

## Swissmem Contribution to ECHA Consultation on the PFAS restriction

|                                                                                       |                                                                                                |
|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| <b>ECHA question</b>                                                                  | <b>Swissmem reply</b>                                                                          |
| Where did you learn about this consultation?<br>(please select all that apply):*      | Industry organisation                                                                          |
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| I am submitting information:*                                                         | on behalf of an<br>organisation or institution                                                 |
| Type of organisation/institution:*                                                    | industry or trade<br>organisation                                                              |
| Country where the organisation or institution<br>is legally established:*             | Switzerland                                                                                    |
| Name of organisation / institution:*                                                  | Swissmem                                                                                       |
| I agree to the disclosure of the name of my<br>organisation/institution to the public | yes                                                                                            |

### General Comments

It is possible to provide both general comments on the Annex XV restriction report subject to this Consultation and answers to the specific questions posed. In both cases, it is necessary to provide supporting evidence to allow ECHA's Committees to take your comments into account. It is important not to leave the submission of any socio-economic information until the consultation on SEACs opinion but already submit relevant comments at this stage.

Select the relevant boxes that cover the content of your comments and provide your non-confidential comments below, (maximum 9 000 characters)

|                                                                                                                                                                                                                                                                                                                                                                 |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| 9 000 characters)                                                                                                                                                                                                                                                                                                                                               | X |
| Scope or restriction option analysis                                                                                                                                                                                                                                                                                                                            | - |
| Hazard or exposure                                                                                                                                                                                                                                                                                                                                              | - |
| Environmental emissions                                                                                                                                                                                                                                                                                                                                         | - |
| Baseline                                                                                                                                                                                                                                                                                                                                                        | - |
| Description of analytical methods                                                                                                                                                                                                                                                                                                                               | - |
| Information on alternatives                                                                                                                                                                                                                                                                                                                                     | X |
| Information on benefits                                                                                                                                                                                                                                                                                                                                         | X |
| Other socio economic analysis (SEA) issues                                                                                                                                                                                                                                                                                                                      | X |
| Transitional period                                                                                                                                                                                                                                                                                                                                             | X |
| Request for exemption                                                                                                                                                                                                                                                                                                                                           | X |
| I understand that it is my responsibility not to include confidential information in responses to general comments and in any responses to requests for specific information (e.g. company name, email addresses, phone numbers, signatures etc.). ECHA will not be held liable for any damages caused by making non confidential responses publicly available. | X |
| Please provide your general comments in the box below (max. 9000 characters)                                                                                                                                                                                                                                                                                    | X |

### **Specific Information Requests**

- 1 Sectors and (sub-)uses:** Please specify the sectors and (sub-)uses to which your comment applies according to the sectors and (sub-)uses identified in the Annex XV restriction report (Table 9). If your comment applies to several sectors and (sub-)uses, please make sure to specify all of them. I have information on this topic

- 2 Emissions in the end-of-life phase:** The environmental impact assessment does not cover emissions resulting from the end-of-life phase. To get a better understanding of the extent of the resulting underestimation, (sub-)use-specific information is requested on emissions across the different stages of the lifecycle of products, i.e. the manufacture phase, the use phase and the end-of-life phase. Please provide justifications for the representativeness of the provided information. In particular: I have information on this topic

Please provide, at the (sub-)use level, an indication of the share of emissions (as percentages) attributable to these three different stages. An indication of annual emission volumes in the end-of-life phase at sector or sub-sector level would also be appreciated.

If possible, please provide for each (sub-)use what share of the waste (as percentages) is treated through incineration, landfilling and recycling. Please provide information to justify the estimates as well as information on the form of recycling referred to.

**3 Emissions in the end-of-life phase:** With respect to waste management options, additional information is requested on the effectiveness of incineration under normal operational conditions (for different waste types, e.g. hazardous, municipal) with respect to the destruction of PFAS and the prevention of PFAS emissions.

I have information on this topic

**4 Impacts on the recycling industry:** To get an understanding of the impacts of the proposed restriction on the recycling industry, information is requested on:

I have information on this topic

The impacts that the concentration limits proposed in paragraph 2 of the proposed restriction entry text (see table starting on page 4 of the summary of the Annex XV restriction report) have on the technical and economic feasibility of recycling processes (together with a clear indication on the waste streams to which the described impacts ~~relate~~ relate) measures that recyclers would need to take to achieve the proposed concentration limits. The costs associated with these measures.

**5 Proposed derogations – Tonnage and emissions:** Paragraphs 5 and 6 of the proposed restriction entry text (see table starting on page 4 of the summary of the Annex XV restriction report) include several proposed derogations. For these proposed derogations, information is requested on the tonnage of PFAS used per year and the resulting emissions to the environment for the relevant use. Please provide justifications for the representativeness of the provided information.

I have information on this topic

tonnage of PFAS used per year

resulting emissions to the environment for the relevant use

justifications for the representativeness of the provided information

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| <p><b>6 Missing uses – Analysis of alternatives and socio-economic analysis:</b> Several PFAS uses have not been covered in detail in the Annex XV restriction report (see uses highlighted in blue and orange in Table A.1 of Annex A of the Annex XV restriction report). In addition, some relevant uses may not have been identified yet. For such uses, <u>specific information</u> is requested on <u>alternatives and socio-economic impacts</u>, covering the following elements:</p> | <p>I have information on this topic</p> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|

a. The annual tonnage and emissions (at sub-sector level) and type of PFAS associated with the relevant use.

b. The key functionalities provided by PFAS for the relevant use.

c. The number of companies in the sector estimated to be affected by the restriction.

d. The availability, technical and economic feasibility, hazards and risks of alternatives for the relevant use, including information on the extent (in terms of market shares) to which alternative-based products are already offered on the EU market and whether any shortages in the supply of relevant alternatives are expected.

e. For cases in which alternatives are not yet available, information on the status of R&D processes for finding suitable alternatives, including the extent of R&D initiatives in terms of time and/or financial investments, the likelihood of successful completion, the time expected to be required for substitution (including any relevant certification or regulatory approvals) and the major challenges encountered with alternatives which were considered but subsequently disregarded.

f. For cases in which substitution is technically and economically feasible but more time is required to substitute:

f.i. the type and magnitude of costs (at company level and, if available, at sector level) associated with substitution (e.g. costs for new equipment or changes in operating costs);

f.ii. the time required for completing the substitution process (including any relevant certification or regulatory approvals);

f.iii. information on possible differences in functionality and the consequences for downstream users and consumers (e.g. estimations of expected early replacement needs or expected additional energy consumption);

f.iv. information on the benefits for alternative providers.

g. For cases in which substitution is not technically or economically feasible, information on what the socio-economic impacts would be for companies, consumers, and other affected actors. If available, please provide the annual value of EU sales and profits of the relevant sector, and employment numbers for the sector.

**7 Potential derogations marked for reconsideration – Analysis of alternatives and socio-economic analysis:** Paragraphs 5 and 6 of the proposed restriction entry text (see table starting on page 4 of the summary of the Annex XV restriction report) include several potential derogations for reconsideration after the consultation (in [square brackets]). These are uses of PFAS where the evidence underlying the assessment of the substitution potential was weak. The substitution potential is determined on the basis of i) whether technically and economically feasible alternatives have already been identified or alternative-based products are available on the market at the assumed entry into force of the proposed restriction, ii) whether known alternatives can be implemented before the transition period ends (taking into account time requirements for substitution and certification or regulatory approval), and iii) whether known alternatives are available in sufficient quantities on the market at the assumed entry into force to allow affected companies to substitute.

I have information on this topic

A summary of the available evidence as well as the key aspects based on which a derogation is potentially warranted are presented in Table 8 in the Annex XV restriction report, with further details being provided in the respective sections in Annex E.

To strengthen the justifications for a derogation for these uses, additional specific information is requested on alternatives and socio-economic impacts covering the elements described in points a) to g) in question 6 above.

a. The annual tonnage and emissions (at sub-sector level) and type of PFAS associated with the relevant use.

b. The key functionalities provided by PFAS for the relevant use.

c. The number of companies in the sector estimated to be affected by the restriction.

d. The availability, technical and economic feasibility, hazards and risks of alternatives for the relevant use, including information on the extent (in terms of market shares) to which alternative-based products are already offered on the EU market and whether any shortages in the supply of relevant alternatives are expected.



e. For cases in which alternatives are not yet available, information on the status of R&D processes for finding suitable alternatives, including the extent of R&D initiatives in terms of time and/or financial investments, the likelihood of successful completion, the time expected to be required for substitution (including any relevant certification or regulatory approvals) and the major challenges encountered with alternatives which were considered but subsequently disregarded.

f. For cases in which substitution is technically and economically feasible but more time is required to substitute:

f.i. the type and magnitude of costs (at company level and, if available, at sector level) associated with substitution (e.g. costs for new equipment or changes in operating costs);

f.ii. the time required for completing the substitution process (including any relevant certification or regulatory approvals);

f.iii. information on possible differences in functionality and the consequences for downstream users and consumers (e.g. estimations of expected early replacement needs or expected additional energy consumption);

f.iv. information on the benefits for alternative providers.

g. For cases in which substitution is not technically or economically feasible, information on what the socio-economic impacts would be for companies, consumers, and other affected actors. If available, please provide the annual value of EU sales and profits of the relevant sector, and employment numbers for the sector.

|                                                                                                                                                                                                                                                                          |                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| <b>8 Other identified uses – Analysis of alternatives and socio-economic analysis:</b>                                                                                                                                                                                   | I have information on this topic |
| Table 8 in the Annex XV restriction report provides a summary of the identified sectors and (sub-)uses of PFAS, their alternatives and the costs expected from a ban of PFAS. More details on the available evidence are provided in the respective sections in Annex E. |                                  |

For many of the (sub-)uses, the information on alternatives and socio-economic impacts was generic and mainly qualitative. In particular, evidence on alternatives was inconclusive for some applications falling under the following (sub-)uses: technical textiles, electronics, the energy sector, PTFE thread sealing tape, non-polymeric PFAS processing aids for production of acrylic foam tape, window film manufacturing, and lubricants not used under harsh conditions.

More information is needed on alternatives and socio-economic impacts to conclude on substitution potential, proportionality, and the need for specific time-limited derogations. Therefore, specific information (if not already included in the Annex XV restriction report or covered in the questions above) is requested on alternatives and socio-economic impacts covering the elements listed in points a) to g) in question 6 above.

a. The annual tonnage and emissions (at sub-sector level) and type of PFAS associated with the relevant use.

b. The key functionalities provided by PFAS for the relevant use.

c. The number of companies in the sector estimated to be affected by the restriction.

d. The availability, technical and economic feasibility, hazards and risks of alternatives for the relevant use, including information on the extent (in terms of market shares) to which alternative-based products are already offered on the EU market and whether any shortages in the supply of relevant alternatives are expected.

e. For cases in which alternatives are not yet available, information on the status of R&D processes for finding suitable alternatives, including the extent of R&D initiatives in terms of time and/or financial investments, the likelihood of successful completion, the time expected to be required for substitution (including any relevant certification or regulatory approvals) and the major challenges encountered with alternatives which were considered but subsequently disregarded.

f. For cases in which substitution is technically and economically feasible but more time is required to substitute:

f.i. the type and magnitude of costs (at company level and, if available, at sector level) associated with substitution (e.g. costs for new equipment or changes in operating costs);

f.ii. the time required for completing the substitution process (including any relevant certification or regulatory approvals);

f.iii. information on possible differences in functionality and the consequences for downstream users and consumers (e.g. estimations of expected early replacement needs or expected additional energy consumption);

f.iv. information on the benefits for alternative providers.

g. For cases in which substitution is not technically or economically feasible, information on what the socio-economic impacts would be for companies, consumers, and other affected actors. If available, please provide the annual value of EU sales and profits of the relevant sector, and employment numbers for the sector.

## **9 Degradation potential of specific PFAS**

**sub-groups:** A few specific PFAS sub-groups are excluded from the scope of the restriction proposal because of a combination of key structural elements for which it can be expected that they will ultimately mineralize in the environment. RAC would appreciate to receive any further information that may be available regarding the potential degradation pathways, kinetics or produced metabolites in relevant environmental conditions and compartments for trifluoromethoxy, trifluoromethylamino- and difluoromethanedioxy-derivatives.

I don't have information on this topic

**10 Analytical methods:** Annex E of the Annex XV restriction report contains an assessment of the availability of analytical methods for PFAS. Analytical methods are rapidly evolving. Please provide any new or additional information on new developments in analytics not yet considered in the Annex XV restriction report. I don't have information on this topic

**Non-confidential attachment**

- Letter Swissmem  
- Excel reply to consultation  
- 24 documents provided by Levitronix

**Confidential attachment**

none

Swissmem reply

see attached letter

Sectors:

- **Food contact materials and packaging** (Cookware, industrial food & feed production)
- **Energy sector** (lithium-ion batteries, sealing, high purity applications, proton exchange membrane, isolation, gas industry compressors for H2-mobility/energy transport&storage, insulating gases for T&D, fuel cells, wind energy)
- **Transport sector** (sealing, electrical engineering and information technology, safety equipment, coating)
- **Electronics and semiconductors** (wires & cables, electronic components production, wafer production, coating, sealing,
- **Lubricants** (grease, dry running friction application, granular solid lubricant, high performance lubricants, liner)
- **Petroleum and mining** (lining, seals, gaskets, sensors, cables, drilling fluids, application in compressors for refinery/gas g
- **Medical devices** (diagnostic equipment, inhalers, tubes)
- **Construction products** (sealing, gaskets)

Sectors not investigated in detail:

- **Chemical industry** (chemical plants installation, compressors)
- **Defence industry** (sealing and gaskets)
- **Printing inks**
- **other niche applications** (research, sealing and gaskets)

Missing sectors and uses:

- **Machinery/mechanical engineering** (valves, sealing, bearings, linings, tube seaming, flame retardant and other sub-uses)
- **Building technology** (HVAC, valves and sealing)
- **Sealing in various sectors** (see above)

#### **Semiconductors & Lubricants:**

There are no emissions during manufacturing and when the substrate is cleaned, special filters are used. The filters are disposable. Consumables like cleaning wipes and gloves might be contaminated with a PFAS-solvent. They are disposed of as hazardous waste. All waste generated during the production processes at a semiconductor-producing company is sorted, collected and disposed of. The incineration of the waste in municipal waste using best available technologies is done at ca 870 to 1000°C with residues that destroy PTFE polymers without releasing PFAS to the environment, therefore, as the PFAS containing waste generated by the company is destroyed as a result of the production of liquid tunable lenses and other optical instruments at this company.

The company is committed to avoiding any release of PFAS to the environment during production of its products and manufacturing. Installed are retaining all PFAS. Depending on these results, adjustments might be made to ensure that no PFAS are being released.

#### **Concerning all sectors:**

Disposal in the environment in Switzerland and most EU-countries is highly unlikely for most mentioned products.

The Interstate Technology Regulatory Council (ITRC, a USA State led coalition) has been cited for their information that fluoropolymers (the Environment) incineration review states that PTFE is stable at 260 °C and therefore would not degrade in a landfill. Further studies under environmental conditions. The EEA has been cited for their finding that PFAS-containing fumes from metal recycling processes are not a concern.

Sources:

<https://pfas-1.itrcweb.org/2-1-environmental-significance/>

<https://rivm.openrepository.com/handle/10029/625409>

<https://setac.onlinelibrary.wiley.com/doi/10.1002/etc.5182>

<https://www.eea.europa.eu/publications/emep-eea-guidebook-2019>

The numbers for the indications of emissions in different life stages are not available to our industry, being a part of a commercial secret. The numbers are extremely low for fluoropolymers. They are also low for the sub-uses where gases (insulating gas in switchgear) are used (e.g. in power plants).

Various sources show that PFAS can be fully destroyed in incineration processes at temperature around 1000°C.

Sources:

<https://www.sciencedirect.com/science/article/abs/pii/S004565350500425X?via%3Dihub>

<https://www.sciencedirect.com/science/article/pii/S0045653519306435?via%3Dihub>

<https://rivm.openrepository.com/handle/10029/625409>

<https://www.wastedive.com/news/clean-harbors-incinerator-pfas-forever-chemicals/640829/>

The EEA has been cited for their finding that PFAS-containing fumes from metal recycling processes can be controlled.

Source:

<https://www.eea.europa.eu/publications/emep-eea-guidebook-2019>

**Foreseen derogations necessary to ensure manufacturing and sustainable technology for the future in Europe:** 5.g

**Energy sector:** 6.f fluoropolymer applications in petroleum and mining industries, 5.r insulating gases in high-voltage switch

**Semiconductors:** 5.k industrial precision cleaning fluids

**Lubricants:** 5.s lubricants where the use takes place under harsh conditions or the use is needed for safe functioning and

**Food contact materials:** 6.a food contact material for the purpose of industrial and professional food and feed production

**Medical devices:** 6.b implantable medical devices (not including meshes, wound treatment products, tubes and catheters)

**Medical devices:** 6.c tubes and catheters in medical devices

**Petroleum & mining:** 6.f fluoropolymer applications in petroleum and mining industries (lining of piping, seals, gaskets, ser



Information from one company respectively:

**Energy sector:** 1-2 t/year,

**Semiconductors:** 0.01 t/year

**Lubricants in the building technology sector:** 2.5 t/year

**Lubricants in compressors for various applications:** unknown

**Lubricants in optical applications:** 0.0002 t/year

**Lubricants in mechanical engineering:** 0.012 t/year

**Food contact materials:** no information available

**Medical devices:** 0.65 t/year

**Petroleum & mining/energy sector:** 23 t/year (various uses and sub-uses, not only for the derogation foreseen)

**Petroleum & mining:** 0.35 t/year

none (for most applications)

0.0006 t/year emissions to air for lubricants in mechanical engineering (information from one company)

no special applications mentioned for most cases

#### **Energy sector:**

- sealing in compressors (PTFE, PEEK/PTFE-mixtures as solid lubricants)
- other sealing applications e.g. use of gaskets to seal capacitors (preventing the leakage of synthetic oil), sealing applications
- piping: Transport of high-purity water or aggressive chemicals in the "new energies" sector (Fluoropolymers/-elastomers such as PTFE)
- High voltage applications: Fluoropolymers for bearings, gliding rings and lubricants and the essential arcing nozzle
- insulating gases (assessment in the existing restriction proposal is incomplete, e.g. for Heptafluorobutyronitrile (C4-FN, C4-FN), C4-FN)
- vacuum valves for PV modules and nuclear power plants (FKM, FFKM, FFKM, FVQM, PTFE, PFA)
- PTFE, PFA, FEP in coatings, peripheral supplies, insulation, flow system, structural and leakage control in gas and steam

#### **Lubricants:**

- specific use missing: PTFE based materials for dry running friction application and PTFE (granular, not micro-powder!) as solid lubricants

#### **PFAS as flame retardents:**

- In some specific cases, PFAS might be used as flame retardents, however, this is very difficult to be known by downstream

#### **Building technology:**

- ball valve sealing for HVAC (PTFE)
- applications for energy-related installations such as elevators, escalators and moving walks

#### **Mechanical Engineering: (PTFE, FKM, FFKM, PVDF, ECTFE)**

- general mechanical engineering
- hydraulic applications
- sealing, sliding rings, sliding foil, shaft seals, valves, linings, bearings

#### **Sealing in various sectors**

#### **Spare parts in various sectors**

- Much equipment used in the industrial sectors, including e.g. motors, generators and power electronic equipment in energy equipment and the original part contained PFAS, it may not be possible to make a spare part without PFAS without having the same properties. This would not be suitable for use in the original equipment. This would lead to the environmental and social cost of the equipment. Therefore, there should be an exemption of at least 30 years for PFAS in spare parts for equipment in the spirit of the legislation.

#### **Transport sector**

- FFKM and FKM are the state-of-the-art sealing materials for ammonia fueled engines due to the high resistance against oil and

**Energy sector**

- compressors: several tons, no emissions during manufacturing (During the production of semi-finished parts, no significant elements, approx. 1/3 of the semi-finished part is waste, which is incinerated. In the in-use phase, the seals are in a closed with reduced wallthickness introduced to reduce waste during production of sealing.)
- piping: production in clean room with air filter, so no emissions
- valves: 15 t/year, emissions <0.3 t/year

**Building technology:** one company uses 20 t/year

**Mechanical engineering:** less or much less than 1 ton per year and per company, no or very small emissions due to abras

**Energy sector:**

- compressors: PTFE-based materials are used for dynamic sealing systems because of their extremely favorable tribological adaptability.
- Piping: Purity, chemical resistance in general plus combination of other properties (e.g. flame retardancy, dielectricity)
- valves for PV modules and nuclear power plants: Sealing materials for vacuum valves that must be extremely resistant to
- FP are used when other polymers cannot reach the required performances in terms of safety and lifetime, due to usage conditions allows (temperature, pressure, chemical environment), but a much shorter replacement time needed for other materials replacement that could be considered.

**Building technology:** tribological properties, temperature resistance, high sealing properties

**Mechanical engineering:** high temperature resistance, chemical resistance, tribological properties, non-stick properties

**Medical devices:** chemical and heat resistance, durability, lubricity, low dielectric constant or biocompatibility.

no information

**Building technology:** lower lifetime, higher abrasion, lower material efficiency, higher energy consumption/lower energy efficiency

**Mechanical engineering:** some alternatives like silica-based coating, PEEK, UHMW-PE are known but do not fulfil the technical requirements known today that fulfill technical and economical viability.

**Energy sector:**

- **compressors:** various substitute materials were tested (plastics, graphite, ceramics), but they either showed very high wear or plastics either show too low temperature stability, poor tribological behavior or are too brittle if filled with inorganic solid lubricants. A good sealing effect. Some of the ceramic materials tested showed high wear themselves and caused high wear of the mating surfaces. Implementing an alternative(s): 15-20 years. If materials with worse tribological properties are used, ring wear of the sealing surfaces and damaged mating surfaces must be replaced. Operation of the compressor is then no longer economically feasible, especially if higher friction coefficients are used. For the compression of very reactive gases such as HCl, H<sub>2</sub>S, O<sub>2</sub> or Cl<sub>2</sub> no alternative is available.

- **other sealing applications:** Compatibility between materials in contact with oil plays a crucial role in the energy sector. Unfortunately, of this application, as they do not take into account the specific problems linked to oil and its compatibility. When non-compatible materials are used, they are incompatible for use in the high-voltage sector. Complex qualification of products is very costly, high costs of validation tests, overheating and even fire. In addition, extreme temperature conditions are present when transporting energy, ranging from -40°C to +150°C, fluctuations without compromising the integrity of the system. There are also sustainability issues, with environmental risks. Infrastructure contributes to the stability and protection of electricity grids, and needs in these areas are growing with the production of renewable energy.

- **valves for PV modules and nuclear power plants:** in literature no alternative could be found, measures have already been taken (e.g. per component, collection of used sealing materials for controlled disposal and possibly recycling). FFKM and FKM are expected to implement an alternative: >15 years

**Building technology:** Various potentially interesting alternative materials are being developed by the suppliers and will be implemented: 2 years from point of technically and economically viable alternative which is not foreseeable at the moment.

**Mechanical engineering:** companies fear for their existence.

unknown

unknown

unknown

unknown

**Energy sector:**

- **Compressors** are needed for LNG transport (LNG terminals, LNG tanker ships) and H2 infrastructure (H2 refueling stations) to achieve the goals of the European Green Deal. Within the hydrogen infrastructure fluoropolymers are used not only for PEM electrolyzers but also as example in (compressor) seals, gaskets, and bearings. For dry-running compressor applications, no alternative sealing materials are available that equal to the derogation for fluoropolymers in the "petroleum and mining" sector. Socio-economic impact: Major loss of jobs and to the stability and protection of electricity grids, and needs in these areas are growing with the production of renewable electricity.
- **sealing applications in energy sector**: There are sustainability issues, with environmental risks in the event of oil leaks and to the stability and protection of electricity grids, and needs in these areas are growing with the production of renewable electricity.
- **sealing applications in energy sector 2**: 0.65 Mio Euros loss, manufacturing in EU at risk, technological drawback of 10 years.
- **piping**: EU Green Deal target areas are at risk (e.g. High Voltage Direct Current Transmission, hydrogen production with cooling systems).
- **valves for PV modules and nuclear power plants**: loss of 100 Mio Euros and approx. 200 jobs, major drawback for manufacturing.

**Building technology**: loss of 200 Mio Euros/year

**Semiconductors**: 5.ee semiconductor manufacturing process, where the following sub-uses have been mentioned:

- electronic components, wires and cables
- coatings, solvents and cleaning
- sealing
- sealing for vacuum valves
- pumping systems
- flowmeters
- photolithography
- handling of wafers, wafer cleaning, wafer edging, wafer plating, wafer polishing
- reactive gas in the process
- optical applications and photonics

-> The list of sub-uses in the documents has been regarded as very incomplete by the respective industry. (Examples: Piezoelectric actuators, etc.)

-> Substances used: PVDF, ECTFE, PTFE, FKM, FFKM, Fluoroelastomers, PFA, FEPM, FVQM

**Food contact materials**: 6.g non-stick coatings in industrial and professional bakeware

**Medical devices**: 5.bb, 5.cc, 6.j, 6.n

**Semiconductors:**

No emissions because of handling in clean rooms with air filters.

In other cases production waste is burned.

Use of one company: 0.15 t/year

Use of other company: 60 t/year

Use of one company: 0.002 t/year for one sub-use, 0.0002 t/year for another sub-use (no emissions: substrate from coating other process are filtered with active coal filters that are disposed of by waste disposal company)

Use of one company: 15t

**Medical devices:**

one company: 0.65 t/year

**Semiconductors:**

- high insulation, large temperature range, oil resistance, solvent resistance, acid resistance and the combination of all functions
- chemical resistance, purity and low permeability against aggressive acids, basics and solvents; mechanical robustness; cleanability

**Medical devices:**

- Only partially replaceable with alternatives: due to regulations, limited lifetime and more environmental pollution due to incineration
- FP are used when other polymers cannot reach the required performances in terms of safety and lifetime, due to usage conditions allows (temperature, pressure, chemical environment), but a much shorter replacement time needed for other materials

**Semiconductors:**

- For applications requiring a wide temperature range (+200°C), solvents, oil and high insulation, there are no alternatives (FP)
- PEEK has been evaluated as alternative e.g. in highly insulating but is not fulfilling the technical requirements as well as FP
- alternatives not available due to sector regulation
- alternatives showing shorter lifetime and therefore producing more material use and less resource efficiency
- alternatives being less tight and therefore causing higher leakage rates
- Metal sealings have been investigated by one company and proven to be workable for their application, but are even more expensive and need to be completed.
- Current "alternatives" represent a downgrade to FP: lifetime will be lower and maintenance will need to be operated more frequently. It depends on the sector: development time + certification process from 2 to 5 years from our side and another 2 years from the customer's side.

**Semiconductors:**

Divers alternatives have been searched for, also because of economical reasons (expensive materials). No feasible alternative found. See report and documents provided by Levitronix: stainless steel, titanium, glass, ceramics, PP, PE, LDPE, HDPE and PEEK. PFA and PTFE concerning chemical compatibility, purity, inertness and chemical barrier properties. The biggest problem is information on resources invested:

- Investments by one company (systems for liquid handling): total of 12 years 1 person FTE, 4.5 Mio Euros. 10+ years estimated to fulfil requirements regarding resistance, stability, purity, installation, welding
- "There is no alternative to fluoropolymer plastics which match the wide chemical resistance, inertness and purity suitable for which length of derogation is suitable and what its cost is."
- Investment by another company: 3.5 Mio Euros so far
- estimated development time by one company: 15 years, loss of sales: 100 Mio Euros, loss of approx. 180 FTE, relocation of

unknown

unknown

unknown

unknown

**Semiconductors:**

- installations, production equipment, the products themselves, materials, additives, and process chemicals have to be included
- the use of fluoropolymers for installations (e.g. complete piping systems or pumps) for handling ultrapure water or aggressive media
- Relocation of R&D, labs and production sites to other continents (US, asia) is feared.
- EU goals regarding digitisation will be difficult to achieve.
- One company (SME) fears a loss of 150'000 Euros per year, another one (SME) fears the loss of 60-70% of sales and 60% of jobs
- Reply by one company: Several customers in various markets like medical, machine vision, laser welding, crop protection are affected by the EU. Internal effects: Significant decrease in equipment lifetime. Significant cost increase. Some of the products could not be replaced. The additional investments are not just against economic goals, but also against ecologic goals and with this, against the competitiveness of the company. Products are discontinued and/or redesigned, as our liquid lenses are critical and in many cases irreplaceable in the newly developed technologies and products. It is also worth noting that besides the EU Green Deal another key EU policy objective is digitisation. The production of optical instruments with lower material and energy use, optimisation and robotisation of industrial processes, miniaturisation of devices, form factor devices are gaining market share and most handheld devices are slim and compact, which require respectively have a smaller materials footprint.

**Energy sector:**

- Heat pump, H2 technology, carbon capture use and storage (CCUS)

**Transport:**

- sealing applications (FKM, PTFE)
- FP are used when other polymers cannot reach the required performances in terms of safety and lifetime, due to usage conditions (temperature, pressure, chemical environment), but a much shorter replacement time needed for other materials.

**Food contact materials:**

- consumer cookware
- industrial food and feed production

**Medical devices:**

- diagnostic equipment
- inhalers
- tubes & catheters
- implantable medical devices

**Construction sector:**

- sealings & adhesive, processing aid, coating

**Petroleum & mining industries:**

- drilling fluids

**Chemical industry:**

- Compressors for various applications
- transport of aggressive chemicals

**Printing inks****Defence industry:**

- sealing & gaskets

information by one company respectively

**Transport:**

- sealing applications: 0.1 t/year used

**Defence industry:**

- sealing & gaskets: 0.1 t/year used

**Food contact materials:**

- non-stick properties, temperature resistance, chemically inert, flexibility, good tribological properties, pressure resistance,  
- FDA- and EU10/2011-approved

**Chemical industry:**

- solid lubricant, sealing: PTFE-based materials are used for dynamic sealing systems because of their extremely favorable  
shape adaptability.

- tubing, transport of chemicals (PTFE, PTFE/PEEK-mixtures, PVDF, ECTFE, FKM, FFKM): chemical inertness

**Transport:**

- sealing applications: Only partially replaceable with alternatives due to regulations, limited lifetime and more environmental  
cheaper, and lead to higher leakage and operating failure. There are problems with approval and insurance. Losses of 0.35

**Food contact materials:**

- consumer cookware: alternatives exist but are by far not equivalent and lead to greater resource uses, as the non-stick pr

**Printing inks:** alternatives feasible and available



**Food contact materials:**

- industrial food and feed production: alternatives for FKM are not applicable for all sub-uses, no alternative known for FEP
- Current "alternatives" represent a downgrade to FP: lifetime will be lower and maintenance will need to be operated more apply. It depends on the sector: development time + Food&Beverage up to 5 years from our side and another 2 years at o

**Medical devices:**

- Only partially replaceable with alternatives: due to regulations, limited lifetime and more environmental pollution due to inc
  - FP are used when other polymers cannot reach the required performances in terms of safety and lifetime, due to usage co
- conditions allows (temperature, pressure, chemical environment), but a much shorter replacement time needed for other m

**Chemical industry:**

- We tested various substitute materials (plastics, graphite, ceramics), but they either showed very high wear, were abrasive
- show too low temperature stability, poor tribological behavior or are too brittle if filled with inorganic solid lubricants. Graphit
- effect. Some of the ceramic materials tested showed high wear themselves and, above all, they caused high wear of the m

**Defense industry:**

- loss of 0.3 Mio Euro/year expected

**Energy sector:**

- Heat pump, H2, CCUS: The planned measures to ban PFAS materials would hinder the use of the climate protection tech
- of 600 jobs.