electronic manufacturing sectors, which at the same time are under unprecedented pressure from global competition and are proving to be essential in enabling the EU's overall competitiveness. The proposal for a Net Zero Industry Act (NZIA) and the CHIPS Act reconfirm the strategic character of these technologies and sectors. We, Co-Signatories, firmly stand behind those very ambitious and vital objectives enshrined in these policies.

The ramping up of clean technology manufacturing needed to deliver these ambitions represents a tremendous challenge. To unlock the necessary investment in manufacturing capacity, safe and reliable access to critical raw materials (CRM) and advanced materials are essential. In the annex of this letter, you can see how fluoropolymers are used across the different sectors represented by the signatories. For most uses, they provide the best combination of conductivity, chemical/thermal stability, and mechanical strength under harsh use conditions. They have been researched, tested, and developed across decades and are now essential and integral parts of our highly specialised technologies.

The Per- and polyfluoroalkyl Substances (PFAS) restriction proposal drafted by five European countries and presented to the European Chemical Agency (ECHA) in January 2023 is an important pillar to the EU's Chemicals Strategy. Now in the hands of the ECHA, we acknowledge the rationale of the restriction proposal to further regulate PFAS and we support such efforts. However, **such a restriction could have dire consequences for the EU's clean technology sectors supported by the NZIA if it takes a PFAS group approach including fluoropolymers while not factoring in the substances' specific profile[3], not judging them on their merits**. PFAS are a class of thousands of chemicals, each with their own safety profile and utility. **It is crucial that the restriction considers essentiality of uses, availability of mature alternatives,[4] socioeconomic, industrial, and environmental impacts, positive contribution of future innovations on fluoropolymer technology, proportionality, and consistency with other policies and wider objectives**. Clean technologies are essential for the green transition and energy security, and thus, need an incentivising regulatory framework to thrive, including with regards to key materials access.

[1] According to the EC proposal for a Net Zero Industry Act (NZIA)
[2] CCUS: carbon capture utilisation and storage
[3] Fluoropolymers are persistent (a main requirement for its industrial use) but chemically and biologically stable, non-bio accumulative, non-bioavailable and non-toxic during their intended use phase (cf. Henry et al. 2018 and Korzeniowski et al. 2023).
[4] E.g., for fluoropolymer manufacturing, the industry is continuously working on R&D programmes for the development of technologies to transition away from the use of fluorinated polymerization aids (PFAS), thus addressing PFAS emission concerns related to the manufacturing phase of fluoropolymers

Unfortunately, the restriction proposal fails to recognise that fluoropolymers meet OECD requirements as polymers of low concern.[5] Using these criteria, research has shown that fluoropolymers are safe and do not pose a significant risk to human health or the environment when used for their intended purposes. They do not present significant toxicity concerns, cannot degrade into other PFAS, and are not "bioavailable", "bioaccumulative" or water soluble. Beyond their unique properties including durability, mechanical strength, inertness, thermal stability, and resistance to chemical, biological, and physical degradation, emissions related to fluoropolymers occur mostly during their production and (potentially) end-of-life phases, and these can be more effectively addressed through existing and new targeted regulations.

Regardless, the proposal by the five countries uses a grouping approach based on chemical structure, thus also including fluoropolymers and perfluoropolyethers and, in doing so, makes assumptions and false equivalencies about the hazards and risks of using fluoropolymers and perfluoropolyethers. In using this approach, it risks creating a disproportionate effect that endangers both established and new industries.

The Co-Signatories fully acknowledge the issue of lifecycle emissions of fluoropolymers and the need to address it. To do so, we believe a restriction is not the proportional policy tool and other options should be considered. Manufacturing emissions may be better addressed through adaptation of existing legislations, such as the Industrial Emissions Directive, while the Manufacturing Programme for European Manufacturing Sites launched by the key producers effectively sets the highest standards for fluoropolymer manufacturing worldwide, going well beyond current European regulatory standards[6]. End-of-life emissions (if deemed necessary based on credible evidence)[7] may be better dealt with through adapting the EU Waste Framework Directive or relating files. Before any legislative adjustments are introduced, more research is needed to better detect the specific fluorinated materials.

Our sectors intrinsically depend on each other and a holistic approach is needed to allow our industries to enable the digital and energy transitions and for the EU to meet its climate objectives. With the proper legislative framework in place to address fluoropolymers' lifecycle emissions, **the European Commission and the European Chemicals Agency should grant an exemption for fluoropolymer production (including relevant raw materials) and use in industrial applications**. This exemption should be coupled with the development of an appropriate regulatory framework as mentioned above.

The Co-Signatories remain available to submit the necessary data and to engage with institutional actors to address the mentioned issues and to allow for the safe and continued use of fluoropolymers.

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[5] Korzeniowski, S.H., et al. (2022), A critical review of the application of polymer of low concern regulatory criteria to fluoropolymers II: Fluoroplastics and fluoroelastomers. Integr Environ Assess Manag. https://doi.org/10.1002/ieam.4646, and Henry et al. (2018), A critical review of the application of polymer of low concern and regulatory criteria to fluoropolymers, Integrated Environmental Assessment and Management published by Wiley Periodicals, Inc. on behalf of Society of Environmental Toxicology & Chemistry (SETAC), Volume 14, Number 3, pp. 316-334. Retrieved on: https://setac.onlinelibrary.wiley.com/doi/10.1002/ieam.4035.

[6] https://fluoropolymers.plasticseurope.org/application/files/7116/9529/6091/Press-Release-FPG-Manufacturing-Programme.pdf

[7] See Krasimir Aleksandrov, Hans-Joachim Gehrmann, Manuela Hauser, Hartmut Mätzing, Daniel Pigeon, Dieter Stapf, Manuela Wexler, Waste incineration of Polytetrafluoroethylene (PTFE) to evaluate potential formation of per- and Poly-Fluorinated Alkyl Substances (PFAS) in flue gas, Chemosphere, Vol. 226, 2019, pp 898-906 (https://doi.org/10.1016/j.chemosphere.2019.03.191), and Dr. Gehrmann, Hans-Joachim, Dr. habil. Bologa, Andrei, Dr. Aleksandrov, Krasimir, Bergdolt, Philipp, Dr. Taylor, Philip, Dr. Schlipf, Michael, Dr. Ameduri, Bruno, Gunasekar, Priyanga, Kapoor, Deepak, Pilot-Scale Fluoropolymer Incineration Study: Thermal Treatment of a Mixture of Fluoropolymers under Representative European Municipal Waste Combustor Conditions, (2023)

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Annex - short description of fluoropolymers used per sector

Hydrogen

Fluoropolymers are used all across the hydrogen value chain. Membranes for PEM electrolysers and fuel cells are made of fluorinated ionomers (typically reinforced with Polytetrafluoroethylene (PTFE)). Alkaline electrolysers and fuel cell systems, as well as solid oxide electrolysers and anion exchange electrolysis technologies are also highly dependent on fluoropolymer components. More widely, fluoropolymers like PTFE, FKM, FFKM, FEPM, FEP are essential also in gaskets, as sealants, binders, or coating materials, in tubing, piping, in hydrogen grid technologies and many of its various end-uses. There are currently no alternatives available that match fluoropolymers' unique performance, resistance, mechanical and chemical stability, and, especially, durability (which current research tracks still drastically lack of). Any alternatives to PFAS-containing products are highly unlikely to be deployable and scalable in the near future (and, even more so, within the derogation period of the restriction proposal). Please find more information in Hydrogen Europe's input to the ECHA consultation on the matter (submission no. 4144).

Wind

The wind industry is reliant on other sectors where fluoropolymers are indispensable and irreplaceable, most notably the lubricants and semiconductors sectors. Direct of use of fluoropolymers by the wind industry is limited to certain niche applications. Examples are certain bearings and plain bushings in the wind turbine rotor, and rotor blade locking systems and release films (protective layers used in the blade manufacturing process to ensure blades do not stick to their moulds. In addition, certain protective coatings and paints may contain fluoropolymers. However, the use of fluoropolymers in these latter applications is often not critical and substitution materials may become or already be commercially available.

Batteries

Battery manufacturers are using a very limited number of PFAS, widely dominated by polymers of low concern. Fluoropolymers such as PTFE and PVDF are the main types of PFAS used in key components of batteries. For example, PVDF and PTFE are used in binders, in solid electrolyte/gel polymer electrolytes and in coatings on the separator of batteries. PTFE is used in gaskets, washers and in oxygen permeable membranes used in batteries. FEP, FKM, PFA, VDF-HFP are also used in gaskets and washers.

Fluoropolymers have unique properties which is why they are used in batteries – they are water, oil and dirt repellent; they are durable under extreme conditions (such as high temperature, high pressure and aggressive chemicals) and they provide efficient electrical and thermal insulation. For most uses of fluoropolymers in batteries, there are currently no non-PFAS alternatives. Non-PFAS alternatives require much research and development, commercial upscaling, extensive electrochemical and mechanical performance and safety testing to be on par with batteries available today. This will take longer than the transition periods and derogation times proposed in the PFAS restriction proposal. Therefore, it is highly unlikely that non-PFAS alternatives will be deployable and scalable in the near future. PFAS emissions across the battery value chain are controlled during the manufacturing and recycling process and since PFAS is embedded well within the battery there is no direct contact of PFAS to consumers during battery use.

Semiconductors

The semiconductor industry relies upon the use of PFAS for critical applications across its supply chain. Their exceptional physiochemical properties – Low surface tension, chemical and thermal stability, purity, high resistance to permeation and corrosion, and non-flammability – provide them a high degree of functionality for thousands of semiconductor manufacturing applications, thereby allowing chemicals and articles made with them to satisfy multiple and overlapping technical requirements simultaneously.

Critical applications of PFAS in semiconductor industry are including but not limited to 1) the chemicals (Photoresists) and special gases (such as CF4, C2F6, C4F8 and C5F8) utilized for photolithography, etching and cleaning processes to incise and fabricate semiconductors, 2) the semiconductor interconnects, capacitors and insulators, and 3) the semiconductor manufacturing equipment (such as dry retching and film deposition tools) and factory infrastructure (such as chemical and ultra-pure water distribution systems). While there is some potential for discovering or inventing replacements in the long term, currently no known alternatives exist for most of the uses of PFAS by the semiconductor industry across their supply chain, thus requiring alternative substances to be researched, developed and potentially applied into mass production to be recognized as viable alternatives. For further information please consult the SEMI PFAS Explainer.

Automotive

The automotive industry is a major downstream user of many PFAS, including fluoropolymers, fluorinated gases, and short-chain PFAS. Fluoropolymers are used for several key technical components, such as gaskets, hoses, joints, O-rings, seals, cords, cables, or sleeves. Fluoropolymers and fluoroelastomers are vital engineering materials that improve CO2e performance of our vehicles and enhance the durability of our components. Data from the automotive industry's International Material Data System (IMDS), taken in Q1 2022, shows the breakdown of reported PFAS in the industry: Nearly 8 million automotive parts contain PFAS substances under the scope of the proposed Restriction. Over 5 million of these parts contain fluoropolymers and fluoroelastomers. The biggest reported PFAS is PTFE fluoropolymer, which is used in nearly 4 million automotive parts. PTFE counts for nearly 50% of the total reported PFAS in automotive parts and more than 70% of fluoropolymer uses.

Geothermal

Fluoropolymers are widely used in the geothermal sector. They are incorporated in equipments used for drilling, well completion, production pumps, sensors, cables and geothermal heat pump systems. At present, substitutes are not available on the market. We recommend adequate supporting measures to allow for their development and demonstration.

Machinery and equipment manufacturing

The manufacturing process of existing and future technologies was not covered as a sector by the dossier submitters for the universal PFAS restriction. Based on the current restriction proposal all manufacturers in the mechanical and plant engineering industry would be affected either in their products or in their production line. For example, hydraulic components, pumps, motors and valves, as well as fittings and compressors are highly affected and widely used in the industry. PFAS, mostly fluorinated polymers (e.g. PTFE, ETFE, FEP, PFA, PVDF, FKM), are often used, for example, in seals, hoses, wires and coatings. PFAS-containing materials are needed in machinery and equipment whenever extreme conditions (high or low temperatures, high frictional resistance, aggressive/corrosive/toxic chemical conditions or a combination of these) prevail. Therefore, most existing industrial plants and applications often do not have equivalent alternatives to the expensive PFAS, which - due to their high price alone- are not used carelessly. Further information can be found in VDMA submissions into the ECHA consultation.

Power Plants (turbine and engine-based power & heat generation)

Fluoropolymers are incorporated into many core components of power plants. Polytetrafluoroethylene (PFTE) is used in components such as rotary shaft seals, valves, electrodes, tubing, cables and gaskets given its low friction properties to prevent leaks and keep contaminants from entering the system. Additionally, Fluorine rubber (FKM), fluorocarbon rubber (FPM) and Tetrafluoroethylene propylene (FEPM) are used in sealings for their resistance to high temperatures, toxic and flammable chemicals. The restriction would constitute a major risk to the existing electricity system at European level due to the lack of replacement components needed also for the maintenance and service of existing plants. As consequence existing power plants may have to be stopped. The use of alternative, PFAS-free components is, at least for now, highly unlikely, as there are no identified replacements in a development stage advanced enough to be deployed at the required scale in the upcoming years. The absolute quantities of fluoropolymers used in power plants are comparably small and the use takes place in protected operating environments with very little risk of uncontrolled release to the environment during use and end-of-life.

Industrial, medical and specialty gas industry

Fluoropolymers are needed at all levels of the distribution and utilisation of industrial, medical and specialty gases: in equipment for cryogenic and low-temperature service, for gas storage and transport; in the gas distribution network and in connections between equipment. The sector uses fluoropolymers for their specific properties. PTFE for its high self-ignition temperature and low heat of combustion in an oxidising environment; in mixtures with other materials such as metals, ceramics, used as self-lubricating bearings, for their chemical resistance and low friction, reducing wear and extending equipment life. PTFE-coated hoses for filling gas in cylinders, for their chemical resistance and compatibility with flammable, corrosive and toxic gases. Fluoropolymer seals (PTFE, PCTFE, FKM), gaskets and O-rings, which ensure the tightness and functionality of equipment in gas and cryogenic applications, critical for process safety. In addition to gas supply problems in other sectors, a ban on fluoropolymers would jeopardise the supply of gases to the medical sector or critical industries, including green hydrogen (cryogenic and gaseous) to enable supply for EU decarbonisation targets, and specialty gases (rare gases, calibration gases, toxic and corrosive gases) and electronic gases and liquids used in the semiconductor industry.

Bulk storage

Bulk storage terminals store oil, gas, food, feed, fats, chemicals etc. and are present in ports, airports, logistic platforms and along rivers, canals, and pipelines. Such terminals hold the strategic energy reserves mandated by the International Energy Agency, as well as NATO fuel stocks. They will be critical to enable the import, export, and European logistics infrastructure for clean products. For example, investments and pilot projects are in progress for storage of CO2, clean chemicals, hydrogen carriers including LOHC, methanol and ammonia, e-fuels, and critical raw materials. Storage infrastructure will continue to provide a buffer to the EU economy and supply chains for energy transition compliant energy carriers and industrial inputs, as they do today with existing carriers. In this context, fluoropolymers are essential in manufacturing valves, gaskets etc. to enable storage infrastructure to function safely and efficiently.

Refrigeration, Air-Conditioning, and Heat Pump (RACHP) equipment

Fluoropolymers that fall under the PFAS definition in the proposal are widely used in RACHP components such as compressors, valves, controls, variable speed drives, leak detection electronics, etc. These systems require sealing materials and bearings that can withstand high pressures, and a wide range of temperatures to operate at their best. This specifically includes PTFE, PFA, FEP, FKM FEPM, ETFE, PVDF, PFPE. Those fluoropolymer materials are highly resilient and provide excellent sealing and frictional properties that are required to minimise leakage of refrigerants and provide energy efficient (low friction) bearings. Such leakage leads to both direct greenhouse gas (GHG) emissions and to reduced energy efficiency and therefore increased energy-related (indirect) GHG emissions.