# Factsheet “PFAS and Consumer Electronics”

## Products:

Consumer electronics (CE) products are used in every household and in many cases also in companies. PFAS, especially fluoropolymers, are relevant for the production of various products in the consumer electronics industry and affect the following product groups, among others:

- TV sets (including displays, housings, cables)
- Projectors
- Sound systems / loudspeakers
- Microphones

Accordingly, consumers and commercial users would be particularly affected by a PFAS ban.

## Market information:

- Market environment: In 2022, sales of around 30.7 billion euros were generated in Germany with classic consumer electronics, privately used IT products and telecommunications. Looking at Europe, sales of around 187 billion euros were achieved.
- PFAS content: It can be assumed that PFAS are contained in a large proportion of products in the electronic consumer goods industry and/or are used in the manufacturing process. A serious, concrete estimate of the proportion is not possible.
- Other relevant information: The market is highly international and characterised by globally extending supply chains or interrelationships.
- Relevance to EU policy/strategic objectives: PFAS used in consumer electronics (CE) products contribute to energy efficiency (e.g. components of displays), durability, heat and chemical resistance and general product safety. Without the use of PFAS, these properties could no longer be guaranteed to the same extent. The consequence would be higher resource consumption due to decreasing in the longevity of products. This contradicts to the EU's climate, environmental and sustainability goals (Green Deal).

## Requirements profile

- Lifetime: Consumer electronics (CE) products must withstand the everyday stress of frequent daily use. PFAS are therefore used, for example, in housings and other components to extend durability.
- Required availability period of spare parts: For displays, for example, this is regulated in the corresponding Ecodesign Regulation. This stipulates that spare parts must be available for at least seven years after the last product in a product series has been placed on the market. According to the present restriction proposal, a PFAS ban would also apply to spare parts and make repairs impossible.
- Temperature resistance: Consumer electronics (CE) products usually have cables whose coating almost without exception contains PFAS to ensure heat resistance.
- Standards: UL 94 is important for PFAS e.g. PTFE as anti-drip agent. PTFE is used to improve flame retardancy. It has an extremely high melt viscosity and is elementary for the safety of electrical and electronic equipment.

# Identified PFAS Uses

## In the finished product

| **1. Displays** | |
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| **PFAS substance/substance group:**<br>Fluoropolymers | **PFAS-containing material/component:**<br>Anisotropic Conductive Film,<br>Assy open cell |
| Reason for PFAS use/requirement profile:<br>• high temperature stability, high electrochemical stability, low dielectric constant, non-flammable and resistant to chemicals, good adhesive properties<br>• The fluoropolymer on the surface of the panel has a refractive index of 1.3, which is almost half the refractive index of 1.0 for air and 1.5 for the polariser TAC film, and suppresses surface reflection. This results in a 3% increase in backlight energy efficiency. It also improves the visibility of the panel by preventing fingerprint stains on the surface. Only fluoropolymer has the above mentioned properties. It cannot be replaced by silicone or other resins that are considered substitutes. | |

| **2. Electrical/electronic components: Printed Circuit Boards, SMD, SMPS** | |
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| **PFAS substance/substance group:**<br>PTFE and other fluoropolymers | **PFAS-containing material/component:**<br>coating, insulators |
| Reason for PFAS use/requirement profile:<br>• anti-fouling, high temperature stability, high electrochemical stability, low dielectric constant, non-flammable and resistant to chemicals. | |

| **3. Housing** | |
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| **PFAS substance/substance group:**<br>PTFE and other fluoropolymers | **PFAS-containing material/component:**<br>Plastic parts |
| Reason for PFAS use/requirement profile:<br>• anti-drip agent, PTFE has high thermal stability and flame resistance. | |

| **4. Remote controls** | |
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| **PFAS substance/substance group:**<br>PVDF | **PFAS-containing material/component:**<br>Li-Ion battery |
| Reason for PFAS use/requirement profile:<br>• Water, oil and dirt repellent, resistant to extreme conditions (high temperatures, pressure and aggressive chemicals), electrical and thermal insulation, good adhesive properties to hold the active mass together in the electrode and ensure adhesion to the current collector. | |

| **5. Cables** | |
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| **PFAS substance/substance group:**<br>PTFE, PFA, PVDF and other fluoropolymers | **PFAS-containing material/component:**<br>Insulators |
| Reason for PFAS use/requirement profile:<br>• Mainly safety-relevant functions such as high temperature stability, high electrochemical stability, low dielectric constant, non-flammable and resistant to chemicals. | |

| **6. Microphones** | |
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| **PFAS substance/substance group:**<br>PTFE and other fluoropolymers, FEP, FKM, PVDF | **PFAS-containing material/component:**<br>Membrane, mesh, electret foil |
| Reason for PFAS use/requirement profile:<br>• Air and sound insulation, anti-fouling, chemical resistance | |

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| • An electret material has a permanent electrical dipole moment. When used in a condenser microphone, it provides the polarisation voltage between the diaphragm and the back plate instead of the external supply voltage. Electret materials are usually polymers with high resistance, a good example is PTFE. Advantage: The generation of a high DC voltage and the extensive filtering required to achieve low noise floor, low ripple and low hum require bulky components (except for battery-powered devices). Since this is not necessary, the miniaturisation potential of electret meters is greatly increased.<br>• High temperature stability with retention of the externally permanently applied charge up to 260°C soldering temperature.<br>• High long-term stability of the applied charge, thus very good product life cycles of up to 25 years. |

| **7. Lubricants** | |
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| **PFAS substance/substance group:**<br>PTFE, PFPE, PFHxA, PFBS etc. | **PFAS-containing material/component:**<br>Lubricants, lubricating oils |
| Reason for PFAS use/requirement profile:<br>• Lubricity, abrasion resistance, low water absorption, low moisture permeability, flame retardancy, durability.<br>• There is no other material than fluoropolymers that can simultaneously fulfil several properties such as flame resistance and chemical resistance in addition to lubricity.<br>• For checking and ensuring the smooth movement of drive parts or sealed parts, such as camera zoom lenses, motors, compressors, etc. | |

| **8. Remaining product** | |
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| **PFAS substance/substance group:**<br>PTFE and other fluoropolymers | **PFAS-containing material/component:**<br>Adapter, adhesive |
| Reason for PFAS use/requirement profile:<br>• anti-fouling, high temperature stability, high electrochemical stability, low dielectric constant, non-flammable and resistant to chemicals. | |

# In the CE appliance manufacturing process

| **1. Semiconductor manufacturing** | |
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| **PFAS substance/substance group:**<br>PFHxA, PFBA, PFBS, Polyfluoroalkyl (meth)acrylate | **PFAS-containing material/component:**<br>Photo acid generators (PAG), photo acid and photoresist. |
| Reason for PFAS use/requirement profile:<br>• Photoacid generators (PAG), surfactants, anisotropic/isotropic etching and protective film formation, low dielectric constants, high thermostability, chemical inertness (to acids, bases and solvents) and low moisture absorption, low electrical permittivity/dielectric losses, low water absorption and low coefficient of thermal expansion (CTE), electrically non-conductive when used as a heat transfer fluid and usable over a very wide temperature range and non-corrosive in closed systems.<br>• Various materials were considered for the photo-acid generators and photoresist needed for the semiconductor manufacturing process, but in the end only fluorine materials remained, which are currently in use. The alternatives described in the dossier have been studied in the past and do not have the same performance characteristics and are therefore not practical. | |

| **2. Production of thin-film components (micro-electro-mechanical systems/MEMS, SAW, etc.)** | |
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| **PFAS substance/substance group:**<br>PFHxA, PFBA, PFBS, Polyfluoroalkyl (meth)acrylate | **PFAS-containing material/component:**<br>Photo acid generators (PAG), photoresist. |
| Reason for PFAS use/requirement profile:<br>• Thin film device manufacturing (MEMS (micro-electro-mechanical systems), SAW, etc.), which began with the manufacture of mechanical components using semiconductor manufacturing technology, uses fluorinated materials for photo-acid generators and photoresist for the same reason as semiconductor manufacturing. The alternative materials described in the dossier have also been studied in the past and have poor performance characteristics, which is why they cannot be used. | |

## In machines and plants for production

| 1. **Machines for semiconductor production** | |
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| **PFAS substance/substance group:**<br>PTFE, PFA, FEP, ETFE, PVDF, FKM, FFKM, FEPM FFKO, PFPE, PCTFE | **PFAS-containing material/component:**<br>Design of polymer substrates and dielectric materials, manufacturing equipment for adhesives, underfills, filters, matrix resins, valve seals, etc., heat transfer fluids, surface protection |
| Reason for PFAS use/requirement profile:<br>• Fluorine compounds such as PFAS are the only materials that can simultaneously perform and exhibit multiple functions, such as low dielectric constant, low dielectric loss tangent, low refractive index, oil repellency, electrical insulation, water repellency, heat resistance, chemical resistance, weatherability, demouldability, flame resistance, separability, wear resistance, surface properties (coefficient of friction), flexural strength, ductility, non-flammability, etc. which are necessary for the normal functioning of semiconductor manufacturing processes, semiconductor manufacturing equipment and semiconductors under various environmental conditions, making substitution by other materials extremely difficult. | |

## Substitution

- Substitutes: Currently neither known nor available. Tested substitute materials proved to be less stable and functional, which suggests a shorter service life. If PFAS were no longer allowed to be used, this would inevitably lead to negative consequences in terms of energy efficiency, quality, safety and product longevity.

## Safe use: avoidance and reduction of emissions and exposure

- Waste collection and recycling: The environmental impact of PFAS in electrical and electronic equipment (EEE) is foreseeably extremely low, as EEEs are to be disposed of properly according to the WEEE Directive.

## Socio-economic impact

### Consequences of the proposed restriction

- Product quality and performance: Replacing PFAS – if substitutes are available at all – would mean a technological step backwards. In addition, product safety would be severely restricted (e.g. flame retardancy) and sales of the products would therefore be significantly jeopardised. In some cases, an external power supply would be required for certain products to function. Another consequence would be higher energy requirements and lower energy efficiency. In addition, there would be lower heat and chemical resistance of the products, lower durability and flexibility, explosion or fire risk (Li-Ion batteries).
- Conflicts with policy goals and strategies: Reduced energy efficiency and product lifespan are in conflict with the transition to improved product durability and sustainability.
- Competitiveness (also on global markets in direct comparison with products containing PFAS): The product performance consumers are used to could no longer be guaranteed for the European market. Illegal import of products containing PFAS is feared as a consequence.

## Required transition period and/or derogations

- A transition period of at least 6.5 years is generally required.
- We request a general derogation period of 12 years (plus transition period) for PFAS in Li-ion batteries (see the submission of ZVEI battery section).
- For semiconductors, a transition period of at least 12 years (plus transition period) is necessary (see the corresponding consultation contribution or the factsheet on semiconductors).
- Polymeric PFAS meeting the OECD criteria for "polymers of low concern" should be excluded from the scope of the restriction or should be granted a long-term derogation.
- All exemptions should include a review option for further prolongation if no substitutes are available.

## Our sector offers:

- It is in the interest of manufacturers to provide innovative, energy- and resource-efficient products that do not pose risks to health and/or the environment. We support the idea of limiting substances that pose risks. However, it is currently only possible to guarantee the product safety of CE devices, especially with regard to flame, temperature and chemical resistance and thus also the durability of products, by using certain PFAS (as described).
- We know our production processes and can virtually rule out exposure to the environment there. In order to avoid a release of PFAS after the products have been placed on the market, we propose to first classify the PFAS to be regulated as SVHC (Substances of Very High Concern), so that the possibility is created to track products containing PFAS. The SCIP database is open to all recyclers and the general public for information. Known and studied recycling processes can then be used to prevent the release of PFAS into the environment.

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