



EUROPEAN INDUSTRIAL GASES ASSOCIATION (EIGA)

COMMENTS ON PFAS ANNEX XV RESTRICTION PROPOSAL



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1 Introduction

EIGA – is a safety and technically oriented organisation representing the vast majority of European and also non-European companies producing and distributing industrial, medical and food gases. The member companies closely co-operate in technical and safety matters to achieve the highest level of safety and environmental care in the handling of gases. EIGA is in frequent touch with Standardisation and Regulatory Organisations and Authorities as well as trade and industrial organisations. EIGA's membership comprises European companies that produce or distribute industrial and/or medical gases.

For information about our sector, please refer to <https://www.eiga.eu/the-industry/statistics/>

For information about application of gases, please refer to <https://www.eiga.eu/applications/>

We recognize the ambition to restrict PFAS to protect human health and the environment for future generations.

In parallel, the PFAS restriction as defined today will significantly impact all aspects of gas industry (e.g. industrial/medical gas production, storage and both cylinder and bulk supply). This includes supply of gases to a range of critical industries including but not limited to:

- liquid and gaseous oxygen for hospital and healthcare facilities, such as was needed for Covid primary treatment;
- oxygen for industrial purposes like steel production
- pure gases and gas mixtures for food industry
- green hydrogen (cryogenic and gaseous) to enable delivery for the EU's decarbonization targets;
- cryogenic and gaseous nitrogen for safety critical inerting processes;
- cryogenic helium for hospital MRI scanners;
- electronic gas (mixtures) towards the Semiconductor Industry;
- refrigerants.

This document describes 5 main uses that will be impacted by the PFAS restriction proposal. For each use our industry depends on the upstream supply chain of equipment for investigation on alternatives.

We understand that research and validation and potential implementation of alternatives will imply massive investment and time.

There are applications where alternatives seem to be not possible within derogation time or not at all. The lack of alternatives can lead to a future risk to not be able to produce and supply gases under the same safe conditions as today.

2 Lubricants (Annex E.2.14.)

2.1 Use of Lubricants containing PFAS in Gas Industry

PFPE based lubricants are widely used in gas equipment for great resistance in oxidizing atmospheres and high pressure. Introduction of these lubricants significantly reduced occurrence of oxygen ignitions (fire) and improved safety of our employees, customers and patients. These lubricants are also used in less severe conditions for their excellent mechanical properties.

The lubricants are used on:

- moving elements in cylinder valves
- moving elements (e.g., spindles, regulators) in equipment used in our applications
- moving elements in machines (e.g. pumps, compressors, vacuum pumps)

Also, other PFAS based substances are used for their good lubricating properties and resistance to harsh environment including oxygen. PTFE seals used in our applications are also considered as lubricant for their self-lubricating and low friction properties which doesn't require additional high performing lubrication containing PFAS.

Typical examples are product lubricated bearings. Fluoropolymer materials like PTFE or mixtures of fluoropolymers with other materials such as metals, ceramics and other polymers are used as product lubricated bearings, as they offer excellent chemical resistance and low friction, which helps to reduce wear and extend the life of the product.

2.2 Key Functionalities

As lubricants are used in very thin layers, they are extremely vulnerable to ignition in the oxygen environment and a wide range of temperatures. To withstand such conditions, lubricants must be extremely resistant to properly support functionality of the equipment. Today only lubricants based on PFPE oil can safely serve in these conditions.

Source of data below: ASTM M36, 2nd edition

	AIT (°C)*	HoC (cal/g)*	OI (%O ₂)*
Hydrocarbon oils	150 - 260	8000 - 12000	17 - 25
Silicone oils	200 - 300	6000 - 6500	21 - 23
Dry lubes (graphite, MoS ₂)	>400	2400 - 3400	ND
Fluorinated oils (PFPE, CTFE)	>450	800 - 1000	>100

*Approximate ranges for comparison

AIT Auto-ignition temperature - temperature at which a material will spontaneously ignite under specified conditions

HoC Heat of Combustion - Energy released during combustion

OI Oxygen Index - minimum concentration of oxygen by volume percentage in a mixture of oxygen and nitrogen introduced at (23 ± 2) °C that will just support combustion of a material under specified test conditions

We use these lubricants also in less severe environments where their excellent mechanical properties guarantee reliable service during whole lifetime and reduce the maintenance need.

2.3 Emissions

Cylinder valves and regulators

Lubricants are applied at the beginning of the life inside the equipment and stay there for the whole life. In cylinder valves, it is a minimum of 10 years. During life, there are no PFAS emissions. End of

life is under the control of gas companies or other companies who own the equipment so waste can be managed.

Total use of PFAS lubricants in this equipment in Europe is in the range of 2.5 tonnes per year. This is based on data from new cylinder valves purchases and estimation of quantities of equipment that we buy in lower volumes (e.g. regulators).

(Vacuum) Pumps, compressors

Lubricants are applied at the beginning of the life inside the equipment. Oil is changed based on the maintenance plan. For all equipment used in our industry in Europe, we estimate a change of 40 tonnes per year of PFAS based oil. This waste is under the control of gas companies and can be managed.

There is no clear evidence but based on available data lubricants can be destroyed by heat when metal melting during recycling as it is impossible to remove them from metallic components at the end of life. A study made by Karlsruhe Institute of Technology¹ confirms that 850°C is sufficient to break down the PFAS and brass melting temperature is 900°C. Other metals used together with PFPE lubricants (e.g. stainless steel, Monel) have even higher melting temperatures.

NOTE The study by Karlsruhe Institute of Technology is provided as separate attachment.

2.4 Alternatives

According to different manufacturers and suppliers of lubricants, there are no available alternatives which can offer similar safety performance in our applications. Even though derogation for 12 years is proposed we have no indication from our suppliers that within this time period an adequate alternative can be developed. Once the alternative is developed it must be properly tested by independent laboratories to confirm safe performance before it can be used in any equipment. Limited laboratory resources within Europe may increase the time needed for introduction of alternatives.

2.5 Concluding Remarks

Based on above and taking in consideration our very high safety standards which cannot be compromised, we strongly insist that the use of PFAS lubricants shall be excluded from the restriction as proposed. We are not in a position to estimate sufficient time needed to develop alternatives. We request that a specific category with longer derogation time for lubricants is defined.

For more information on compatibility of materials and incidents with oxygen see EIGA O2-learning².

¹ Waste incineration of Polytetrafluoroethylene (PTFE) to evaluate potential formation of per- and Poly-Fluorinated Alkyl Substances (PFAS) in flue gas
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² <https://www.eiga.eu/elearning-courses/oxygen/>

3 PTFE-Tape (Construction products - Annex E.2.13.)

3.1 Use of PTFE thread sealing tape in Gas Industry

Our industry uses PTFE thread sealing tape in various applications.

1. Connection between gas cylinder valve and cylinder
2. Equipment for cryogenic and low temperature service (as low as -270°C)
3. Equipment for storage and transportation of gases
4. Equipment for gas distribution network

The Bulk Gas Industry mentioned in the restriction proposal includes examples of gases below (pure or mixtures in gaseous or liquid state):

- Industrial gases, e.g., air gases as nitrogen, oxygen and argon or other gases as hydrogen, helium, carbon dioxide
- Medical gases, e.g., oxygen, nitrous oxide, medical air, carbon dioxide, helium
- Food gases, e.g., nitrogen, oxygen, carbon dioxide, ethylene, argon, rare gases
- Specialty gases, e.g., rare gases, calibration gases, toxic gases, corrosive gases
- Electronic gases and liquids, e.g., gases for use in processes of semiconductor industry

These products are supplied in cylinders, cylinder bundles, cryogenic dewars, drums, bulk cryogenic tankers, bulk gas trailers, tanks, vessels, pipelines

Leak tight connections on these packages are essential as leaks can cause harm to people and environment (toxic, asphyxiating, corrosive, explosive, flammable, oxidizing)

3.2 Key Functionalities

PTFE as material for thread sealing tape is used because of some key functionalities.

From a practical point of view, one of the key functions is the ease of use of PTFE tapes in thread sealing. As already mentioned in Annex E (E.2.13.2.2.) of the proposal "*PTFE tapes have high tensile strength and by using PTFE tape the sealings becomes durable, water- and heat resistant.*" The high stability of PTFE thread sealing tape as lubricant permits the appropriate torque to be applied on conical thread connections to guarantee the pressure tightness over a wide pressure and temperature range during the life cycle of the equipment. Over the years of application, the gas industry has accumulated a long-term experience using PTFE tape or PTFE cones. Standards and procedures have been developed for the correct application achieving very reliable and reproducible sealings for the various applications. Thus, the level of safety in the gas industry has been significantly increased using PTFE thread sealing tape.

Another key functionality of PTFE is the high auto-ignition temperature (AIT) and low heat of combustion. These parameters are not only but especially very important for the use in oxidizing gases. The AIT of most materials is significantly reduced in oxygen-rich or oxidizing environments. Under high pressure (e.g., 200-300 bar) the risk of an ignition is much higher than under usual atmospheric conditions since it can easily be triggered by the contact of an ignitable material to a high flow of an oxidizing gas. In case of an oxygen fire, temperatures reach a level at which even steel equipment burns. Due to its considerably high AIT, PTFE reduces the risk of an oxygen ignition and consequently a violent fire in the facilities of the gas supplier but also in the customers' equipment as for example in hospitals.

In addition, PTFE offers a very high chemical resistance against all molecules in the gas industry. Besides oxidizing components, especially corrosive components must be mentioned in this case. PTFE sealing tape can thus be used as a universal component.

Due to their properties, components made from PFAS (PTFE, PCTFE, PFDF, FKM) are required by law for some applications, e.g. corrosive gases. The legal framework is given by e.g. ADR (Agreement of