COMMITTEE FOR EUROPEAN
CONSTRUCTION EQUIPMENT

Brussels, 22 September 2023

CECE comments regarding the Consultation on Annex XV report on PFAS

Recommendations:

1. **Anticipating that an 18-month transition period will be conducive to impeding our supply chains with durable and severe repercussions on the Single Market in addition to imperiling the EU Green Deal and its circularity objectives, CECE requests ECHA to provide for transition periods of four to eight years in keeping with our industry's specificities. On principle, applications of PFAS should be allowed until the full-scale availability of technically suitable, commercially viable and irrefutably safe alternatives can be demonstrated.**
2. **CECE calls upon ECHA to level the playing field between industries that share supply chains and technologies and request ECHA to grant the construction equipment industry, at the very least, the same derogations for the applications of refrigerants as the ones granted to the automotive industry.**
3. **Similarly, CECE calls upon ECHA to grant the construction equipment industry, at the very least, the same derogations for the use of PFAS in applications affecting the proper functioning related to its safety, its operators, workers/users, and goods in addition to proposing a 13.5-year derogation after entry into force.**
4. **CECE stands for an exclusion of fluoropolymers (including fluoroelastomers and polytetrafluoroethylene) from this restriction proposal or, at the very least, a 13.5-year derogation after entry into force for our essential fluoropolymers uses on O-rings, seals, coatings, hoses, clutch plates alongside brake friction disks. CECE invites ECHA to work on restrictions of high-risk PFAS instead of adopting the Dossier Submitters' 'one-ban-fits-all' approach.**
5. **In case of any fluoropolymers (including fluoroelastomers and polytetrafluoroethylene) restriction, CECE requests a general 13.5-year derogation after entry into force for all other**

essential PFAS uses on O-rings, seals, coatings, hoses, clutch plates alongside brake friction disks.

6. **Having regard to the magnitude of this restriction proposal, CECE would like to invite the Commission to periodically exercise its implementing powers, conferred by Article 133 of Regulation (EC) No 1907/2006 ('REACH'), with the aim of reevaluating and redefining the duration as well as the scope of the derogations proposed or for reconsideration, following stakeholder consultations.**
7. **Considering that the revision of REACH is likely to take years, CECE calls upon the Commission to publish, at its earliest convenience, a Communication delineating the Essential Use concept and its methodology in future substance restrictions under REACH.**
8. **CECE stands for a cross-sector 13.5-year derogation after entry into force for uses of PFAS in Li-ion batteries.**
9. **Uses of PFAS in spare parts, remanufactured, refurbished, or second-hand products should benefit from a permanent derogation.**

Table of Contents

<u>Introduction</u>:

The Committee for European Construction Equipment (CECE) welcomes the opportunity to contribute to the public consultation organised by the European Chemicals Agency (ECHA) on the PFAS restriction proposal. CECE represents the construction equipment sector's durable and innovative machinery which are working tools to help build the houses, offices, factories, roads, railways and bridges that serve citizens across the globe. Manufacturers invest and innovate continuously to deliver equipment with highest productivity and lowest environmental impact. In the same vein, efficiency, safety and high-precision technologies play a pivotal role. In that regard, as a forward-looking industry, we are contributing to the EU Green Deal and digital transformation. The PFAS restriction proposal may jeopardise the fulfilment of the objectives of the Green Deal and, if applied as is, would drastically affect our sector's supply chains, halting the manufacturing of our products.
In October 2021, CECE contributed to the second public consultation on a restriction for PFAS organised by the competent authorities for REACH of the Netherlands, Germany, Denmark, Sweden, and Norway. Within the framework of ECHA Stakeholder consultation and having regard to the PFAS restriction proposal, we would like to submit the following evidence-based comments.

PFAS are vital for our industry. These substances have been selected precisely for their durability and reliability which contribute substantially to the safety of products. The Dossier Submitters' one-ban-fits-all approach on a hugely diverse group of PFAS with varying risk profiles creates a disproportioned burden for a huge portion of the supply chain. Construction equipment applications often require demanding technical requirements due to the challenging environments in which those types of machines operate. Manufacturers design their products to operate for decades under extremely harsh and demanding environments. Materials, parts, and complex components need to meet rigorous design and testing requirements to ensure critical functions operate safely, continuously, and effectively on the jobsite. The specific characteristics are determined by the technical function of the component/system but can be generally described by the Annex I table breaking down the challenging environment wherein construction equipment operates on a regular basis. It is essential that any replacement material meets the necessary performance requirements and still offer durability, quality, and safety of PFAS.

Annexes II (summary table) and III (survey among CECE members) summarize our industry's PFAS applications and sub-uses. We have assessed the minimum cost, for a large company within our industry, which would amount to €100 M in Research & Development (R&D) if the restriction proposal is brought into force as currently proposed. The cost for changes and re-investment in manufacturing has yet to be determined but it is expected to be significant as well.

CECE wishes to provide ECHA with the below data set, as an overview of our sector, to better introduce CECE's role in the European Union (EU)'s economic landscape.

Source : https://www.cece.eu/our-sector-in-figures

Methodology:

Our input to this Stakeholder Consultation predominantly encapsulates industry-generated data that were anonymized and merged due to their business confidential nature. They originate from multiple CECE members which possess operating plants across the European Union and all over the world. CECE members scrutinized their supply networks and reported on the presence of PFAS in both their manufacturing activities and their multiple supply chains. In addition, CECE carried out a literature review to reference academic studies on PFAS drawing on latest research.

CECE decided to respond to this stakeholder consultation by outlining key substances, covered by the PFAS Restriction Proposal, representing, to the best our knowledge, the majority of applications and sub-uses specific to the construction equipment industry.

1. General comments on proposed 18-month transition period

In view of the amplitude of this restriction proposal, a transition period longer than the proposed 18-month timespan would enable the construction equipment industry to continue developing sustainable substitutions, placing safe and durable products on the market and, ultimately, reducing waste generation. As recently proposed by Orgalim[1], representing Europe's technology industries, transition periods of four to eight years after entry into force would facilitate transition and mitigate possible socioeconomic impacts. In light of the Commission's exercise of its powers to adopt delegated acts, under Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment, longer transition periods would be more consistent with today's industrial realities.

Recommendation 1:
Anticipating that an 18-month transition period will be conducive to impeding our supply chains with durable and severe repercussions on the Single Market in addition to imperiling the EU Green Deal and its circularity objectives, CECE requests ECHA to provide for transition periods of four to eight years in keeping with our industrial sector' specificities. On principle, applications of PFAS should be allowed until the full-scale availability of technically suitable, commercially viable and irrefutably safe alternatives can be demonstrated.

[1] https://orgalim.eu/position-papers/green-transition-orgalim-position-and-recommendations-proposed-pfas-restriction

2. Comments on proposed restriction of Fluorinated Gases (F-Gases)

Refrigerants, such as R-134a and R-1234yf, are used for heating, ventilation, and air conditioning (HVAC) systems. The construction equipment industry utilizes refrigerants (containing PFAS) to fulfil various health, safety and ergonomic requirements to cool down operator stations. These fluorinated gases (especially R-1234yf) present non-corrosive and non-toxic characteristics with a low global warming potential (GWP), zero ozone depleting potential (ODP) and a low boiling point.

a. Refrigerants

The EU regulatory framework already provides for the control and prevention of exposure, including leakage, in addition to requiring proper service personnel training. All currently available solutions are either intended to be banned or present an extreme risk to health and safety of the machine operator due to their flammability (e.g., ammonia, propane, and isobutane). First estimates by our industry foresee a 7-year timeframe needed to develop a commercially viable and available alternative (cf. below table)[2]. CO2-based air conditioning systems are being explored by the automotive industry, but the viability for production in the near future has not yet been demonstrated. For lack of drop-in substitute for PFAS, our industry estimates that, upon identification of a suitable alternative, a 20 to 25-year timespan is needed to make any alternative substance operational across our complex supply chains. This alternative development process entails lengthy steps such as the revision of data collection and information exchange systems, training, formatting of information, testing, validation, and certification among others.

ACTIVITY	TIME
IDENTIFICATION	
IDENTIFY ALL SUBSTANCES CLASSIFIED AS PFAS FROM REG. LIST	1 months
IDENTIFY HIGH RISK COMPONENT TYPES	6 months
CREATE LIST OF AT-RISK PARTS AND SUBCOMPONENTS	6 months
UPDATE INTERNAL DATA COLLECTION AND COMPLIANCE SYSTEMS	9 months
SUPPLIER COMMUNICATION AND TRAINING	3 months
REQUEST DATA FROM SUPPLIERS	12 months
FORMAT DATA, CHECK ACCURACY & STORE DATA	1 months
TOTAL	38 months
VALIDATE AND TEST	
VALIDATE PIP PFAS PRESENCE WITH SUPPLIER	1 months
INVESTIGATE ALTERNATIVE MATERIAL	6 Months
PROCURE PROTOTYPE MATERIALS	6 Months
COMPONENT VALIDATION OF NEW MATERIAL	6 Months
PRODUCT VALIDATION WITH NEW MATERIAL COMPONENTS	12 Months
TURN INVENTORY TO PURGE SUPPLY CHAIN & ENSURE COMPLIANCE	6 Months
TOTAL	37 months
RECERTIFICATION	
RECERTIFICATION	12 Months
TOTAL	87 Months

Table enumerating the logistical challenges in case of PFAS general prohibition

[2] AEM, 2023, *The Essential Societal Benefits of Per- and Polyfluoroalkyl Substances in Non-Road Equipment* (Accessible upon request only)

b. Air conditioning

Air-conditioning systems are vital to provide operators of construction machinery with a controlled temperature in the cabin, allowing them to operate machinery in a safe way without adverse effects to their health. There are currently no commercially viable alternatives meeting our HVAC system requirements. The continued usage of R134a or R1234yf is necessary. The derogation for those systems is crucial. With no derogations, the construction equipment industry will have no choice but to place machines without air conditioning on the European Union market, which would be extremely detrimental to the health of operators. Therefore, the safe operations of the machine may be at risk due to an unhealthy and unsafe working environment.

Sales of machines without air conditioning would be seriously impacted both in the EU and in non-EU countries. Most markets require air conditioning for their operators' comfort and safety. All over the world, the EU-manufactured construction equipment is oftentimes a critical equipment which is solely dependent on the import market for these countries. Without air conditioning, our exports to these countries, with extremely hot temperatures all year long, would be brought to a halt almost overnight.

The research costs and development time for alternatives is still unknown to us, but to verify innovative solutions into our equipment would have an estimate cost of €25M, in the case of a large enterprise, and the time for development and verification will span over seven years upon making an alternative available. CECE stands for an extensive derogation period. As in most other sectors engineering resources are scarce hence the resources that will have to be mobilized to redevelop air-conditioning systems will adversely affect the development of battery-electric machines alongside other green transition technologies. Out of the €25M approximately, €15-20M are related to workforce, and the remainder lies in testing and prototypes. Additionally, testing capacities of manufacturers and independent testing companies will be overloaded due to the new requirements which can result in unwanted delays in deliveries and in loss of business for the end user.

The usage of F-gases in the machinery is not only needed for HVAC, but also for cooling batteries and electrical cabinets in the larger battery-electric machines. This application needs to benefit from a similar derogation as well.

c. Coherence of the EU regulatory framework on fluorinated gases

A derogation was rightly proposed for refrigerants in mobile air conditioning (MAC)-systems in combustion-engine vehicles with mechanical compressors until 6.5 years after entry into force (cf. derogation 'p.') in addition to refrigerants in transport refrigeration other than in marine applications until 6.5 years after entry into force (cf. derogation 'q.'). As stated above, a seven-year transition period is required to develop safe alternatives. The 5-year derogation falls short of these technical challenges.

Recommendation 2:
CECE calls upon ECHA to level the playing field between industries that share supply chains and technologies and request ECHA to grant the construction equipment industry, at the very least, the same derogations for the applications of refrigerants as the ones granted to the automotive industry.

Furthermore, given the multiplicity of PFAS definition globally, refrigerants are classified as PFAS by several competent authorities. R-134a and R-1234yf, the most relevant refrigerants to our industry, are covered by this restriction proposal albeit presenting no chemical or hazard characteristics that would justify such a prohibition. A thorough (re-)evaluation of these substances, drawing on latest research, would contribute to making a more proportionate decision on fluorinated gases.

As argued by EUROMOT, the European Association of Internal Combustion Engine and Alternative Powertrain Manufacturers, in their feedback submission to ECHA, potential alternatives such as ammonia, propane, or isobutane are not adequate for applications with an ignition source because of their flammability. Therefore, their use in engine systems is ruled out on the grounds that there is a high risk of catastrophic failure. Further refrigerants, such as carbon dioxide, adequate for other industries, require a considerable product redesign and often translates into comparatively larger systems which jeopardizes their use in engines. The design of refrigeration systems is long and technically complex considering the strict safety requirements. As a consequence, the use of these fluorinated gases will be necessary over time.

In addition, the coherence of the EU regulatory framework on fluorinated gases needs to be prioritized. The overlap between the future Commission decision on the PFAS restriction proposal and the future F-Gases Regulation has to be clarified and defined.
Considering the most recent developments, the inter-institutional negotiations on the Revision of the F-Gases Regulation may not be concluded by the end of the EU

legislature and may be carried over to the next EU legislature (as of late 2024) thereby adding to the legal uncertainty surrounding the future use of fluorinated gases in refrigeration applications and for HVAC systems.

3. General comments on proposed restriction of Fluoropolymers (including fluoroelastomers and polytetrafluoroethylene)

a. The essential use of fluoropolymers to comply with safety requirements

Under this restriction proposal, it is regrettable that fluoropolymers and perfluoropolyethers, as potential derogations, were only marked for reconsideration regarding applications affecting the proper functioning related to the safety of transport vehicles, and affecting the safety of operators, passengers or goods until 13.5 years after entry into force (potential derogation ‘o.’). More concerning is the narrow scope of this potential derogation inasmuch as construction equipment was omitted despite sharing supply chains and technologies with the automotive industry.
As AEM, the North American Association of Equipment Manufacturers, pointed out in their position paper, fluoropolymers in seals and hoses guarantee that hydraulic systems keep pressure. Unexpected hydraulic hose failures bring about pressure losses which, in turn, may result in loads falling abruptly on a jobsite, potentially causing severe harm to workers[3].

In the same way as vehicles, construction equipment functions at hot temperatures. These regular operations are conducive to fires which can only be prevented with the use of PFAS.

<u>Recommendation 3</u>: **CECE calls upon ECHA to level the playing field between industries that share supply chains and technologies and request ECHA to grant, at the very least, the same derogations for the use of PFAS in applications affecting the proper functioning related to the safety of construction equipment, its operators, workers/users, and goods in addition to proposing a 13.5-year derogation after entry into force.**

b. The relevance of waste practices as opposed to a general prohibition

CECE is of the view that fluoropolymers should be excluded from the PFAS restriction proposal or, at least, should be dealt with in a more proportionate fashion. Plastics Europe’s Fluoropolymers Product Group (FPG) rightly argued that

[3] *Op. cit.* p.14

concerns of persistence can be appropriately mitigated by regulating manufacturing and waste practices in lieu of a blanket ban[4].

Based on an industry-supported study, fluoropolymers should be differentiated from other PFAS as they meet the criteria to be classified as polymers of low concern due to their high molecular weight, narrow molecular weight distribution, and negligible oligomer content in addition to their organic and inorganic leachability[5]. The study demonstrated that PTFE does not present any acute or sub-chronic systemic toxicity, irritation, sensitization, local toxicity on implementation, in vitro and in vivo genotoxicity, hemolysis, complement activation, or thrombogenicity.

It is noteworthy that the European Commission's Joint Research Centre (JRC) recently released a study that acknowledges the importance of fluoropolymers in the supply chains of strategic technologies and sectors in the EU[6]. Regarding Li-ion battery technology, the JRC interestingly classified two fluorinated polymers, PVDF (Polyvinylidene Fluoride) and PTFE, as precursor materials for battery components and key intermediate materials to produce battery precursors (cf. p.243). Polytetrafluoroethylene and expanded polytetrafluoroethylene were also identified, among other PFAS, as materials for electrolysers, data transmission networks and robotics. In addition, another fluorinated polymer, optical fiber cladding material, was singled out as processed materials for data transmission networks alongside data storage and servers.

Recommendation 4:
CECE stands for an exclusion of fluoropolymers (including fluoroelastomers and polytetrafluoroethylene) from the restriction proposal or, at the very least, a 13.5-year derogation after entry into force for our essential fluoropolymers uses on O-rings, seals, coatings, hoses, clutch plates alongside brake friction disks. CECE invites ECHA to work on restrictions of high-risk PFAS instead of adopting the Dossier Submitters' 'one-ban-fits-all' approach.

[4] https://fluoropolymers.plasticseurope.org/application/files/8716/7991/0281/21_March_FPG_Statement_on_the_PFAS_REACH_restriction_report.pdf

[5] Henry BJ, Carlin JP, Hammerschmidt JA, Buck RC, Buxton LW, Fiedler H, Seed J, Hernandez O. A critical review of the application of polymer of low concern and regulatory criteria to fluoropolymers. Integr Environ Assess Manag. 2018 May;14(3):316-334. doi: 10.1002/ieam.4035. Epub 2018 Mar 30. PMID: 29424474. [Accessible from: https://doi.org/10.1002/ieam.4035]

[6] Carrara, S., Bobba, S., Blagoeva, D., Alves Dias, P., Cavalli, A., Georgitzikis, K., Grohol, M., Itul, A., Kuzov, T., Latunussa, C., Lyons, L., Malano, G., Maury, T., Prior Arce, A., Somers, J., Telsnig, T., Veeh, C., Wittmer, D., Black, C., Pennington, D. and Christou, M., Supply chain analysis and material demand forecast in strategic technologies and sectors in the EU – A foresight study, Publications Office of the European Union, Luxembourg, 2023, doi:10.2760/334074, JRC132889.
[Accessible from: https://op.europa.eu/en/publication-detail/-/publication/9e17a3c2-c48f-11ed-a05c-01aa75ed71a1/language-en]

4. Comments on proposed restriction of Family of Fluorocarbon-based Fluoroelastomer Materials

Fluorocarbon-based fluoroelastomers, such as FKM products, are often used within high-temperature systems with upper usage limit around 230-250°C, depending on the sealing material applied, whilst maintaining strong chemical resistance.

Fluoroelastomers are also used as a vulcanizing agent which is vital for the performance of rubber-based products. Today, no PFAS-free alternative is capable of performing at temperature and chemical resistance requirements for mobile machinery products. Mobile machinery products are exclusively used in an industrial setting. Recycle, Rebuild and Reuse processes are in place to control the use and waste of this type of product. Considering the applications review in the below sub-sections, a blanket ban on Fluorocarbon-based Fluoroelastomers proves to be disproportionate. A recent industry-conducted study notably concentrated on the health and environmental impacts of fluoroelastomers and concluded that they are stable from a thermal, biological and chemical perspective, negligibly water-soluble, nonmobile, nonbioavailable, nonbioaccumulative and nontoxic[7]. Additionally, the study found that fluoroelastomers meet the polymer hazard assessment criteria to be regarded as polymers of low concern. Therefore, CECE would like to invite ECHA to take fluoroelastomers out of the scope of this restriction proposal on the grounds explained above and based on the essential sector-specific applications detailed below.

O-rings and sealings, containing FKM, are operating in harsh conditions and hot temperatures and pressures where no alternative exists thus far. We have estimated that construction machinery uses over 10 000 parts containing PFAS, the majority of these being O-rings, sealings, hoses, wirings and PTFE coated parts (e.g., screws, bearings and friction plates).
For parts and components operating in harsh environments, suppliers need to develop alternatives and, as Original Equipment Manufacturers (OEMs), the construction equipment industry would need another 5 years once the new supply chain is operational to carry out verification, of newly developed components in their products to validate safety, performance, and reliability, especially for safety critical systems.

[7] Korzeniowski, S.H., Buck, R.C., Newkold, R.M., kassmi, A.E., Laganis, E., Matsuoka, Y., Dinelli, B., Beauchet, S., Adamsky, F., Weilandt, K., Soni, V.K., Kapoor, D., Gunasekar, P., Malvasi, M., Brinati, G. and Musio, S. (2023), A critical review of the application of polymer of low concern regulatory criteria to fluoropolymers II: Fluoroplastics and fluoroelastomers. Integr Environ Assess Manag, 19: 326-354. [Accessible from: https://setac.onlinelibrary.wiley.com/doi/10.1002/ieam.4646]

Regarding sealings and O-rings deployed in harsh conditions and hot temperatures, derogations of at least 13.5 years, after entry into force, are necessary to ensure that alternatives can be developed and verified by the supplier prior to OEM verification. For engines, transmissions, and hydraulic applications the cost for development and verification of those are estimated to be over €20M, upon development of alternatives conducted by the supplier. In that regard, CECE would like to highlight that the alternatives development will be solely dependent on the supply chain, and more specifically on the material formulators and compounders. OEMs cannot develop the alternatives which is why a PFAS prohibition, with no extensive transition period, would imperil our regular operations.

Regarding the substitution of the screws, we foresee a period of approximately 2 to 3 years with a cost exceeding €2,5M for a large enterprise. This will be detrimental to quality and durability bringing about the end-of-life earlier and intensifying the replacement frequency. Maintenance periods will shorten which will subsequently generate more waste.
In terms of O-rings, there are some parts designed for less harsh conditions (e.g., outside the engine bay) that may be substituted within 2-3 years after new materials have been developed by upstream supply chains. The estimated cost for these parts accounts for €70M, in the case of a large enterprise.

Recommendation 5:
In case of any fluoropolymers (including fluoroelastomers and polytetrafluoroethylene) restriction, CECE requests a general 13.5-year derogation after entry into force for all other essential PFAS uses on O-rings, seals, coatings, hoses, clutch plates alongside brake friction disks.

Insofar as OEMs define performance requirements and the supply chain selects the appropriate material solutions, CECE would like to emphasize that the use of, for instance, FKM in O-rings and sealings is not a preferred solution, in terms of material. It is a necessary solution to ensure safe and durable equipment. For engines, gearboxes, and transmissions as well as hydraulic applications, PFAS-containing parts are the only materials available today to minimize risks of safety critical failures, leakage (with major environmental consequences) and fires, among other issues. It needs to be ascertained that safe machines can be placed on the market with high durability. This policy direction should coincide with the ambitions of EU Green Deal to avoid excess waste and unnecessary use of rare materials and other resources where and when possible.
The below sub-sections delve into specifics and provide evidence-informed descriptions of essential applications and sub-uses.

Recommendation 6:
Having regard to the magnitude of this restriction proposal, CECE would like to invite the Commission to periodically exercise its implementing powers, conferred by Article 133 of Regulation (EC) No 1907/2006 ('REACH'), with the aim of reevaluating and redefining the duration as well as the scope of the derogations proposed or for reconsideration, following stakeholder consultations.

The development of alternatives will take years, adding to the legal uncertainty. An adequate use of implementing powers in the coming years would mitigate the legal uncertainty in addition to helping take the most proportionate decisions.
On that occasion, CECE would like to emphasize that the Revision of REACH will now fall under the next Commission in 2024, in view of the legislative calendar, and the debates surrounding the future provisions relating to Essential Use are at the beginning. WSP's report supporting the Commission in developing an essential use concept[8] proposed broad criteria for a use of a substance to be defined as 'essential' for society. Therefore, the Commission ought to clarify its intentions on the Essential Use concept and the regulatory implications that the WSP report may have.

Recommendation 7:
Considering that the revision of REACH is likely to take years, CECE calls upon the Commission to publish, at its earliest convenience, a Communication delineating the Essential Use concept and its methodology in future substance restrictions under REACH.

a. O-Rings

FKM is the preferred method for sealing wide range of fluids and gasses. O-Rings are relatively low cost, durable and serviceable and are therefore used in their thousands across our members' product lines. As the complexity of products has increased, O-Rings have also had to adapt particularly in their physical characteristics considering pressure and it has superior temperature and chemical resistance. As an example due to the addition of emissions reduction technologies, temperatures in and around engines and their ancillary components have significantly increased and, as a result, the requested target life for seals has increased accordingly. This has driven most manufacturers to transition to FKM for more seals over the years. If manufacturers were required to replace those seals with others made of materials inferior to FKM, there would be a drastic reduction in durability. Machines would have to be replaced and

[8] European Commission, Directorate-General for Environment, Bougas, K., Flexman, K., Keyte, I. et al., Supporting the Commission in developing an essential use concept – Final report, Publications Office of the European Union, 2023,
[Accessible from: https://op.europa.eu/en/publication-detail/-/publication/69d5ea0d-d359-11ed-a05c-01aa75ed71a1/language-en/format-PDF/source-284023091]

rebuilt at much lower hours, drastically increasing the workload for technicians and creating additional waste. There is no alternative polymer or elastomer available on the market that has equivalent performance and durability.

On average, a machine contains 300 – 3700 seals used in connection points and joints. Depending on the machine and its application, 17-62% of these seals contain PFAS (50-2300 seals per machine). The PFAS seals are strategically used in systems that require performance at hot temperatures (>250°C), and/or require chemically inactive properties (e.g., low absorption).
Depending on the application and system conditions, an FKM-based O-ring could have a functional performance life from 10 to 100 times longer than an NBR- or EPDM-based O-ring, which are currently the best performing non-PFAS replacement material. With the average life of a machine being 10-60k hours, the lifecycle reduction has a significant impact on cost and waste produced.
In one machine model, it is currently recommended, for maintenance purposes, to replace the FKM-based O-Ring seals every 3000 machine hours, which is about every 6 months. Replacing the FKM-based seals with a lower temperature performing NBR-based seal will reduce the service life by approximately 97%. Using NBR-based seals will require replacement every 100 hours, which is about once per week.
Depending on the location of the seal, the required time to replace a seal varies significantly. At a minimum, 1 labor hour is needed. Engine removal and reconditioning equals about 24 hours.

b. Seals

1) Viton™ seals

The following chart (cf. below), taken from ASTM D2000, which is a standard classification system for rubber products that provides a way to describe their physical properties and suitability for specific environments. It was designed for automotive applications but is also used by other industries. The widely used Viton™ seals are made of Fluorine Latex ('Kautschuk') Material (FKM), which is a fluorocarbon-based fluoroelastomer. The closest material, in terms of temperature and chemical resistance, which is not a PFAS, is AEM/ACM, which has ~75°C less temperature resistance and a ~20% weaker oil

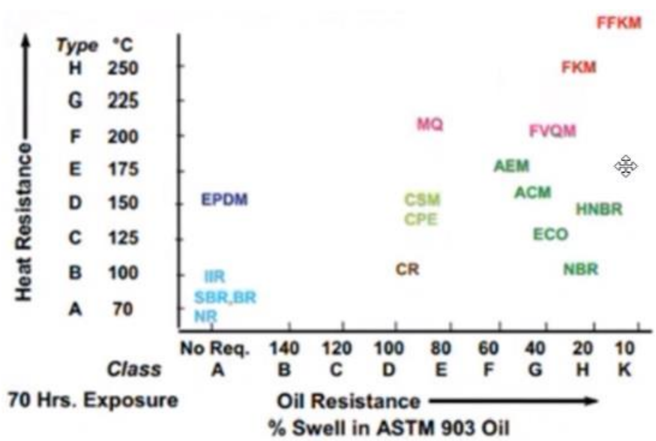

Figure 1: Performance by Heat and Oil Resistance
ASTM / IISRP / ISO Designation

resistance proving it to be not suitable for the harsh applications in construction equipment. It has become apparent that there are no viable alternatives available today.
Any restriction on the use of FKM as a material will result in significantly reduced seal lifetime and higher risk of leaks.

2) Press-in-Place Seals

Most of these seals are FKM on the same grounds as FKM use for O-rings.

3) Fuel Systems

FKM is a recommended seal material in diesel and biodiesel fuels. As well as the other properties duly noted, FKM is able to better withstand degradation from exposure to fuel and this is particularly true of the more recent biodiesel blends which are favored where decarbonization is being implemented. Other materials swell significantly and most, if not all, manufacturers switched exclusively to FKM in fuel systems over 20 years ago.

4) Clutch Disks

Friction disks for transmissions commonly use FKM compounds. FKM is preferred over other polymers, such as NBR, because of its superior temperature resistance.

5) Water Seals

Water seals are used to seal the coolant passages on engine blocks. These are typically coolant resistant FKM (CR-FKM). This material is the only available option because the application requires a coolant resistant material that can also withstand high ambient temperatures (from the cylinder).

6) Liner Seals

Manufacturers use FKM and CR-FKM on cylinder liner seals as well. The upper liner (or filler bands) are typically CR-FKM, because they are exposed to high temperatures and seal coolant from the bottom side of the seal.

7) Shaft Seals

Some rotating shaft seals are also made of FKM because of the need for high temperature resistance.

5. Comments on proposed restriction of Polytetrafluoroethylene

Polytetrafluoroethylene (PTFE) is an essential substance for the construction equipment industry which needs a derogation from the PFAS restriction proposal. In view of End of Life (EoL) risk-management practices, PTFE does not generate PFAS into the environment. A study released in Chemosphere review scrutinized PTFE combustion under regular waste incineration conditions at a pilot plant in Germany[9]. The researchers concluded that municipal incineration of PTFE, utilizing best available technologies (BAT), is not a significant source of PFAS under study and should be regarded as an appropriate method of waste treatment. As a result, a PTFE ban would be disproportionate in view of the available risk mitigation techniques.

a. Lithium-ion batteries

In the context of the electrification of our industrial machinery, including construction equipment and with the ever-growing demand for long-lasting batteries, it has become apparent that certain fluoropolymers will be instrumental in facilitating this cross-sector transition to zero-emission technology.
The automotive industry as well as the construction equipment industry need lithium-ion (Li-ion) batteries respectively for their electric vehicles and machines. This increased demand relies on gaskets for the electrodes of li-ion batteries. Certain corporate researchers surveyed the use of fluororesin made of PFA (Perfluoroalkoxy Copolymer), which is a co-polymer of PTFE, due to its electrolyte resistance, electrical insulation properties, climate resistance and low moisture permeability[10]. They found that the PFA gaskets present a long-term reliability in the case of automotive Li-ion batteries.

<u>Recommendation 8</u>:
CECE stands for a cross-sector 13.5-year derogation after entry into force for uses of PFAS in Li-ion batteries.

[9] Krasimir Aleksandrov, Hans-Joachim Gehrmann, Manuela Hauser, Hartmut Mätzing, Daniel Pigeon, Dieter Stapf, Manuela Wexler (2019), Waste incineration of Polytetrafluoroethylene (PTFE) to evaluate potential formation of per- and Poly-Fluorinated Alkyl Substances (PFAS) in flue gas. Chemosphere, Volume 226, 2019, Pages 898-906, ISSN 0045-6535,
[Accessible from: https://www.sciencedirect.com/science/article/pii/S0045653519306435]
[10] Liu J, Aoyama T, Tsuda H, Sukeagawa M. Long-term reliability evaluation of fluororesin gasket for electrode of automotive lithium-ion battery using simulation. COUPLED VIII : proceedings of the VIII International Conference on Computational Methods for Coupled Problems in Science and Engineering [Internet]. CIMNE; 2019. p. 269–79.
[Accessible from: https://upcommons.upc.edu/handle/2117/190005]

b. Sealings and adhesives

1) Crankshaft Seals

These seals use a PTFE wafer as the main sealing lip on the crankshaft. To our knowledge, most if not all engine models use this type of sealing technology. There may be a few other types of crankshaft seals that do not use PTFE, but it would be a massive undertaking to design all new crank seals if PTFE would be banned.

2) Reciprocating Seal Rings

There is a family of PTFE rectangular shaped seal rings that are used with rubber energizers to seal reciprocating joints. PTFE is used because of its low friction properties.

3) Lip Seals

There is a family of machined lip seals made from PTFE billets that are used in brakes and transmissions as reciprocating seals again because of the low friction properties.

c. Coatings

A large percentage of highly durable O-rings (and most of the very high-volume STOR/ORFS O-rings) are coated with PTFE. This is done to reduce the friction when the O-ring is installed into the joint.

6. Comments on Essential applications with unspecified PFAS

Due to trade secret obligations, it was not possible to specify the PFAS used in multiple essential applications. In this case, we strived to submit, in lieu, data relating to the economic cost of a PFAS ban and the timespan needed to develop an alternative.

a) Hoses

Certain companies in the construction equipment industry offer over 100k variations of hoses with PFAS and produce millions of these hose assemblies per year. One of their most common hoses used on the engines of their machines has PFAS in it. These hose assemblies are primarily used on the engines due to their high temperature performance properties. If PFAS was restricted, exploring the possibility of replacing these hoses with a tube would cost approximately $2M per instance. If a tube is not a viable replacement, then a new hose material would need to be developed costing roughly between $3M and $5M per hose type. Upon identification, development and validation of this new product would take 7 years and will likely be an iterative process due to the performance requirements and the dynamic nature of the machine cycles. After this time, an additional delay of 3 to 5 years and a sum of $500k - $1M would be needed for the new material to qualify for use in engine applications. The total time and value of replacing PFAS in our high temperature engine hoses could range from 7 to 13 years and $2M to $6M per instance.

b) Clutch plates and brake friction disks

PFAS is used in a proprietary compound in high energy transmission clutch plates, and brake friction disc packs (e.g., large mining equipment) due to the high temperature requirements and cycles these systems face. Any known substitute would decrease the current life of the friction discs by 75%. Switching to this material will cause a redesign of transmission controls, cooling systems and recertifying brake systems. Our current life of our high-performance compounded plates requires a change every 20.000 hours during a major maintenance session. The process of removal and reinstallation of the transmission takes 24 labour hours. In addition, rebuilding of the transmission takes about 65 labour hours and replacing the brake friction discs takes about 23 hours.
A new/replacement compound would reduce the life of the clutch, and friction disc plates by 75% which will require three additional replacements of the plates during the service life of the machines transmission and braking systems.

7. Comments on Essential uses of PFAS in Spare parts, remanufactured, refurbished, or second-hand products

a) Spare parts

CECE would also like to address spare parts. Our products often have extended lifecycles, regularly over 20 years for larger products. This circularity is key in the purchasing decisions of our customers, and we have extensive spare parts and service networks that have been developed over many years to foster repair of products. Spare parts constitute an important area of our industry and without a spare part derogation, this will adversely affect both our business in Europe, including loss of full-time equivalents (FTEs), and the possibility to simply and quickly repair machines already on the market. It would be impossible for manufacturers to develop and supply full component assemblies including alternative sealing technologies (even if they would be available) for these older machines that today would be repaired through the relatively simple replacement of a seal or O-ring. Our machines today work in many applications including civil construction, mining of essential minerals, infrastructure, waste treatment, and disaster relief. In case of breakdown of machines cleaning airports or building roads and with no opportunity to procure and install spare parts easily and at a reasonable cost, the impact on society will be severe. For instance, many roads may not be finished in time due to the lack of spare parts and the necessity to buy new machines instantly to finish the construction. Airports may not be cleaned from snow due to machines standing still and which cannot be repaired. Many roads may not be cleaned from waste or snow after a natural disaster hindering emergency vehicles to rescue people in need because there are no spare parts available to repair them in a time-sensitive manner. These examples of applications highlight the socio-economic consequences of a blanket ban on PFAS. Small and Medium-sized Enterprises (SMEs) should not be dealt with as an afterthought. In case they are deprived of spare parts to maintain their equipment, the impact on their business would be detrimental.

With an extensive prohibition of PFAS, and in the absence of drop-in alternatives without PFAS, the ‘end-of-life’ of construction equipment will be fast-tracked and its servicing, repair, and maintenance will be put in jeopardy.
Remanufacturing, refurbishing, servicing, maintenance, and repairs are instrumental in the EU Green Deal and circularity.

b) Remanufactured, refurbished, or second-hand products

In the context of the inter-institutional negotiations on the Proposal for Ecodesign for Sustainable Products Regulation (ESPR) and notably the negotiations between the European Union and India on a future trade agreement, the PFAS restriction proposal is at odds with the remanufacturing, refurbishment, and wider circularity incentives that the European Commission has been developing over the last few years. As an exemplification of this policy direction, the Commission tabled a Proposal for a Directive on common rules promoting the repair of goods earlier this year. If adopted, this directive would apply to the repair of goods purchased by consumers in the event of a defect of the goods that occurs or becomes apparent outside the liability of the seller.

The consequences of a PFAS prohibition on the aftermarket across industries should not be underestimated. Given that many engines would have to be withdrawn from the market, the supply of second-hand products would severely shrink and thereby incentivize the disposal of products. The coherence of the EU regulatory framework would thus be undermined. In addition, the socio-economic costs of engine and other products shortages should not be downplayed. The subsequent price increases of products, usually subject to remanufacturing and refurbishment and placed on the aftermarket, will further highlight the negative effects of this PFAS restriction proposal.

Recommendation 9:
Uses of PFAS in spare parts, remanufactured, refurbished, or second-hand products should benefit from a permanent derogation.

<u>Conclusion:</u>

The PFAS restriction proposal, if brought into force as is, would put the placing on the Single Market and the export of construction equipment, manufactured in EU-based plants, in jeopardy for several years. Many enterprises and their suppliers would be faced with dramatically high risks of economic or technical shutdowns and relocations overseas. The importance of PFAS in the EU economy should not be underestimated and a higher political debate should also be brought about, considering the social, economic, and cultural repercussions that the indiscriminate phase-out of PFAS will generate. Therefore, CECE calls upon the European Commission to ultimately take the most proportionate measures to safeguard our industry whilst fulfilling the EU Green Deal.

About CECE

CECE, the Committee for European Construction Equipment, represents the interests of 1,200 construction equipment manufacturers through national trade associations in Europe.
CECE manufacturers generate €40 billion in yearly revenue, export a sizeable part of the production, employ around 300.000 people overall. They invest and innovate continuously to deliver equipment with highest productivity and lowest environmental impact.
Efficiency, safety and high-precision technologies are key. See also www.cece.eu

Annex I: Summary table of challenging environment of construction equipment operations

Strain	Description
Pressure	Various systems, such as the hydraulic and engine systems, experience extreme pressure up to 500 bar.
Temperature	The engine compartment, regenerative breaking components* and exhaust system operate at temperatures as high as 800°C. Non-road equipment is also exposed to cyclical temperature due to its operation outside which can be exposed to temperatures ranging from -40°C to +80°C. * Such as break resistors which recover the heat from breaking to decrease the overall energy requirements of the system and compressors for air-conditioning systems.
Mechanical	Machines are subject to a high degree of mechanical wear and tear, sealing parts must survive the shear forces due to the mechanical movement of the equipment.
Chemical resistance	Seals interact with various fluids, requiring a high degree of chemical and corrosion resistance to ensure the continued operation of exposed parts. Exposure to substances such as fuel, hydraulic fluid, coolant with additives (e.g., 2-ethyl hexanoic acid), and carboxylic acids, exhaust gas fumes (highly acidic) and engine oil (highly alkaline).
Electrical and flammability resistance	In case of fire, materials used in mobile machinery must possess low burning characteristics to protect the

	machine, its environment and, first and foremost, the operator and any bystanders. Electrified machines currently use electrical systems with a voltage up to 600 V, requiring reliable electric insulation materials to prevent the risk of electric shock. There is a growing trend to electrify larger machinery, which will require even higher operating voltages in excess of 1000 V to remain efficient, leading to increasing (rather than decreasing) requirements for the materials in use.
Vibration	Vibration of up to 45.0mm/s which can cause high frequency fatigue to components due to the repeated strain imposed. The mechanical alternating stress between joint components will make joints undergo cyclic tension and pressure, which lead to the generation, expansion, and extension of cracks.
Ultra-Violet (UV) light	Long-term durability against factors such as ultra-violet (UV) in outdoor environments is an important design criterion for the selection of exposed non-metallic materials (hoses, seals, etc.).
Hazardous or explosive environments	Operation in hazardous or explosive environments requiring ATEX rating, such as in chemical plants, mining, and petrochemical applications.
Harsh environments	• Mining and earth moving equipment where operation in extremely dusty, humid, wet, muddy and damp environments is necessary. The operation of such equipment is often up to 24 hours a day over extended periods of time. Due to the need to carry heavy payloads over rough terrain, the energy and therefore high

	temperature requirements of these systems are especially demanding. • Exposure salt spray due to their operation near the sea.

<u>ANNEX II</u>: Summary table of main PFAS applications in the construction equipment industry

Substances / Applications	Fluoropolymers – Polytetrafluoroethylene (PTFE), Perfluoroalkoxyl polymer (PFA) & Polyvinylidene fluoride (PVDF) – PTFE and Teflon, PFA & PVDF	Fluorinated Gases - Refrigerants - Hydrofluorocarbons (HFCs) & Hydrofluoroolefins (HFOs)	Fluoropolymers - Family of Fluorocarbon-based Fluoroelastomer Materials - FKM, FPM & Viton™	1-Propene, 1,1,2,3,3,3-hexafluoro-, polymer with 1,1-difluoroethene	Ethene, tetrafluoro-, homopolymer
O-rings	PTFE		FKM, FPM		X
Seals (crankshaft, shaft, liner, lip, water seals; Press-in Place seals; piston; reciprocating rings)	PTFE		FKM, Viton™		X
PTFE tape					
Bushings					
Shims					
Teflon coated parts	PTFE				
Hoses	Teflon Seal Plug		Viton™		
Wires, cables or Looms					
Electrical equipment, including printed circuit boards, CPUs, LCD Screens, inverters etc.	Perfluorosulfonic Acid-PTFE Copolymer				
Lubricants and greases	PTFE			X	X
Hydraulic Oil					
Adhesive tape					
Bearings			FKM		

HVAC		R-134a & R-1234yf			

Substances / Applications	**Fluoropolymers – Polytetrafluoroethylene (PTFE), Perfluoroalkoxyl polymer (PFA) & Polyvinylidene fluoride (PVDF) – PTFE and Teflon, PFA & PVDF**	**Fluorinated Gas - Refrigerants - Hydrofluorocarbons (HFCs) & Hydrofluoroolefins (HFOs)**	**Fluoropolymers - Family of Fluorocarbon-based Fluoroelastomer Materials - FKM, FPM & Viton™**	**1-Propene, 1,1,2,3,3,3-hexafluoro-, polymer with 1,1-difluoroethene**	**Ethene, tetrafluoro-, homopolymer**
Fittings and fixtures	PTFE				
Precision Switch	PTFE				X
Cab seat	PTFE, PFA				X
Armrest kit LH & RH					X
High Water Temperature Switch			Viton™		
Oil Pressure Switch			Viton™		
Clutch			FKM		
Gear Motor	PTFE				
Gear Pump	PTFE		Viton™		
Oil Service Valve	PTFE			X	
Oil level capacitance switch	PTFE				
Water level capacitence switch	PTFE				
Liquid level sensor	PTFE				
Wear ring, Dust ring, Back-up ring	PTFE				

Powder coating	PTFE				
Fuel systems			FKM		
Brake friction disks (PFAS unspecified)					

Substances / Applications	**Fluoropolymers – Polytetrafluoroethylene (PTFE), Perfluoroalkoxyl polymer (PFA) & Polyvinylidene fluoride (PVDF) – PTFE and Teflon, PFA & PVDF**	**Fluorinated Gas - Refrigerants - Hydrofluorocarbons (HFCs) & Hydrofluoroolefins (HFOs)**	**Fluoropolymers - Family of Fluorocarbon-based Fluoroelastomer Materials - FKM, FPM & Viton™**	**1-Propene, 1,1,2,3,3,3-hexafluoro-, polymer with 1,1-difluoroethene**	**Ethene, tetrafluoro-, homopolymer**
Hydraulic control valve			Viton™		
Hose pipe rupture valve			Viton™		
Exhaust Blanket – Turbo Outlet	Teflon				
Exhaust Blanket – Doser Inlet	Teflon				
Exhaust Blanket – Doser Outlet	Teflon				
Exhaust Blanket – SCR Inlet	Teflon				
Mirror head	PTFE				
Bracket	PTFE				
Slipring seal kit	PTFE				
Stepseal kit	PTFE				
Li-ion batteries	PTFE, PVDF				

Gaskets for the electrodes of li-ion batteries	PFA				
Gasket	PTFE		FKM	X	
Filter			FKM	X	
Thermostat					X
Controller	PTFE				X

<u>Annex III</u>: Survey conducted among CECE Members

The responses have been aggregated in order to give an overview of the construction equipment industry's perspectives on PFAS-related matters.

1. **Are you aware of what Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) are?**

☐Yes
☐No

Yes: 100%

No: 0%

2. **Are there any PFAS in products/parts/components supplied to your company?**

☐Yes: 80%
☐No : 0%
☐Unknown: 20%

3. **If so, which PFAS are found in your products can you provide a CAS/EC number?**

Five CECE company members agreed to disclose the PFAS which they use for the purpose of ECHA stakeholder consultation on the PFAS restriction proposal. Due to the business confidential nature of these data, the submissions of these CECE company members were anonymized.

Company 1	Company 2	Company 3	Company 4	Company 5
Oxetane, 2,2,3,3-tetrafluoro-, homopolymer, fluorinated	PTFE	Oxetane, 2,2,3,3-tetrafluoro-, homopolymer, fluorinated	1-Propene, 1,1,2,3,3,3-hexafluoro-, oxidized, polymd.	Polytetrafluoroethylene
Tetrafluoroethylene	FKM	Tetrafluoroethylene	Hexafluoropropylene-tetrafluoroethylene-vinylidene fluoride copolymer	Perfluorooctanoic acid
Bisphenol AF	FVMQ	Bisphenol AF	Perfluorooctanoic acid	Perfluoro(propyl vinyl ether)-tetrafluoroethylene copolymer
Methyl nonafluorobutyl ether	Polytetrafluoroethylene	1-Propene, 1,1,2,3,3,3-	4,4'-Difluorobenz	Hexafluoropropylene-

		hexafluoro-, oxidized, polymd., reduced, hydrolyzed	ophenone-hydroquinone copolymer	tetrafluoroethylene-vinylidene fluoride copolymer
Methyl perfluoroisobutyl ether	Hexafluoropropylene-vinylidene fluoride copolymer	Ethyl perfluorobutyl ether	Polytetrafluoroethylene	Hexafluoropropylene-vinylidene fluoride copolymer
Propanoyl fluoride, 2,3,3,3-tetrafluoro-2-[1,1,2,3,3,3-hexafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)propoxy]-, polymer with 2,2,3-trifluoro-3-(trifluoromethyl)oxirane, reaction products with 3-(ethenyldimethylsilyl)-N-methylbenzenamine	1-Propene, 1,1,2,3,3,3-hexafluoro-, polymer with 1,1-difluoroethene	Methyl nonafluorobutyl ether	Tetrabutylammonium hexafluorophosphate	Propanoyl fluoride, 2,3,3,3-tetrafluoro-2-[1,1,2,3,3,3-hexafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)propoxy]-, polymer with 2,2,3-trifluoro-3-(trifluoromethyl)oxirane, reaction products with 3-(ethenyldimethylsilyl)-N-methylbenzenamine
Hexafluoropropylene-tetrafluoroethylene copolymer		Methyl perfluoroisobutyl ether	Perfluoro(propyl vinyl ether)-tetrafluoroethylene copolymer	Poly[oxy[trifluoro(trifluoromethyl)-1,2-ethanediyl]], α-(1,1,2,2,2-pentafluoroethyl)-ω-[tetrafluoro(trifluoromethyl)ethoxy]-

Hexafluoropropylene-tetrafluoroethylene-vinylidene fluoride copolymer		Siloxanes and Silicones, Me Ph, Me 3,3,3-trifluoropropyl	Bisphenol AF	Bisphenol AF
Perfluoro(methyl vinyl ether)-tetrafluoroethylene copolymer		Propanoyl fluoride, 2,3,3,3-tetrafluoro-2-[1,1,2,3,3,3-hexafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)propoxy]-, polymer with 2,2,3-trifluoro-3-(trifluoromethyl)oxirane, reaction products with 3-(ethenyldimethylsilyl)-N-methylbenzenamine	Fluorosilicic acid	Nafion 117
Perfluoro(propyl vinyl ether)-tetrafluoroethylene copolymer		2,4,6-Trimethyl-2,4,6-tris(3,3,3-trifluoropropyl)cyclotrisiloxane	Phosphonium, triphenyl(phenylmethyl)-, salt with 4,4’-[2,2,2-trifluoro-1-(trifluoromethyl)ethylidene]bis[phenol] (1:1)	
Propylene-tetrafluoroethylene copolymer		Hexafluoropropylene-tetrafluoroethylene copolymer	Hexafluoropropylene-vinylidene fluoride copolymer	
Perfluorooctanoic acid		Hexafluoropropylene-tetrafluoroethylene-vinylidene fluoride copolymer		
2-(N-Methylperfluorobutanesulfamoyl)ethanol		Perfluoro(methyl vinyl ether)-tetrafluoroethylene copolymer		
Perfluorobutane		Perfluoro(propyl vinyl ether)-tetrafluoroethylene copolymer		

Ethene, 1,1,2,2-tetrafluoro-, polymer with 1,1-difluoroethene and 1,1,2-trifluoro-2-(trifluoromethoxy)ethene		2-(Perfluorooctyl)ethyl acrylate		
Poly[oxy[trifluoro(trifluoromethyl)-1,2-ethanediyl]], α-(1,1,2,2,2-pentafluoroethyl)-ω-[tetrafluoro(trifluoromethyl)ethoxy]-		3-Ethoxy-1,1,1,2,3,4,4,5,5,6,6,6-dodecafluoro-2-(trifluoromethyl)hexane		
2-[Methyl[(1,1,2,2,3,3,4,4,4-nonafluorobutyl)sulfonyl]amino]ethyl 2-methyl-2-propenoate		Perfluoro-3,6-dioxa-4-methyl-7-octenesulfonic acid-tetrafluoroethylene copolymer		
1-Hexene, 3,3,4,4,5,5,6,6,6-nonafluoro-, polymer with ethene and 1,1,2,2-tetrafluoroethene		Perfluorooctanoic acid		
N-Methylperfluorobutanesulfonamide		Ammonium perfluorooctanoate		
Ethene, 1,1,2,2-tetrafluoro-, oxidized, polymd.		Ethene, 1,1,2,2-tetrafluoro-, polymer with 1,1-difluoroethene and 1,1,2-trifluoro-2-(trifluoromethoxy) ethene		
1,1,1,2-Tetrafluoroethane		Pigment Yellow 128		
Polytetrafluoroethylene		Poly[oxy[trifluoro(trifluoromethyl)-1,2-ethanediyl]], α-(1,1,2,2,2-pentafluoroethyl)-ω-[tetrafluoro(trifluoromethyl)ethoxy]-		
Hexafluoropropylene-vinylidene fluoride copolymer		Polysiloxanes, Me 3,3,3-trifluoropropyl		
1-Pentene, 2,3,3,4,4,5,5-heptafluoro-, polymer		(Perfluorooctyl)ethanol		

with ethene and 1,1,2,2-tetrafluoroethene				
		Pigment Yellow 154		
		1-Hexene, 3,3,4,4,5,5,6,6,6-nonafluoro-, polymer with ethene and 1,1,2,2-tetrafluoroethene		
		Siloxanes and Silicones, Me 3,3,3-trifluoropropyl, hydroxy-terminated		
		Siloxanes and Silicones, Me 3,3,3-trifluoropropyl, Me vinyl, hydroxy-terminated		
		Ethene, 1,1,2,2-tetrafluoro-, oxidized, polymd.		
		Phosphonium, triphenyl(phenylmethyl)-, salt with 4,4'-[2,2,2-trifluoro-1-(trifluoromethyl)ethylidene]bis[phenol] (1:1)		
		Pigment Yellow 128		
		Polytetrafluoroethylene		
		Hexafluoropropylene-vinylidene fluoride copolymer		
		1-Chloro-4-(trifluoromethyl)benzene		

4. Which products/components can PFAS be found in?

☐ O-rings: 66%
☐ Seals: 66%
☐ PTFE tape: 0%

- [ ] Bushings: 50%
- [ ] Shims: 0%
- [ ] Teflon coated parts: 50%
- [ ] Hoses: 83%
- [ ] Wires, cables or Looms: 50%
- [ ] Electrical equipment, including printed circuit boards, CPUs, LCD Screens, inverters etc.: 83 %
- [ ] Lubricants and greases: 50%
- [ ] Hydraulic Oil: 16%
- [ ] Adhesive tape: 0%
- [ ] Bearings: 50%
- [ ] Batteries: 0%
- [ ] Fittings and fixtures: 33%
- [ ] Other: 83%
- [ ] None: 0%
- [ ] Unknown: 66%

5. Do you know why PFAS are being used in your product?

- [ ] Temperature resistance: 60%
- [ ] Chemical resistance: 60%
- [ ] Wear resistance: 60%
- [ ] Pressure resistance: 20%
- [ ] Fire retardant: 0%
- [ ] Surfactant: 0%
- [ ] Surface treatment for any textiles: 0%
- [ ] Reduction of surface friction: 60%
- [ ] Cleaner: 0%
- [ ] Other: 60%
- [ ] None: 20%
- [ ] Unknown: 80%

6. Are you aware of the various global PFAS laws and regulations being introduced around the world?

- [ ] Yes
- [ ] No

Yes: 100%

No: 0%

7. **Is your company planning to start an investigation into PFAS content of its products?**

☐ Yes
☐ No

Yes: 100%

No: 0%

8. **Are you aware of a possible replacement for PFAS in the products that you have identified?**

☐ Yes
☐ No

Yes: 60%

No: 80%