ANNEX 1- Answer to question 6 from Europump

6:**Missing uses – Analysis of alternatives and socio-economic analysis**: 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, specific information is requested on alternatives and socio-economic impacts, covering the following elements:

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.

Application (no finished list)	Use	Property	PFAS
Pumps in Oil and Gas Industry	Gaskets, seals, wear parts in hydrocarbon upstream, midstream and downstream. Fastener coatings in offshore applications	Resistance against hydrocarbons Temperature resistance Low coefficient of friction Corrosion resistance and anti-galling properties	FKM, FFKM PTFE, ETFE
Pumps in chemical process industry	Gaskets, seals, wear parts, diaphragm, inserts	Resistance against aggressive chemicals Temperature resistance Low coefficient of friction	FKM, FFKM, PTFE, PVDF, PFA
Pumps in food industry	Coatings, seals,	Non-sticking properties Resistance against aggressive cleaning chemicals	PTFE, PFA, FKM
Pumps in energy generation	Gaskets, seals	High temperature resistance even in the presence of air borne oxygen	FKM, FFKM, PTFE, PFA
Pumps in the pharmaceutical and biotechnological industry	Coatings, seals, gaskets, diaphragm	Resistance to high temperatures and aggressive chemicals being used in CIP and SIP	PTFE, PVDF, FKM, FFKM, PFA

Submersible pumps in dewatering	Seal, cable sheath	Low coefficient of friction Weathering resistance and low water uptake	PTFE, PVDF, FKM, FFKM, PFA
Pump in other industries - Wastewater treatment - Dosing - Mining industry - HVAC - Drinking water - Cryogenic applications - H2 production - Environmental mitigations - other	Seals, gaskets, diaphragms, cables, coatings, wear parts, bearings, …	Resistance against chemicals, temperature, weather, or a combination thereof → Safety Use due to tribologic functionality → energy efficiency, duration, safety Use due to hygienic aspects → health	PTFE FKM FFKM FPE (PFPE) ETFE ECTFE PVDF PFA PCTFE
Spare parts for pumps	Seals, gaskets, diaphragms, cables, coatings, wear parts, bearings, …	Resistance against chemicals, temperature, weather, or a combination thereof → Safety. Use due to tribologic functionality → energy efficiency, duration, safety Use due to hygienic aspects → health	PTFE FKM FFKM FPE (PFPE) ETFE ECTFE PVDF PFA PCTFE
Machining industry - production of (PFAS AND NON-PFAS containing) materials - production of (assembled) products - spare parts	Seals, gaskets, coatings, production aids, sliding parts, …. **To be specified by machines manufacturers**	Temperature (changes), chemicals, steam, anti-stick properties, hygiene,…	PTFE FKM FFKM FPE (PFPE) ETFE ECTFE PVDF PFA PCTFE
Electronic industry - production of semi-conductors - production of other electronics	**To be specified by electronics manufacturers.**		

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

- Affected companies: almost all
- Many pumps will still be sold because essential for moving fluids everywhere but:
  - they will not fulfil the function as before,
  - earlier failures shall be expected,
  - changed processes are required,
  - some customers will not be able to sell products (e.g. in chemical industry), where pumps with advantageous properties of fluorinated polymers are required
- For those sectors where less efficient alternatives would be an option, higher consumer prices must be expected, as long and often stand-still times for maintenance would come up and lead to reduced production capacity (→ this effect might scale up along supply chain),
- Safety aspect: alternatives lead to higher risk for workers, users and environment:
  - e.g. in case of leakage (in plants where aggressive, toxic, volatile substances are pumped),
  - if alternative materials composed products start burning in specific used (which is impossible with respective fluorinated polymers) power accidents, where insulation materials cannot be further used and no equivalent alternatives are available
  - …
- Fulfilment of other regulations might be difficult, if not impossible: change of materials or design could lead to incompliance with other regulations such as:
  - energy efficiency regulations,
  - non-flammability of construction products,
  - reduced carbon footprint targets,
  - renewable energy targets,
  - ATEX,
  - Food contact,
  - Drinking water contact,
  - …
- Main problem to define clear numbers is that pump industry is less describing the own business, but more the other businesses → example chemical industry: a dedicated survey on pump industry is bringing less important information than the information which is coming from the users of pumps,
- Regarding the influence in the upstream supply-chain, it is also difficult to express good values, as the processes of (pre-)suppliers are usually not exactly clear. PFAS play an important role:
  - for motors,
  - in electronics,
  - in production of materials and components,
  - in other manufacturing processes.

Sector/ Application/ Use	**Pump manufacturers either as producer or user** (Europump: 450 companies, 10 bio € turnover, 100.000 employees)	**Industrial users/ customers**	**consumers**
Pump industry	Worst case 100% → if suppliers cannot deliver (also NON-	Dependent on the application the impact on the user	The disruption of the supply chains may lead to non-

	PFAS products) pump manufacturers will not produce anything or, in few cases, may produce in very degraded and dangerous conditions.	of the pump (customer of the pump industry) may be more detrimental than on the pump industry itself.	availability of **essential goods**.

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.

Providing a concrete example:

- In case PTFE, PFA or PCTFE is used due to its sliding properties, an alternative could, from practical aspects be lead (Pb), but it is, due to its hazardous properties, no alternative. PTFE, PFA or PCTFE has been implemented as substitute for applications, where formerly lead (Pb) has been used. → this substitution would in any case be a regrettable substitution
- In most cases, the (very) expensive fluoropolymers are only used, where either all alternatives would quickly fail and lead to safety problems in many cases, the fluorinated polymer ensures function of the product/part (for an acceptable and longer duration) or where the conditions are not exactly known (e.g. composition of wastewater changes regularly (oil, water, bacteria, antibiotics, other drugs, rainwater, pesticides, fertilizer…)).

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.

- A forecast is absolutely impossible. A main factor is the dependency on the chemical industry, if an alternative is found (at all). We can only provide a timeline for R&D regarding integration of alternatives in pumps after they are developed and made available by the chemical industry. Until now finding a substitute was not in focus.
- A design change, if possible at all, means on the one hand a long time to find a new suitable design, which fulfils intended functions, and on the second hand a long test duration, especially if different properties need to be qualified. For most trials a decreased performance is expected and different approaches will need to be assessed. It may also lead to an extension of pump range complexity because of replacement by many new designs instead of one.
- If for example metals are used instead of fluorinated polymers for sealing functions, the design needs to be re-worked, higher forces need to be applied to achieve the same tightness level, the machining tolerances must be more precise, and the chance that looseness appears in a shorter time increases. After dismantling, re-use of such metallic seals is impossible.
- In case polymer alternatives are identified, production process adaptions are required. New moulding processes need to be established, including new tools

(which might require PFAS in the process, if no alternatives in such processes are found). Where a fluoropolymer needs to be replaced by multiple polymers, the qualification time and the investments increase significantly.

f. For cases in which **substitution is technically and economically feasible** but more time is required to substitute:
    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);
    ii. the time required for completing the substitution process (including any relevant certification or regulatory approvals);
    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);
    iv. information on the benefits for alternative providers.

- Where a substitute is available, it is used already, as PFAS (material) use leads to higher (initial) material costs, which most customers do not accept.
- Where PFAS (fluorinated polymers) is used it is the only solution, as the life-time, functionality (including energy efficiency), and safety (work safety, safe use, tightness, …) are substantially better than other material solutions.

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.

The effect on the pump industry includes both upstream and downstream concerns. The complexity of the pump industry supply chain makes it impossible to quantify the socio-economic impact on the creation of pumps. The complete industry is affected. Where parts of the supply chain are not working, the complete pump economy breaks down. Pump manufacturers will not get materials from their supply chain (as well PFAS containing and NOT-PFAS containing materials), and will not be able to produce pumps

Downstream, pumps are used within the complete supply chain as part of the manufacturing process and are vice versa getting their parts, materials, and energy from many actors along the supply chain, who also use the pumps. Therefore, it would be a highly complex exercise to estimate the costs given the web of interaction between downstream and upstream aspects of the pump industry.

Pumps are used within and/or pump production is dependent on:
- Manufacture of basic chemicals
- Manufacture of materials (PFAS containing and NON-PFAS containing)
- Manufacture of components (including multi-material components like electronics)
- Manufacture of (assembled) products
- Manufacture of machines for the different production steps
- Water treatment (including industrial wastewater treatment)
- Energy production and transport (esp. renewable energy)
- Recycling and disposal
- Other industry sectors (food and feed production where disinfection is required, pharmaceutical industry, …)

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It is quite apparent that the effect of a ban or a severe restriction on PFAS use goes far beyond any one industry or market sector. Essentially this will take a number of technologies relating to sealing, chemical resistance, heat resistance, environmental contamination, product purity, process contamination, and friction reduction, back to where they were in the 1950s. There are more than 10,000 of compounds affected and there are certainly many times this number of processes and applications involved. This completely precludes any practical attempt to set up a "by exception" regulation. Such a ban or restriction of PFAS compounds will have the effect of making large swaths of European industry, such as chemicals, pharmaceuticals, aircraft, and automotive, to name a few, uncompetitive in many international markets. The social and economic ramifications in Europe of this are simply beyond imagination and clearly must be avoided.