

PFAS restrictions on industrial materials

Perfluoroalkyl substances (PFAS) are a class of chemical substances that are widely used in consumer products and in many technical areas due to their outstanding and unique properties. They are characterized by high chemical stability, resistance to aqueous and oily substances and high heat resistance up to over 250 °C. For this reason, we encounter PFAS in many everyday objects such as baking paper, outdoor clothing, stain protection and fire extinguishing foams [1]. Due to their high inertness, the substances are also persistent in the environment, they degrade only slowly and can accumulate in organisms. PFAS are associated with various health problems [2], which is why the European Commission has already issued bans on PFOS (perfluorooctane sulfonic acid and derivatives) and PFOA (perfluorooctanoic acid and derivatives) in recent years [3]. A far-reaching proposal to restrict the production, use and placing on the market of all PFAS in the EU has now been published in 2023.

How are PFAS defined - what is planned as part of the restriction and what consequences does this already have today?

According to the OECD, PFAS are basically defined as substances that have at least one fully fluorinated methyl group (-CF₃) or one fully fluorinated methylene group (-CF₂-) in their structure [4]. In the PFAS restriction proposal submitted to the ECHA by the five EU member states Denmark, Germany, the Netherlands, Norway and Sweden, this definition is slightly diluted. Depending on which atoms are bound to the fluorinated groups in question, substances are excluded from the planned restriction [5].

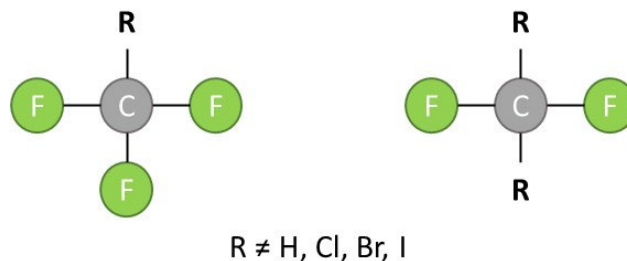


Figure 1: Display of the perfluoromethyl group (left) and the perfluoromethylene group (right). According to the OECD definition, all substances containing one of these groups are classified as PFAS.

In its original form, the restriction procedure provided for a six-month public consultation phase following the development of a restriction proposal. As part of the consultation, all stakeholders were to be given the opportunity to comment on the proposal and contribute their own views. This second phase was completed in September 2023, with more than 5600 comments submitted by more than 4400 organizations [6]. In the current third phase, the comments are being reviewed in expert committees and a scientific assessment of the PFAS restrictions for various areas of application is being developed. Individual sectors will be discussed step by step; meetings on consumer products, cosmetics, ski wax, packaging, textiles, metal coatings and petroleum/mining applications are planned for 2024. Information on other application sectors will be published successively. The consequences for these sectors, i.e. the substances affected, exemptions and the granting of transitional periods, are therefore difficult to predict at present.

Although the PFAS restriction has neither been fully defined nor implemented, manufacturers and distributors are already reacting by discontinuing products. This includes chemicals manufacturer 3M, for example, which

plans to discontinue the production of PFAS chemicals by the end of 2025. Many well-known companies such as Adidas, Ikea and Unilever have already confirmed their intention to eliminate PFAS from their products. Some plastics processors have also already announced that they are phasing out the production of components containing PFAS.

The demand for PFAS will therefore inevitably fall, which raises the question of future supply. This will have consequences even for applications and sectors exempt from the restriction if materials or components are no longer available on the market.

How does a PFAS ban affect mechanical and plant engineering?

In mechanical and plant engineering, PFAS are often used in the form of polymers, for example for seals, hoses, coatings or lubricants. They are relatively easy to identify when used as a base material. However, they are also frequently used as functional additives in compounds, for example as triboadditives, which many end users are not aware of. Some typical representatives of fluorine-containing polymers are listed in Table 1.

Table 1: List of fluoropolymers and their common trade names

Description	Abbreviation	Examples for trade names	Affected by PFAS regulation?
Polytetrafluoroethylen	PTFE	Teflon, Algoflon, Polyflon, Dyneon	Yes
Perfluoralkoxy-Copolymer	PFA	Teflon, Hyflon, Neoflon, Dyneon	Yes
Tetrafluorethylen-Hexa-fluorpropylen-Copolymer	FEP	Teflon, Dyneon, Neoflon	Yes
Ethylen-Tetrafluorethylen-Copolymer	ETFE	Aflon, Dyneon, Neoflon, Tefzel	Yes
Ethylen-Chlortrifluor-ethylen-Copolymer	ECTFE	Halar	Yes
Polychlortrifluorethylen	PCTFE	Voltatef, Aclar, Halon	Yes
Polyvinylidendifluorid	PVDF	Hylar, Kynar, Solef	Yes
Polyvinylfluorid	PVF	Tedlar	No
Fluorkautschuk	FKM	Viton, Day-EL, Tecnoflon, Dyneon	Yes
Perfluorkautschuk	FFKM	Kalrez, Chemraz, Perlast, Simrez	Yes
Perfluorpolyether	PFPE	Fomblin, Galden, Krytox, Brayco	Yes

Due to their unique properties, fluoropolymers perform essential functions, which is why they can sometimes be substituted in products with limited performance, but sometimes not at all. Due to the resulting competitive disadvantage for European companies, the VDMA calls for the general exemption of fluoropolymers in industrial applications in its position paper on PFAS [8]. Even if exemptions are created for fluoropolymers, as is being discussed in the USA and UK, for example, the chemicals and auxiliaries required for their production may be affected by the restriction. Furthermore, the guaranteed availability of the starting materials must be questioned against the background of the product discontinuations already mentioned.

The way out of the PFAS jungle

In view of this uncertain outlook, users of PFAS-containing materials are well advised to deal with the effects of a restriction on their products in good time and to prepare for all situations. The first step in a systematic approach is to take stock - to identify all PFAS in your own products and processes, including materials with

PFAS-containing additives and process auxiliaries affected by a restriction. This is the only way to gain an overview of the consequences that a complete restriction could have in a worst-case scenario.

Based on the specification of the applications in which the PFAS are used, a comparison can be made with materials available on the market and alternatives can be identified. In the course of a material preselection, the group of possible candidates is systematically and cost-effectively tested in order to be condensed to a final selection. These materials are then used for qualification at application level. This is what a targeted approach could look like.

However, it cannot be ruled out that PFAS cannot be replaced equivalently or by other plastics in certain applications, respectively. It may be necessary to switch to other material classes, or the applications may have to be rethought and redeveloped.

The expertise of Materiales in chemistry and hazardous substance management on the one hand and material engineering on the other makes a valuable contribution to the identification of PFAS in the customer portfolio and the development of alternative solutions. Do you need support with PFAS in your company? Then please do not hesitate to contact us.

[1] <https://www.verbraucherzentrale.de/wissen/umwelt-haushalt/produkte/ewigkeitschemikalien-pfas-wo-sie-stecken-warum-sie-problematisch-sind-81811>

[2] <https://www.atsdr.cdc.gov/pfas/health-effects/index.html>

[3] <https://echa.europa.eu/de/hot-topics/perfluoroalkyl-chemicals-pfas>

[4] https://www.oecd-ilibrary.org/environment/reconciling-terminology-of-the-universe-of-per-and-polyfluoroalkyl-substances_e458e796-en

[5] <https://echa.europa.eu/documents/10162/f605d4b5-7c17-7414-8823-b49b9fd43aea>

[6] https://www.reach-clp-biozid-helpdesk.de/SharedDocs/Meldungen/DE/REACH/2023-09-26_Konsultation_zur_PFAS_Beschr%C3%A4nkung

[7] <https://www.umweltbundesamt.de/themen/pfas-beschaenkung-echa-gibt-naechste-schritte>

[8] <https://www.vdma.org/viewer/-/v2article/render/79600192>