Unione costruttori regolatori, associati
dispositivi di sicurezza e relativi sistemi per il gas

UCRS Position on PFAS restriction proposal

September 2023

Contents

1. Introduction

UCRS is the Italian Association representing manufacturers of following product categories:

- Gas pressure regulators
- Safety devices for gas pressure
- Complementary equipment for pressure control stations
- Complete stations for pressure control and measurement of combustible gases
- Fuel gas odorization systems

2. Purpose

National authorities from Denmark, Germany, the Netherlands, Norway, and Sweden have jointly proposed a significant restriction on per- and polyfluoroalkyl substances (PFAS) under the European Union's chemicals regulation, REACH. This comprehensive proposal encompasses the entire lifecycle of PFAS, including their manufacture, placement on the market, and usage in various products and mixtures, provided their concentration exceeds a specified threshold.

What sets this proposal apart is its ambition—it represents the most expansive substance restriction ever contemplated within the European Union. It introduces an extended definition of PFAS, potentially encompassing around 10,000 different substances. This move has important implications for a wide range of industries.

It is essential to recognize that not all PFAS compounds are created equal in terms of their environmental persistence and toxicity. Within the sector of gas infrastructure and installations, the most pertinent concern revolves around polyfluorinated substances, which lack the same level of environmental persistence as some other PFAS variants.

The polyfluorinated materials are commonly employed in gas infrastructure and installations industries; polytetrafluoroethylene (PTFE) and fluoroelastomer (FKM) are renowned for their exceptional chemical resistance, corrosion resilience, and durability in various service conditions, Those products are a popular choice for gaskets, seals, linings, and seats.

It is worth highlighting the importance of distinguishing between different PFAS, particularly when dealing with polyfluorinated materials. The impact of the current PFAS restriction proposal extends to all manufacturers in the mechanical and plant engineering sector. It affects both the availability of goods, and the production processes themselves.

Why fluoropolymers should be treated differently:

Fluoropolymers, such as PTFE, ETFE, FEP, PFA, PVDF, and VDF-co-HFP, stand apart from other PFAS for several compelling reasons:

Unique Toxicological and Environmental Profiles: Unlike non-polymeric PFASs that may raise concerns due to their toxicological and environmental impacts, fluoropolymers exhibit distinct characteristics. These characteristics set them apart significantly from non-polymeric PFAS and warrant their classification as a separate category.

Compliance with OECD Criteria: Fluoropolymers adhere to the rigorous criteria outlined by the Organization for Economic Co-operation and Development (OECD) for being designated as Polymers of Low Concern (PLC). They are non-toxic, biocompatible, insoluble, and immobile molecules, signifying negligible adverse effects on the environment and human health.

Scientific Validation: This information is well-documented in research literature, confirming that fluoropolymers, including PTFE, unequivocally meet the widely accepted assessment criteria to qualify as PLCs. As a result, they are acknowledged to pose low hazards to both human health and the environment.

Owing to these compelling attributes, fluoropolymers are not only permitted but are also extensively employed in critical applications, including medical technology and as materials for food contact. Additionally, the industrial production of fluoropolymers is safely managed within controlled facilities, ensuring the utmost security and adherence to strict guidelines.

Summary of Rationale for the UCRS Request:

- Safety, Efficiency and sustainability are pillars of management of Gas Infrastructure and installation.
- Part of gas infrastructure and installation may operate in harsh environments and only fluoropolymers can deliver the performance needed for safe and efficient operations.

- No suitable alternatives exist today that can deliver simultaneously all the required properties to ensure the safe and sustainable operation.
- In the event that suitable replacements become commercially available, implementation timelines are in excess of five years due to complex re-design and re-certification activities.
- Fluoropolymers are typically a cost premium over non-PFAS materials. They are used because the technical requirements of existing gas infrastructure and installations eliminate the possibility of utilizing existing alternatives.
- Gas infrastructure and installations equipment providers are downstream users of fluoropolymers, so emissions are non-existent until end-of-life, which is on the order of 15+ years.
- Gas infrastructure and installations equipment using fluoropolymers are key enablers of decarbonization initiatives such as renewable gasses (production of: H2, gases from waste, methanation process, etc..) which are foundational to fulfilling European sustainability priorities.

3. Industry Description

The global oil and gas infrastructure market size was estimated at USD 664.69 billion in 2022 and is projected to hit around USD 1,230.25 billion by 2032

The Europe oil and gas infrastructure market size was valued at USD 106.8 billion in 2022 (www.gminsights.com).

The below listed equipment is an essential resource for safe and reliable use of the gas infrastructure and installations:

- Pressure Regulators
- Pressure Safety Devices
- Filters / separators
- Heaters / heater exchangers
- Automatic shut-off valves;
- Automatic burner control systems;
- Gas/air ratio controls;
- Multifunctional controls;
- Complete Gas pressure control and metering stations for transmission and distribution;
- Auxiliary Devices for Gas Pressure Control Stations;
- Odorizing systems;
- Etc...

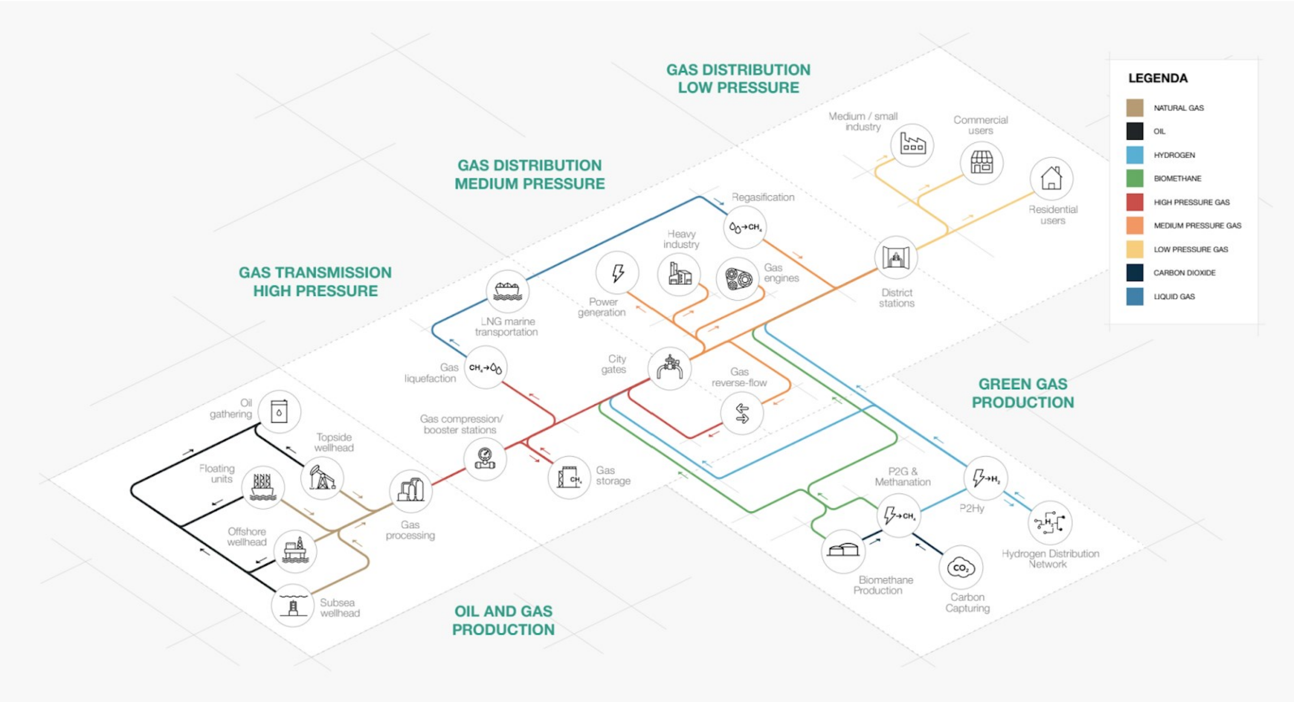

Figure 1 - Example of a Gas infrastructure and installations

These applications often involve exposure to multiple extreme environmental conditions simultaneously.

- Hazardous environments are prevalent and include pressure, fire, explosion, and toxic chemical threats. These environments often require equipment certifications (e.g. ATEX Directive 2014/34 EU, PED 2014/68 EU in Europe);
- High pressures (e.g. up to 250 bar);
- High temperatures (e.g. up to 200°C);
- Low temperatures (e.g. up to -200°C);
- Low friction / Non-adhesive resistance;
- Purity / inert;
- Chemical resistance: Chemical compatibility of seals is critical in low carbon fuel sources such as bio/digester gas containing hydrogen sulphide, and hydrogen applications.

These challenging environments demand the use of high performance and high reliability materials like fluoropolymers, which are vital as an engineering material class, not because of one particular characteristic, but because of the multiple properties any one of them simultaneously possesses.

Other polymers can demonstrate superior performance in one sole property. For example, Polyetheretherketone (PEEK) has slightly higher temperature performance than fluoropolymers. However, fluoropolymers are the best choice when both high temperature and chemical resistance are needed simultaneously.

4. Implications

The potential impact of excluding PFAS from equipment for gas infrastructure and installations will have significant consequences as summarized below:

No Fluoropolymers = No Services and industrial Process feed by Gas infrastructure and installations.

- Gas infrastructure and installations control and safety devices utilize PTFE parts;
- PTFE is better at sealing gases than graphite, is inert and delivers performance at extreme temperatures, - 200°C to +260°C;
- PTFE and PFA liners are used to protect metal from corrosive media.
- Pressure regulators utilize PTFE and PCTFE in valve seats to control the pressure of media used in etching and chemical vapor deposition processes for semiconductor manufacturing;
- PTFE and PCTFE provide unprecedented purity and compatibility with the processed gases to prevent a reaction with the media. PCTFE also delivers an ideal compressive modulus and creep resistance for maintaining sealability;
- Across all pressure vessels – from a home pressure cooker to a three-story pressurizer in a nuclear reactor – a relief valve is required by law for safety;
- Industrial relief valves use PTFE, FKM & FFKM in valve seats at high temperatures (>150°C) and high pressures (>100 bar);
- Pressure vessels include boilers, heat exchangers, chemical reactors, etc...;
- Alternative materials do not provide adequate properties for reliable seals on these devices.

No Fluoropolymers = Slower Adoption of Sustainability Initiatives

- Fluoropolymers such as PTFE are utilized in most decarbonization activities such as H2 production and storage, mobility, wind and solar.
- Fluoropolymers are used to enhance the characteristics of elastomeric materials.

These potential implications show the value of fluoropolymers as an enabling material for gas infrastructure and installations. The loss of these resources and goods would have significant consequences.

5. PFAS Functionality

Gas infrastructure and installation equipment must be designed with substantial robustness to operate safely and reliably. This equipment is built with high safety margin and high-performance materials often defined by industry standards. Failure is not an option for this equipment. For example, a lack of performance of safety shut-off devices can compromise the safety of the infrastructure, harm of people and an impact to the environment (release of polluting gases).

Due to the potential severity of a failure, significant caution is expressed regarding the removal of fluoropolymers, a material that has performed so reliably for over decades. As previously stated, fluoropolymers provide an unmatched multitude of high-performance properties simultaneously to deliver the required functionality to the components used in Gas infrastructure and installation equipment, per Table 1 below.

Table 1 - List of common fluoropolymers and their functional properties leveraged for each application.

Applications	Fluro polymers	Equipment	Properties
Liners	• PTFE • PFA • FEP • ETFE	• Pressure, Flow, Level and Temperature • Measurement	• Chemical Resistance • Low Friction / Adhesive Resistance • High & Low Temperature Resistance • Corrosion Resistance • Mechanical Strength
Seals (O-rings, Gaskets, etc.)	• FKM • FFKM • PTFE • PCTFE	• All Equipment	• Chemical Resistance • High & Low Temperature Resistance • Low Friction / Adhesive Resistance • Fugitive Emissions Standards • Rapid Gas Decompression Resistance
Valve Seats	• PCTFE • PTFE • ETFE	• Valves, Regulators & Actuators	• Chemical Resistance • Mechanical Properties (compressive modulus) • Low Temperature Resistance

Liners:

Liners are used to protect surfaces from corrosion and wear and to provide a low friction surface. They are exclusively made out of fluoropolymers, which are applied as a thin coating or as a prefabricated sheet.

Seals:

All Pressurized equipment utilize seals for containment of gases or fluids. Types of seals are dynamic or static and include O-rings, bellows, bushings, and gaskets for crucial functions such as safety shut-off applications.

Fluoropolymers are used when operating conditions exceed the performance requirements of other sealing materials.

PTFE is used to prevent leaks between a dynamic stem or shaft and the valve body.

Several factors must be considered when choosing the most suitable material, namely fugitive emission standards, chemical resistance, temperatures, and pressures.

Seats:

A seat is a mechanical seal used in safety valves, relief valves and pressure regulators to create a tight seal between the moving and stationary parts for control of fluid flow and pressure containment. Valve seats are made out of fluoropolymers to accommodate performance requirements such as chemical resistance, temperature resistance, and mechanical properties.

6. Alternatives

The equipment that may be affected by PFAS REACH restriction require high performance and high reliability to prevent failures in products that could result in harm to people and the environment.

Availability

Non-fluoropolymer alternative materials do not exist today for specific applications due to the harsh operating conditions in which the materials are required to operate. Finding suitable alternatives is extremely challenging and the evaluations require reliable lab and field test, approval, certifications, etc. to verify durability and behavior over time and in any case will be the best secondary and tertiary choices. For example, some industry standards require 5 years of field experience to validate elastomeric materials.

Another consequence concerns the spare parts to be provided for maintenance of already in service equipment originally designed including PFAS materials.

The non-PFAS spare parts can compromise the original performances and approvals, leading to a possible replacement of the whole equipment. This situation is critical to align with the European core values of sustainability and economic efficiency, as well as the commitment to fostering a culture of repair and reusability.

Non-PFAS Elastomers

Traditional elastomers such as Ethylene Propylene Diene Monomer (EPDM), Hydrogenated Nitrile Butadiene (H-NBR), and Silicone were considered as alternatives for seals, but were deemed unsuitable due to their inferior chemical resistance, temperature limitations, and mechanical properties. Most elastomers cannot perform at operating conditions that exceed 150°C. Using materials that are not adequate for the operating condition is not recommended and would, at a minimum and best case, require an unrealistic number of maintenance cycles. Furthermore, safety of workers and the environment could be compromised due to increased probability of failure and possible releases of hazardous materials.

All potential alternatives, metals, non-PFAS polymers, and non-PFAS elastomers, may lead to increased maintenance cycles and generation of higher amounts of environmental waste.

Economic Feasibility

Cost is not the deciding factor for use of fluoropolymers in gas infrastructure and applications. Fluoropolymers are typically more expensive than non-PFAS materials. They are used because of their technical requirements. The primary consideration for applications in gas infrastructure and installations is performance to ensure that safe and efficient operations are maintained.

Even if alternatives were available today, the time needed for careful and comprehensive engineering work that accompanies a material change in a highly regulated segment can be in excess of years with substitution costs. Substitution costs, while substantial, will pale in comparison to the on-going costs of increased production facility downtime due to more frequent maintenance cycles and shorter life of components caused by decreased performance of any alternative.

Another significant consideration is the intensive engineering effort that accompanies a material change in components for Infrastructure. Activities to be conducted include finding and evaluating alternatives, modifying designs, re-qualification testing and re-certification (ATEX, Pressure Equipment Directive 2014/68/EU, GAR), supply chain cadence change, and customer relations.

Hazards and Risks

Safety is the deciding factor for use of fluoropolymers in gas infrastructure and installations applications. These materials are selected due to their high performance. The use of inferior performing alternatives could lead to a breach of containment and a subsequent release of media, which could harm humans, the environment and critical equipment.

Non-Polymeric PFAS Processing Aids in Fluoropolymers

Gas infrastructure and installations equipment providers are downstream users of fluoropolymers and do not handle any non-polymeric PFAS. The main concern related to fluoropolymers, in terms of human and environmental exposure, is the use of non-polymeric PFAS as polymerization aids in the manufacturing process, rather than the fluoropolymer itself. The fluoropolymer itself is not toxic, bio-accumulative, and/or water soluble, in contrast to the processing aids. Suppliers are addressing this and making progress on the development of non-fluorinated processing aids to be used in the production of fluoropolymers. It is expected that fluoropolymers will not degrade to other PFAS during normal conditions of use or in the environment.

Recent indications received from fluoropolymer suppliers suggest that incineration of fluoropolymer waste at industrial incinerators can achieve complete thermal destruction of fluoropolymers under specific conditions; therefore it could be concluded that the environmental impact of their by-products can be controlled.

7. Emissions

Concerns related to PFAS emissions during the manufacturing of fluoropolymers are expected to be addressed and should be manageable in a reasonable and defined timeframe, per feedback received in a recent inquiry. Implementation of various abatement technologies/emission control methods to reduce the environmental footprint are necessary and we intend to continue maintaining a responsible supply chain.

8. Socioeconomic Implications

The Europe oil and gas infrastructure market from oil and gas segment account for USD 3 billion revenue in 2022 (www.gminsights.com).

Exclusion of fluoropolymers in gas infrastructure and installations as a use sector and implementation of an all-PFAS ban will have significant socioeconomic implications on the European economy.

Furthermore, through the possible elimination of fluoropolymers, the EU could fall behind other countries on technology competitiveness, especially in the area of chemical processing. Potential outcomes include reduction in manufacturing operations resulting in higher imports for everything from food to pharmaceuticals. Material limitations will continue to narrow the scope of technology-related activities that can be accomplished including those critical to Europe's future, namely alternative energy, transportation, etc.. Materials are critical enablers of these technologies, and a derogation of fluoropolymers will enable Europe to maintain a level playing field, increasing the probability of achieving a successful outcome.

All companies who manufacture equipment for gas infrastructure and installations will be affected by the restriction.

9. End-Of-Life

Differentiation Between Consumer and Industrial Applications: by implementing effective risk management practices, industrial stakeholders can ensure the professional and responsible handling of PFAS, PFAS-containing materials, and products throughout their entire life cycle.

Gas infrastructure and installations equipment can be disassembled and separated at the end-of-life for processing or re-use in a circularity methodology. The fate of fluoropolymers at the end-of-life in this business sector is controllable and can be any one or more of the following:

<u>Recovery and Recycling:</u>
Fluoropolymers can be chemically returned back to their building blocks for reconstruction without damage to their properties. Melt-processable fluoropolymers, which excludes PTFE, can be recycled through traditional mechanical methodologies. The challenge for non-melt processable fluoropolymers like PTFE is identifying ways to return materials to a facility that can perform chemical recycling. This is a difficult problem, but not insurmountable.

Incineration:

There are available studies that strongly suggest that PTFE, the most stable fluoropolymer, undergoes complete thermal decomposition at a temperature of about 800°C and is safe for incineration at municipal incineration facilities. Therefore, it is assumed that most other fluoropolymers also thermally decompose within similar parameters and are also safe for incineration at most typical municipality incineration facilities.

Landfills:

Fluoropolymers are inherently safe, non-mobile, non-bio accumulative and non-toxic. Waste is chemically inert and therefore, fluoropolymers disposed in landfills do not pose any substantive threat to human health and the environment.

10. Ending Statement

UCRS is in favor of safeguard of environment and ban of toxic substances emission and fully committed to comply with all relevant environmental laws and regulations in the country.

However, due to need of safety, efficiency, and functionality, the use of PFAS is still necessary and derogations should be then assured for in Gas infrastructure and installation applications.

In closing, UCRS derogation request is:

- Incorporation of Gas infrastructure and installation equipment as a missing use.

Fluoropolymers are clearly differentiated from other substances in this very broad group of PFAS chemicals. There is strong evidence that suggests that these materials will not give rise to situations of concern for human health or the environment, acknowledging as well that industry continues to make significant progress to limit the use of PFAS polymerization aids and to introduce adequate abatement techniques to keep emissions of potentially harmful fluorinated by-products under adequate control.
Fluoropolymers are known for providing many beneficial properties simultaneously (combined in single products) that allow the continued development of applications critical to society, not only related to technological progress, but specifically in terms of safety to the population and development of green energy alternatives.