6. Missing uses – Analysis of alternatives and socio-economic analysis:

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

Application	Use of PFAS	Property	PFAS
Industrial food and feed production	Pump Heads, valves, seals, tubing, liners, coatings, diaphragms	Hygienic, non sticking surface and high resistance against aggressive highly concentrated chemicals. High temperature stability	PVDF, PTFE, PFA, FKM
Metal plating and manufacture of metal products	Pump Heads, valves, seals, tubing, liners, coatings, diaphragms, sliding parts	high resistance against aggressive highly concentrated chemicals. High temperature stability	PVDF, PTFE, PFA, FKM, ECTFE
Hydraulic fluids	Pump Heads, valves, seals, tubing, liners, coatings, diaphragms, sliding parts	high resistance against aggressive highly concentrated chemicals. High temperature stability	PVDF, PTFE, PFA, FKM, ECTFE
Energy sector	Pump Heads, valves, seals, tubing, liners, coatings, diaphragms, sliding parts	high resistance against aggressive highly concentrated chemicals. High temperature stability	PVDF, PTFE, PFA, FKM, ECTFE
Lubricants	diaphragms	High mechanical bending stability	PTFE
Petroleum and mining	Diaphragms, seals, liners, coatings,	Resistance against hydrocaobons, odorants, different concentrated additives at high temperature.	PTFE, FKM, ECTFE
Public and domestic drinking water plants	Pump Heads, valves, seals, tubing, liners, coatings, diaphragms	Hygienic, non sticking surface and high resistance against aggressive highly concentrated chemicals.	PVDF, PTFE, PFA, FKM
Public and domestic swimming pool applications	Pump Heads, valves, seals, tubing, liners, coatings, diaphragms	high resistance against aggressive highly concentrated chemicals.	PVDF, PTFE, PFA, FKM
Industrial und public waste water treatment plants	Pump Heads, valves, seals, tubing, liners, coatings, diaphragms	high resistance against aggressive highly concentrated chemicals.	PVDF, PTFE, PFA, FKM
Public car, train or aircraft	Pump Heads, valves, seals, tubing,	high resistance against aggressive	PVDF, PTFE, PFA, FKM

washing station	liners, coatings, diaphragms	highly concentrated chemicals.	
General industrial und public chemical process plants	Pump Heads, valves, seals, tubing, liners, coatings, diaphragms	high resistance against aggressive highly concentrated chemicals.	PVDF, PTFE, PFA, FKM, ECTFE
Galvanic industry	Pump Heads, valves, seals, tubing, liners, coatings, diaphragms	high resistance against aggressive highly concentrated chemicals.	PVDF, PTFE, PFA, FKM, ECTFE

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

Affected by the ban of PFAS would be a complete chain of companies. Starting with the equipment manufacturer (e.g. pumps and valves) followed by the users (chemical industries cant treat their chemicals without the equipment containing PFAS) and finally followed by their users (if some chemicals cant be produced any more e.g. for lithium batteries). **Thus, the ban of polymer PFAS will not only damage the business of the equipment manufacturer, but also the business of a lot of companies requiring the equipment to produce essential but harness products for the end consumer.**

Speaking for an manufacturer of equipment (pumps, valves etc) we can state, that we have not identified any material, witch has the same mechanical and chemical properties as PVDF or PTFE.

- Pumping membranes will fail after much shorter time, exposing the operator to the risk, that he gets in contact to highly aggressive chemicals.
- Customers will need to much more carefully select the specific pump for an application considering chemicals, their concentration and their temperature to make sure, the material fits exactly their process. Many customers will not be able to do the right selection and the equipment will fail with above consequences.
- Spare parts will not be available for the customer process. They will have to make dramatic changes to their equipment.

Due to limited lifetime and less chemical compatibility, the PFAS ban will significantly increase risk for those, working with highly aggressive chemicals.

d. The availability, technical and economic feasibility, hazards and risks of alternatives for the relevant use.

First, we have to state, that the fluoropolymers come at a significant cost, related to other polymers. If there would be easy substitutes, the market would have already solved this.

PFAS polymers are used, because they offer an unique combination of material properties:

- Chemical stability
- Mechanical properties such as sliding, bending..
- Good cleanability, non sticking…
- Temperature stability
- Electrical behaviour

Up to our knowledge, there is no good candidate, who can in all these disciplines.

Especially for the diaphragm, we have the following requirements:

1. General chemical resistance
2. Mechanical resistance (because of the changing pressure form vacuum up to maximum back pressure of the specific type of dosing pump (e.g. 2.5 MPa for small, general use dosing pumps (applications x to y) and higher back pressure application in chemical industry and petrol industry (up to 100 MPa).
3. Flexibility of the diaphragm (because of the movement of the diaphragm). The typical lifetime of a diaphragm are 10 exp 7 to 10 exp 8 strokes.
4. Temperature stability of the diaphragm : typical
   - 30 °C up to 120 °C for PTFE diaphragm
   And -30 °C up to 180 °C for composite diaphragms . The reason for the higher temperature for composite diaphragms is the vulcanisation process to get a composite of rubber, fabric and PTFE foil. The typical vulcanisation temperatures are about 180 °C of the rubber.
5. Smooth surface of the diaphragm
   A harsh surface of the diaphragm will limit the lifetime of the diaphragm because of Adhesion of crystals or dirt in the fluid to be dosed
6. Easy to clean the surface
   A typical maintain work is to clean the dosing head and the diaphragm form dirt of crystals without chemistry

The development of the diaphragm is a 60 year long process. Still the properties of the PTFE that is supplied by our suppliers is still under development.

The combination of all the six points end up , that the only PTFE is able to meet all six points.

PTFE unique in chemical resistance. PEEK is not stable for strong oxidizing chemicals (e.g. ozone, Chlorine dioxide, peracetic acid…or strong acid like sulfuric acid). These chemicals are very important in drinking water plants, or general chemical industry and are about 20 % of our sales. (see chemical resistance list appendix xxx)

PEEK as a chemical resistant material is not flexible enough to be used as diaphragm.

The composite diaphragm (patented by our company) has the highest flexibility of all types of PTFE diaphragms (50 % more flexibility compared the pure PTFE diaphragms. The advantage is a dosing pump, that is 30 % less expensive compared to pumps with pure PTFE diaphragms.

e. For cases in which alternatives are not yet available, information on the status of R&D processes for finding

For some applications, we started tests with alternative material. PE for example. could be a candidate, with some sositive properties. Even, if these tests would be successfully completed in a short time, it would take years to change the product portfolio. We use hundreds of injection moulds. To change them would be extremely high cost and capacity to order them would not be available on the market.

However, we can not even expect fast success to successfully finish the tests for the alternative materials. The knowledge of chemical compatibility of a wide range of substances at different concentrations, applications and temperatures was built up over decades. This knowledge is the base of safe usage of critical chemicals.

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

Du to some shortage on PVDF material supply in 2022, we already tried to substitute PVDF material, which was unnecessarily used in our products. But as fluoropolymer are used for their special properties, the chances to change the material were very limited.

g. For cases in which substitution is not technically or economically feasible, information on what the socioeconomic impacts would be for companies, consumers, and other affected actors.

Nobody buys da positive displacement pump, because he just like pumps. He always wants to run a process. Keeping in Mind, that a PFAS ban would remove the pump, the valve and the tube, the customer will not be able to run anymore his process. He could be producing chemicals, or pharmaceuticals, which are not at all related to PFAS, but without his equipment, he will not be able to manufacture, medicine, food, cars, homes etc.

Its impossible to draw the complete picture, where our equipment could be used.

The impact just on our company would be on > 2500 employees. But the impact on our customers would be a complete deindustrialization.

7. Potential derogations marked for reconsideration – Analysis of alternatives and socio-economic analysis:

Application	Use	Property	PFAS
Industrial food and feed production	Pump Heads, valves, seals, tubing, liners, coatings, diaphragms	Hygienic, non sticking surface and high resistance against aggressive highly concentrated chemicals. High temperature stability	PVDF, PTFE, PFA, FKM
Metal plating and manufacture of metal products	Pump Heads, valves, seals, tubing, liners, coatings, diaphragms, sliding parts	high resistance against aggressive highly concentrated chemicals. High temperature stability	PVDF, PTFE, PFA, FKM, ECTFE
Hydraulic fluids	Pump Heads, valves, seals, tubing, liners, coatings, diaphragms, sliding parts	high resistance against aggressive highly concentrated chemicals. High temperature stability	PVDF, PTFE, PFA, FKM, ECTFE
Energy sector	Pump Heads, valves, seals, tubing, liners, coatings, diaphragms, sliding parts	high resistance against aggressive highly concentrated chemicals. High temperature stability	PVDF, PTFE, PFA, FKM, ECTFE
Lubricants	diaphragms	High mechanical bending stability	PTFE
Petroleum and mining	Diaphragms, seals, liners, coatings,	Resistance against hydrocaobons, odorants, different	PTFE, FKM, ECTFE

		concentrated additives at high temperature.	
Public and domestic drinking water plants	Pump Heads, valves, seals, tubing, liners, coatings, diaphragms	Hygienic, non sticking surface and high resistance against aggressive highly concentrated chemicals.	PVDF, PTFE, PFA, FKM
Public and domestic swimming pool applications	Pump Heads, valves, seals, tubing, liners, coatings, diaphragms	high resistance against aggressive highly concentrated chemicals.	PVDF, PTFE, PFA, FKM
Industrial und public waste water treatment plants	Pump Heads, valves, seals, tubing, liners, coatings, diaphragms	high resistance against aggressive highly concentrated chemicals.	PVDF, PTFE, PFA, FKM
Public car, train or aircraft washing station	Pump Heads, valves, seals, tubing, liners, coatings, diaphragms	high resistance against aggressive highly concentrated chemicals.	PVDF, PTFE, PFA, FKM
General industrial und public chemical process plants	Pump Heads, valves, seals, tubing, liners, coatings, diaphragms	high resistance against aggressive highly concentrated chemicals.	PVDF, PTFE, PFA, FKM, ECTFE
Galvanic industry	Pump Heads, valves, seals, tubing, liners, coatings, diaphragms	high resistance against aggressive highly concentrated chemicals.	PVDF, PTFE, PFA, FKM, ECTFE