Perfluoropolyether (PFPE)
✓ Section I: Personal Information
✓ Section II: Zhejiang Chuangfu High Tech New Materials Co., Ltd
✓ Section III: ① General Information

Perfluoropolyether (PFPE) is widely used in the fields of chemical, electronic, electrical, mechanical, nuclear engineering, and aerospace due to its high temperature resistance, oxidation resistance, radiation resistance, corrosion resistance and chemical inertness. PFPE has different application scenarios based on its molecular weight. Molecular weight Mn500-1500 is a perfluoropolyether electronic fluid, which is mainly used for cooling and temperature control in semiconductor manufacturing processes and heating components, packaging and leak test of electronic components. Molecular weight Mn2000-10000 is perfluoropolyether oil, which meets the requirements of high temperature and high load applications in the mechanical and automotive industries. Its high stability and good wear resistance make PFPE oil and grease suitable as lubricants under harsh operation conditions with long service period. PFPE has a wide liquid temperature range with low evaporation, high static viscosity, very low steam pressure, low flow temperature and good high-pressure lubrication. It is applied to vacuum pumps (rotary pumps, turbomolecular pumps and steam diffusion pumps) with corrosive gases in various operating environments. PFPE is used as a lubricant for compressors and valves, and these applications can not be replaced.
Perfluoropolyether (PFPE) is considered a kind of polymer PFAS. They are different polymers made from perfluoroether monomers, which are mainly used as lubricants, oils, and water repellents (Wang et al., 2020). They are different from other fluoropolymers because they are composed of carbon and oxygen with a skeleton of fluorine atoms directly connected to carbon atoms. Perfluoropolyether belongs to the category of polymers, which are classified as “a low concern polymer”. They have chemical stability, biological stability/inertness, negligible solubility in water (without migration), non bioavailability, non bioaccumulation with no toxicity[1]. It is recommended that regulatory agencies and scientists should evaluate PFPE products from a life cycle perspective, including the substances and by-products used in the manufacturing process.

② Specific information 1-10 (*refer to the table below)
✓ Section IV: Publicly available attached materials
✓ Section V: Non Public Attached Materials (Classified Information) General Comments:

Q1: (Final) Product Area/Purpose (Reference: Table 8, Annex XV pp.80-114)
✓ Question 2: Emissions from manufacturing/use/disposal stages
Perfluoropolyether electronic fluid is mainly used for heat conduction, with a suitable working temperature of less than 180°C. Select a suitable boiling point liquid according to the working temperature. Generally, the working temperature is 30°C

less than the boiling point temperature of the liquid. In this case, the annual emission of perfluoropolyether electronic fluid is less than 1% with the total loss of not more than 2t.
Perfluorinated polyether oil: used in a temperature range of 100-280 °C for extremely low vacuum pumps, with an ultimate vacuum of 10-8 Tor. Due to its extremely low saturated vapor pressure, it hardly evaporates, and all oils used in vacuum pumps and mechanical lubricants can be 100% recycled. There are multiple perfluorinated polyether oil recycling companies in China that specialize in the recycling of fluorine oil. The recycled fluorine oil can be reused through processes such as filtration, impurity removal, and distillation, The fluorine oil recovery rate of the entire industry has reached 100%.

✓ Question 3: Incineration treatment
At service life end of PFPE, all PFAS are recycled. PFPE can be reused through processes such as filtration, impurity removal and distillation. Almost all PFAS is burned and decomposed into HF, so no PFAS is released into the environment.

✓ Question 4: Impact on the recycling industry
✓ Question 5: PFAS usage and emissions applicable for extended (derogation) purposes
✓ Question 6: Omission of restriction draft or information on alternatives and socio-economic impacts for purposes have not been carefully discussed
Perfluoropolyether (PFPE) is a synthetic oil that combines good physical and chemical properties, making it used in demanding application equipment. PFPE has excellent thermal stability, chemical inertness, non volatility, and unparalleled lubrication performance at extreme temperatures. Extreme environments require high chemical stability and extreme pressure of lubricants, so they can continue to work in extreme environments. The main substitutes include mineral oil, PAO synthetic oil, silicone oil and hydrocarbon synthetic oil, etc. However, these synthetic hydrocarbon oils have poor thermal and oxidative stability and pose a combustion risk at high temperatures. Especially when it is operated under harsh conditions with oxygen enrichment, strong oxidants and corrosive chemicals, etc., there is currently no substitute. Our downstream clients have not identified the alternative solutions nor initiated any research and development plans. Therefore, its decrease must exceed 12 years.

✓ Question 7: After the opinions are collected, reconsider the use of alternatives for extended periods and information on their socio-economic influence.
The semiconductor industry must use special gases and certain toxic strong oxidants in the chip processing, thus it requires to widely use vacuum pumps in the process with excellent adaptability. PFPE is widely used due to its excellent performance. Especially it has even more excellent performance in eliminating the hazards of fire or explosion. World renowned vacuum pump manufacturers (such as LeyBold and Edwards) use PFPE oil as their vacuum pump medium to ensure that their vacuum

equipment continues to maintain excellent performance in special environments. At present, there are no other materials or substitutes that can meet the very important functions of chemical resistance, high temperature resistance, low friction coefficient, and biocompatibility of the semiconductor vacuum pump lubricating oil products. In the future, there are no other substitutes in the market that can replace PFPE, as they have a positive impact on the product (chemical resistance, high temperature resistance, low friction coefficient and biocompatibility).

✓ Question 8: Information on alternatives for other specific uses and socio-economic impacts

All PFPE product lubricants are crucial: for electronic products, PFPE lubricants can ensure contact quality. Without PFPE, mechanical-electrical integration on the vehicle is prone to failure, thus affecting the safety of the vehicle; for the use in bearings, PFPE lubricating oil is non flammable and is ensured to be used at high temperatures. Therefore, all the industries with high temperatures in their processes shall will stop production, including glass, metal, etc. Specific performance of our customers expected: The automotive industry has a wide expected temperature range and chemical compatibility requirements due to plastic or elastomer contact. Low torque electrical applications at wide operating temperatures. The vacuum pump conforms to gas or oxygen liquid under pressure (to avoid any explosion).

✓ Question 9: The possibility of decomposing substances excluded from the draft restriction (as stipulated in item 1) into specific subgroup substances (additional information)

✓ Q10: Information related to PFAS analysis methods

General information:

14.Integr+Envir+Assess+++Manag+-+2021+-+Buck+-+Identification+and+classification+of+commercially+relevant+per-+and.pdf

Reference

1.Regulatory management option analysis for fluoropolymers Fluoropolymers Group (FPG) of Plastics Europe

20211104_FP_RMOA_Final_3.pdf

2.Scientific Basis for Managing PFAS as a Chemical Class

3.Integrated Environmental Assessment and Management-Volume 14, Number 3-pp.316–334

Integr Envir Assess Manag - 2018 - Henry - A critical review of the application of polymer of low concern and regulatory.pdf