Position paper of the semiconductor industry on the restriction proposal for PFAS substance group

Status: 06.09.2023

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1) General

PFAS is an acronym for per- and polyfluorinated chemicals. According to the latest estimates, this group of substances includes more than 10,000 different substances. PFAS do not occur naturally. They are characterized by the fact that they are permanently stable and water, dirt, and grease-repellent. Because of their unique combination of properties, PFAS are used in a wide variety of products such as outdoor equipment, cookware, dirt-repellent carpets, and food packaging.
In addition, they are indispensable in many industrial processes as auxiliary materials or in the infrastructure, e.g., in the form of pipe linings and reliable seals.

2) Background

On February 7, 2023, the European Chemicals Agency (ECHA) published a preliminary version of the Restriction Dossier for Per- and Polyfluorinated Alkyl Substances (PFAS) on their website.

The restriction dossier is based on an initiative by five member states: Germany, the Netherlands, Sweden, Denmark, and Norway and sees an EU-wide ban on the manufacture, placing on the market and use of all substances defined as PFAS (as such or above certain concentration limits in mixtures and products).

However, the technically required robustness and positive properties of PFAS also make them so-called “forever chemicals” which, if released uncontrolled into the environment, will hardly degrade. This results in the aim of this ban: to stop further accumulation of PFAS in man and the environment; to eliminate any negative impact on human health and protect nature. Thus, the necessary and natural stability of the PFAS substances determines their fate at the same time. And directly calls into question the search for and use of alternatives, as possible substitutes would also need to have these non-degradable properties.

It should also be mentioned that PFAS substances contain chemical bonds with fluorine, which is one of the most electronegative (reactive) atoms of the periodic table. This is exactly what makes the chemical bonds so stable. Finding another element with the same inert effect is not possible and will always lead to alternatives that deteriorate and burden nature even more due to the higher consumption. However, new risks would also arise here. For example, seals are always a weak point in technical systems, especially for aggressive chemicals or use at elevated temperatures. Failure can lead to the uncontrolled release of large quantities of hazardous substances into the environment. Here it should be considered whether the risk of tested, reliable PFAS in a controlled industrial environment is not the better solution. From a purely legal point of view, the approval and operation of high-tech equipment and processes are called into question by this proposed restriction.

The proposal that has now been published stipulates that PFAS may only be used for a limited period in areas where there are no suitable alternatives in the foreseeable future or where the socio-economic benefits outweigh the disadvantages for man and the environment. Possible examples of this are industrial processes such as the production of semiconductors, personal protective equipment for rescue and security forces or medical products.

3) Differentiation

The large substance group of PFAS is divided into further groups - see the following picture - some of which differ greatly in their properties and risk profiles.

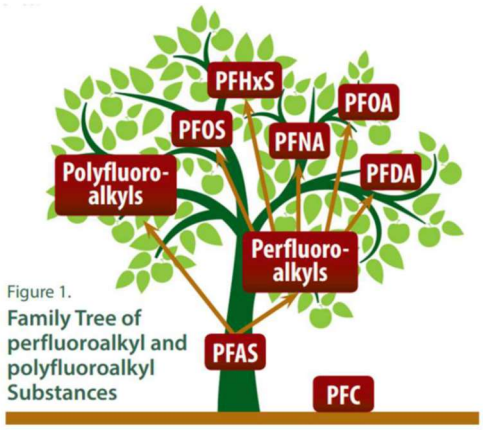

Figure 1.
Family Tree of perfluoroalkyl and polyfluoroalkyl Substances

Source: https://health.hawaii.gov/heer/environmental-health/highlighted-projects/pfas/

Many of the substances are not classified as hazardous substances under the CLP Regulation. The most industrially relevant fluoropolymers meet the OECD criteria for “polymers of low concern” (PLC). This classification means that fluoropolymers do not have acute or exhibit subchronic systemic toxicity, irritation, or sensitization; are bioavailable and not water-soluble and, when used as intended, none pose a potential risk. These include PFA, FEP, ETFE and also PTFE – colloquially known as Teflon.

4) Specificities of the semiconductor industry

Extremely high purity requirements apply throughout the semiconductor industry – both in terms of the raw materials used and the environmental conditions. All processes are designed to protect the products from unwanted contamination. The use of PFAS-containing components in infrastructure makes a major contribution to this. Decades of experience have shown that even the smallest changes in the processes mean that the product no longer meets the requirements and can therefore not be used for the intended purpose. Therefore, changes in the highly complex processes generate serious effects and are usually associated with high costs.

According to the applicable international standards such as ISO 9001, such changes must be reported to the customer, which starts a qualification phase of several months to several years for such a product. Of course, when developing new and further processes, we always ensure that hazardous

substances that pose a risk to human health and the environment are only used where their physical and/or chemical properties are absolutely necessary, and in the smallest possible quantities.
This always includes the implementation of correspondingly effective protective measures. This is in the very best interests of the industry, since the delivery, storage, use (occupational safety) and disposal of hazardous substances cause very high costs and also involve considerable liability risks. The use of less hazardous substances is therefore an ideal means of saving costs. Nevertheless, there are special uses, e.g., of process chemicals containing PFAS, where there is not even a rudimentary idea for their substitution.

5) Possible impacts of a PFAS ban

Due to the large number of substances that would be restricted, an extremely wide range of industry would be affected and the ban would generate massive economic and social effects.

Because of the inert behavior of PFAS - they do not react with the products (= do not contaminate them) - PFAS are often used in the semiconductor sector in industrial plants in hoses, lines, valves, and other system parts. Here they contribute to the safety and longevity of the systems and industrial infrastructure. Due to the general conditions (e.g., high temperatures, high pressures, and extreme pH values), there are often no suitable alternatives.
If the restriction were to come into effect to the extent envisaged, companies in the semiconductor sector would face a multitude of problems (potentially even the end of production in Europe):

- Reduced availability of substances in Europe leads to a shortage of affected process chemicals and components. In extreme cases, supply chains may even be permanently interrupted (e.g., due to the closure of European SMEs). One would (have to) switch to suppliers from non-European countries.
- In the medium term, the safety and functionality of systems will be impaired, so that the quality of the products will suffer.
- The costs arising from the substitution requirement limit the financial resources of the companies, which would then have to limit other expenditures, e.g., for research and development.
- Legal compliance cannot be used as a price argument for customers, i.e., the costs for the substitution of PFAS cannot be passed on to the products for companies. This weakens the competitiveness of European companies compared to non-European competition. This would contradict the goals of the REACH regulation, where the restriction proposal is a legal part of.
- If the proposed restriction were to be implemented in this way, the semiconductor industry would no longer be able to contribute to the goals of the Green Deal and industrial transformation in the intended scope and timeframe. On the contrary – there would be a high risk of further weakening European sovereignty. Subsidized investments such as the settlement of chip factories, the implementation of funded innovative projects such as the IPCEI ME/CT (Important Project of Common European Interest Microelectronics/Communication Technology), European Chips Act or Critical Raw Materials Act would be torpedoed.
- Entire branches of industry that process electronic components and socially used applications such as automobiles, aircraft, space travel, communication networks (e.g., fiber optic cables), medical technology and the defense industry would be called into question. The same applies to the activities of research institutions.

- A transitional period of 13.5 years is mentioned in the restriction proposal for the semiconductor manufacturing process. This raises the question of what exactly does the term "semiconductor manufacturing process" encompass? Apart from that, it is proven state of the art in our industry to equip the infrastructure and plant components with components made from fluoropolymers. Alternative substances would need to have similar properties to ensure the same functionality and safety. It therefore seems unlikely that a substitute will be found, tested, and qualified within 13.5 years. Is an extension of the exemption period planned for this case? If not, many companies would have to stop doing business in Europe.
- Since PFAS are often no longer contained in the end products but are only used as process chemicals or as part of production plants, it would be possible to import competing products from non-EU countries without any problems. This would also be associated with a further cost disadvantage for European companies if production methods that have been tried and tested over many years can no longer be used. These non-EU competitors do not have the considerable additional costs for the qualification of substitutes. It should be clear what this will mean for future investment decisions.

6) Evaluation of the restriction proposal

The scope of the proposed restriction is very broad. Many substances with very different properties and risk profiles are affected. A subdivision (see picture above) and a correspondingly differentiated evaluation of the risks associated with these groups and already established protective measures was not done. Instead, the proposed restriction would apply to the entire substance class with > 10,000 individual substances and ban them completely by defining the scope as “manufacture, placing on the market and any use”. The few proposed exceptions are also limited in time.

Many of the substances are currently not classified according to the CLP regulation.
The authorities justify the restriction with the persistence of the substances. However, persistence alone does not represent a hazardous property, or is rather an indication of harmlessness since there is no reaction with the environment. In addition, there are established recycling processes for a wide range of PFAS groups of substances that are already in use [1)].

The "restriction" is anchored in the REACH regulation. There it is laid down in Art. 68 for the enactment of new and the amendment of existing restrictions:
"1. Where the manufacture, use or placing on the market of substances poses an unacceptable risk to human health or the environment that needs to be addressed at Community level, Annex XVII shall be amended in accordance with the procedure referred to in Article 133(4) by: new restrictions on the manufacture, use or placing on the market of substances on their own, in mixtures or in articles are imposed or existing restrictions in Annex XVII are amended in accordance with the procedure laid down in Articles 69 to 73. Such a decision will take into account the socio-economic impact of the restriction, including the availability of alternatives.”
A risk assessment for these substances in the interaction of dangerous properties and exposures related to specific uses as described in REACH and the consideration of alternatives did not take place. This procedure therefore contradicts the REACH regulation.

[1)] https://www.pro-kunststoff.de/assets/Merkbl%C3%A4tter%20und%20Co/FP%20TM-10-Recycling-von-Fluorkunststoffen.pdf

In the restriction proposal, the substance group of 'PFAS' is mentioned in general, but no specific identifier (e.g., CAS number) for affected substances is given. This makes it much more difficult to analyze how affected each company is and to query the supply chain.

In the semiconductor sector, PFAS are used in two ways:

1. in the area of infrastructure and as highly standardized system components as well
2. as process chemicals.

The use of these products in industrial plants has so far only been insufficiently considered in the restriction dossier.

The evaluation of alternatives – or their (non-)existence- for the granting of exceptions is a crucial factor. Here, too, a specific use in the semiconductor industry and the associated requirements for the materials or components used, must be considered. Even if there is an alternative on a laboratory scale, this does not mean that it is also suitable for mass production. In addition, there are other factors that need to be assessed and that decide on the suitability of supposed alternative substances:

- Safety check (occupational safety, environmental compatibility)
- Existing legal regulations (e.g., classification under CLP)
- Technical standards
- Technical data (e.g., energy consumption, service life, functionality)
- Economic analysis
- Availability on the market + conditions in the supply chain etc.

The absolute ban and any time limit at all, even if 13.5 years are planned for the "semiconductor manufacturing processes", seems absurd if substitutes are not even theoretically conceivable.
In areas where PFAS can be replaced, typical development times of 20-30 years from the idea to the industrial product must be expected.

7) Possible improvements and requests

Of course, the semiconductor industry supports the reduction of risks to human health and the environment out of conviction, but regulatory measures such as the restriction proposal for PFAS should be carried out in an appropriate and holistic manner, considering all resulting consequences. From our point of view, the following aspects should be considered:

- Following the REACH regulation, a differentiated assessment of the risks to man and the environment (hazards + exposures) - including already established protective measures/use- must take place. A distinction between industrial uses and consumer products would probably be helpful.
- If the assessment does not result in an unacceptable risk, these substances or groups of substances must be removed from the restriction.
- There must be a holistic consideration of alternatives, if there are any. Safe uses of PFAS, that cannot be replaced by suitable alternatives, must continue to be possible for industrial uses in Europe.

  - The transitional periods must be appropriate and sector specific. A blanket regulation cannot reflect the special features common for the semiconductors industry, such as development periods, qualification, and certification phases at customers.
  - Exceptions for the semiconductor industry, where PFAS are not included in the product and where safe use is already proven, should be established indefinitely.
  - It must be prevented that European companies no longer produce, due to the PFAS restriction, but non-European companies can import such articles into the EU.
  - The PFAS that are regulated with this restriction should be clearly identifiable, e.g., with a CAS number, so that the companies and also the actors in the supply chain can act efficiently and transparently.
  - A method must be found to identify PFAS contained in articles along the supply chain. It would still have to be discussed which data is required exactly.
  - There must be coherence between the chemical policy regulations and the measures to implement the EU's goals from the Green Deal.
- After the end of this public consultation and based on the facts submitted, the restriction proposal must be revised and corrected on the points where assumptions are made, e.g., regarding the availability of alternatives or where technical solutions were assumed.

8) Summary

The semiconductor industry is characterized by very high investment costs as well as considerable ongoing operating costs. The manufacturing processes have been optimized over many years, even the smallest changes can have fatal consequences. Any changes therefore mean at least high additional costs, but also high risks that it will not function.

A PFAS ban would SIMULTANEOUSLY force changes in production processes in many different places. Even if the transition periods appear “generous” at first glance, it is to be expected that new investments will already (!) have been diverted to regions of the world that are not affected by the not reliably calculatable risk of this ban. When the ban then comes into force, the written-off production facilities will be shut down in a precisely planned manner.