International Association of Oil & Gas Producers

POSITION STATEMENT | FEBRUARY 2024

IOGP Europe response to the ECHA consultation on Universal PFAS restriction proposal

9493

Date:
2023/09/25 19:35

Content:
Scope or restriction option analysis
Environmental emissions
Information on alternatives
Other socio economic analysis (SEA) issues
Request for exemption

Type:
BehalfOfAnOrganisation

Org. type:
Industry or trade association

Org. name:
IOGP Europe (transparency register number 3954187491-70)

Org. country:
Belgium

Attachments:
(See Attachments panel in Adobe Acrobat)

1 - IOGP Europe statement on PFAS regardin CCS sector

2 - PFAS in mining_Wood_Report_July2021

3 - Wood report IOGP response_Nov2020

4 - Figure Sureflex

General Comments:

1) Scope or restriction option analysis

We take note of the ECHA restriction proposal derogation period of 12,5 years + 18 months for "Petroleum and mining" industry, however the oil & gas sector is vital for the functioning of the EU economy. Oil & gas industry including onshore and offshore is predominantly using equipment that contains Per- and polyfluoroalkyl substances (PFASs) in variety of applications such as flexible pipes, sealing devices, o-rings and pipe gaskets, and others, used for safe transportation and storage of oil, gas and LNG, which in turn provide safe, and reliable energy to the EU.

The PFAS that are used in these applications are mainly fluoropolymers such as Polyvinylidene fluoride or polyvinylidene difluoride (PVDF), Polytetrafluoroethylen (PTFE) and Fluoroelastomer (FKM), which have been developed to serve specific purpose – withstand high temperatures and pressure. No suitable alternatives that could replace them and ensure similar performance and safety level have been discovered and developed so far.

Fluoropolymers (fluoroplastics and fluoroelastomers) have fundamental capabilities which are critical to safety in many applications in a wide range of our products essential to society at present and for technologies needed for the future. The massive scale of products and parts affected makes replacement unachievable in decades, even if alternatives were available.

We acknowledge that some PFAS substances have an unacceptable risk to human health or environmental impact must be better controlled or restricted. In contrast, some subgroups (like fluoropolymers) can be used in a manner that is protective to the environment, safety, and human health from leaks of methane, volatile organic compounds (VOCs), hazardous fluids, oil and chemical spills through their particular applications in a wide cross-section of business, including extraction of hydrocarbons, chemical and petrochemical, power generation and supply, waste water, and compression of natural gas or hydrogen. These compounds are neither water soluble, toxic nor bioavailable and therefore do not pose a risk to human health or the environment.

In summary, a blanket PFAS restriction that includes fluoropolymers is unachievable and undesirable due to the scale complexity and impact on both current supply chains and the economy of the future. For these materials a targeted approach is recommended involving robust emission monitoring control and abatement in manufacture and disposal, supported by material return and recycling systems wherever feasible.

Adopting the ban on fluoropolymers as proposed would be both highly detrimental and call into question the future of our manufacturing, supply and service support for affected products within Europe, which, if ceased, would place at risk several billion euros in European commerce, several thousand industrial jobs, and adversely impact thousands of customers and suppliers. This would not reflect a balance between risk and impact given that Henry (2018)[1] and Korzeniowski (2022)[2] demonstrated that most fluoropolymers meet the Organisation for Economic Co-operation and Development (OECD) criteria to be defined as 'polymers of low concern' (PLC).

A comprehensive, but not full list, has been presented in the Annex XV of the ECHA restriction proposal (page 147- 151). For the moment, not all applications have been identified within oil & gas sector that contain PFASs, and therefore it is very challenging to estimate an approximate impact that could stem from the restriction. Oil & gas industry has very limited influence on the chemical composition of the polymers required to construct the equipment, but makes an effort to urge the Polymer Manufacturers to share data with ECHA and urgently explore suitable alternatives.

Current applications: Petroleum and mining - Oil& Gas

Future applications:

- Hydrogen transport pipelines
- Hydrogen storage
- CCUS projects (Pipelines to transport CO_2)

Flexible pipes are used to transport oil from wells to a processing facility and downstream consumption sites. We started developing flexible pipes several decades ago and have since expanded their production as an effective means of reducing corrosion associated with metallic/steel pipes and enabling development of remote offshore fields via Floating Production Storage and Offloading platforms. Flexible pipes are enabling technology for development of floating production units where steel pipes are not able to withstand the dynamics imposed from the floating unit. PVDF is the main element to ensure the product's flexibility and durability. The ability to transport flexible pipes on reels and install them from reels enables reduction of carbon emissions, and minimizing the use of: energy, installation time, and the number of pipe connections which in turn reduces chances of leakages during operation.

This ban would also affect technologies of the future, impeding EU climate targets and other objectives set out in:

- The EU Critical Raw Materials Act
- The EU Net-Zero Industry Act
- REPowerEU
- The Hydrogen Strategy
- The Air Quality Agenda
- The EU Methane Regulation

Once alternative chemicals are identified for a particular use, the process of redesigning, retesting, and recertifying equipment will be resource and time intensive. Furthermore, a wide of range standards will need to be revised. It is impossible to re-engineer substitute compounds in all products by the proposed deadlines even if all available research resources were to be redirected to the sole task of developing products with PFAS-free alternatives once these are known. The rush to qualify materials and associated products under applicable standards will overwhelm the capacity of qualified laboratories.

Considering the low risk profile of fluoropolymers, the ability to manage their safe production and use through other regulatory means (e.g., the Industrial Emissions Directive), the lack of alternatives that meet harsh environmental conditions (i.e., chemical, high temperature and pressure), and the substantial adverse socio-economic impact of banning further use, we strongly recommend exempting fluoropolymer production and use in industrial applications from the overall PFAS restriction and instead use other tools that are outlined in the "Transition pathway for the chemical industry, as outlined in the footnote."[3]

1 Henry et al. (2018), A critical review of the application of polymer of low concern and regulatory criteria to fluoropolymers, Integrated Environmental Assessment and Management published by Wiley Periodicals, Inc. on behalf of Society of Environmental Toxicology & Chemistry (SETAC), Volume 14, Number 3, pp. 316-334. Retrieved on: https://setac.onlinelibrary.wiley.com/doi/10.1002/ieam.4035

2 Korzeniowski, S.H., et al. (2022), A critical review of the application of polymer of low concern regulatory criteria to fluoropolymers II: Fluoroplastics and fluoroelastomers, Integrated Environmental Assessment and Management, Volume 19, Number 2, pp. 326–354. Retrieved on: https://setac.onlinelibrary.wiley.com/doi/epdf/10.1002/ieam.4646

3 The proposal focuses on the following: add PFAS where possible as a group in the review of annexes of the Environmental-Quality Standards Directive and Groundwater Directive; address the emissions of PFAS from the waste stage including through the revision of the Sewage Sludge Directive; address the presence of PFAS in food by introducing limits in the Food Contaminants Commission Regulation; address PFAS concerns at a global scale via proposals under the Stockholm Convention and the Basel Convention. Source: "Transition pathway for Chemical Industry"; p. 55, 2023; Retrieved on: https://ec.europa.eu/docsroom/documents/54595

For exempted uses, we recommend establishing a regulatory framework that incentivises:

- Best practices for the manufacturing, use, and end-of-life stages of fluoropolymers, implementing circular economy practices across value chains;
- Research on alternative substances that can meet current standards (e.g., performance, quality, durability, efficiency, availability, and economic viability).

Please note that due to the complexity of products and global supply chains, it has not been possible to investigate the impact of these restrictions on all product lines.

Clarification is also needed in the legal text of any restrictions and derogations:

- On fluorinated materials that are necessary to produce fluoropolymers, to confirm that a derogation of a use would similarly apply to the entire upstream value chain of that use, including the use of monomers and polymerisation aids in the case of fluoropolymers;
- To confirm that any derogations include spare parts necessary for repair and maintenance. Failure to include spare parts in a derogation may lead to additional and substantial costs to replace equipment before the end of its service life.

We strongly encourage ECHA to re-assess the complete ban of fluoropolymers for the reasons stated above.

2) Environmental emissions

More data and research is necessary to establish a link between fluoropolymers contained and emissions when used in the oil and gas applications.

3) Information on alternatives

Based on expert knowledge and discussions with manufacturers there are at this point in time no suitable alternatives for fluoropolymers used in the flexible pipes that could ensure similar performance and safety of operations.

Existing or under development alternatives, such as polyethylene (PE) and polyamide (PA), cannot operate safely in the same high pressure high temperature (HPHT) environment and the mechanical properties of other materials, such as the stiffness of polyetheretherketone (PEEK), render them unusable in flexible pipes. Using such alternatives would significantly deteriorate the quality of the flexible pipes, with potential harmful impact on the safety of people and environment.

4) Other socio-economic analysis (SEA) issues

It is very challenging to determine the socio-economic impact as not all applications containing PFASs in the oil & gas have been identified.

Based on the closer evaluation of the flexible pipes only, the impact can be severe resulting in challenges to ensure PFASs free spare parts that will be required.

Flexible pipes may undergo partial replacement to ensure the reliability and durability of the equipment. Under the current proposal, producing, procuring, or selling any PFASs containing spare parts would not be possible as of 2026-2027. That means that if PFASs-free spare parts will not be available, oil & gas production would have to be stopped for undetermined period of time, which could result in curtailment of production impacting security of supply towards the EU and potentially resulting in higher oil & gas prices.

The supply chain for oil & gas equipment will be disrupted, with potentially many manufacturers closing their business or moving outside Europe.

Moreover, PFASs restriction proposal will have an impact on the applications used in the development of Carbon Capture and Storage (CCS) and Hydrogen (H2), as well as applications preventing methane and CO_2 leakages. That might derail the EU from the achievement of the Green Deal targets, and especially the net zero objective by 2050.

5) Request for exemption

The proposed 12,5 year derogation + 18 months for the petroleum and mining industry is stringent. Provided that PFAS manufacturing, use and imports will be banned after 6 years, oil & gas industry including onshore and offshore is concerned that lack of replacement parts and products after these 6 years may lead to premature obsolescence of the flexible pipes already deployed in the field, followed by inability to produce the field resources, producing a total lack of consistency between sectors. Moreover, given that alternatives in some applications such as flexible pipes do not exist, we would like to propose:

- Unlimited-time derogation for fluoropolymers used in the petroleum and mining industry equipment and replacement parts and products.

For the purpose of responding to this public consultation, 'IOGP Europe Statement on PFAS regarding CCS sector' is attached as an official document accompanying these responses, also containing the relevant request:

- Unlimited-time derogation for fluoropolymers used in the CCS sector (see attached document number 1).

Answer to specific info request 1:

Sector: Petroleum and mining industry

Sub-use: Flexible Pipes in oil and gas applications

A wide range of fluoroplastics and fluoroelastomers are identified as being used in the oil and gas industry. The most common use for these materials in this sector is in the components of the equipment and piping used in extraction, transport, and storage of petroleum resources. In particular, fluoroplastics and fluoroelastomers are essential material for key components in unbonded flexible pipe. For instance, Polyvinylidene difluoride (PVDF) is used as pressure sheath which its primary function is to ensure containment of reservoir fluids and gases in the bore of the pipe throughout the service life for the pipe. PVDF is a long-term (typically 30 years) chemically resistant polymer commonly used in flexible pipe design especially suitable for use at high pressure and high and low temperatures.

Sealing systems at the end fitting of flexible pipes also commonly use fluoroplastics and fluoroelastomers. Specifically, the Fluoroelastomer (FKM) and Polytetrafluoroethylene (PTFE) materials are used to maintain sealing systems functionality throughout pipe service life due to their unique properties such as high and low temperature resistance, high mechanical strength, chemical resistance, corrosion resistance, inertness, non-adhesive/low friction resistance, low permeation, flexibility/ductility, light weight and non-flammable nature.

Answer to specific info request 2:

1. Manufacturing phase
   a. Manufacturing of PVDF pellets – data to be supplied by material manufacturers.
   b. Extrusion of plastic sheath layers from pellets – data to be supplied by material manufacturers.
      i. Estimated PVDF waste for the manufacturing step is between 5 to 15 tons of PVDF waste per year. Some Flexible Pipe manufacturers already have a waste management program based on full recycling (i.e. no landfilling nor incineration, only for re-use in other applications).

2. Use phase
   a. Flexible pipes are used for transporting hydrocarbons, and injection of fluids and water offshore.
   b. There are no emissions throughout typical 30-year service life of flexible pipes, since flexible pipe are usually operated in the range of 50% to 75% of PVDF melting point, and since no known PVDF degradation that may result in emissions has been observed so far below its melting point.
   c. PVDF has no exposure to the environment since PVDF is an internal layer within the flexible pipe. d. PVDF is a stable polymer matrix which does not age over a typical 30 year service life.

3. End of life phase Worldwide
   a. Flexible pipe operators use decommission plans to describe treatment of flexible pipe after the end of their service life including flushing and cleaning post last day of operation.
   b. Decommission plans strictly follow host country regulations.
   c. Host country regulations:
      i. Do not distinguish between flexibles pipes made with PVDF from flexible pipes made with other grades of polymers.
      ii. May allow abandonment on seabed or require retrieval and disposal (including to designate companies in host country approved or certified by regulators to dispose flexible pipes).
   d. Not all flexible pipe operators have decommissioned flexible pipes made with PVDF.
   e. Normally flexible pipes (regardless of the polymers used) are abandoned on the seabed after being safely secured for short-term or long-term storage, or retrieved, recycled and disposed of in the host country. Retrieved flexible pipe are not normally sent back to original flexible pipe manufacturers.
   f. No emissions from end-of-life of flexible pipes with PVDF can be reported, since no operator participating in the IOGP Flexible Pipe Subcommittee is aware of any incineration of any polymer extracted from retrieved flexible pipes.

Relevant studies and reports on disposal of fluoropolymers:

We would like to draw attention of the reviewers to the following publications regarding disposal of fluoropolymers:

- Recent peer-reviewed studies carried out by Aleksandrov[4] on PTFE have supported incineration as an appropriate form of disposal. These studies have found that combustion of PTFE does not degrade into the identified PFAS of environmental concern under typical municipal level conditions using Best Available Techniques (BAT), where PTFE is largely transformed to carbon dioxide and hydrofluoric acid. The study concluded that the municipal incineration of PTFE should therefore be considered an acceptable form of waste treatment. The Dutch Institute for Public Health and Environment (RIVM)[5] also found that polymer molecules are destroyed with the gasification process, although more information was required regarding the kind and degree of by-products formed and on the rate of mineralisation. Additional research, funded by the EU research programmes, would be needed on the topic to fill in any gaps on disposal of PTFE.
- Engineering plastics like PVDF[6] are a class of polymeric materials with unique mechanical and thermal properties in a wide range of conditions. Hence, the recycling of these materials is a great challenge. However, recent studies have shown that mechanical recycling is an opportunity to minimize the potential impact of PVDF waste landfill. PVDF recycled samples for offshore applications were investigated through analytical techniques. Extensive evaluation of results shows no evidence that reprocessing by extrusion causes significant changes in the properties of PVDF.
- The development of FKM-recycling processes[7] is important to reduce the costs of this raw material. However, strong chemical bonds make it difficult to be cleaved by the devulcanization processes. In contrast to the vast number of publications to be found in the field of rubber and especially tire recycling, only a few publications deal with the recycling of FKM. However, recycling methods for conventional rubber cannot be automatically adapted to fluoroelastomers. In fact, only two methods were found to be viably functioning for recycling FKM: The milling of FKM to a fine powder to be added to virgin FKM and the mechanical devulcanization of FKM and addition to virgin FKM. A comparative study for both methods has not been published yet. Additional research, funded by the EU research programmes, would be needed on FKM-recycling processes.

[4] Aleksandrov, K., et al. (2019), Waste incineration of polytetrafluoroethylene (PTFE) to evaluate potential formation of per- and poly-fluorinated alkyl substances (PFAS) in flue gas, Chemosphere, Volume 226, pp. 898-906. Retrieved on: https://doi.org/10.1016/j.chemosphere.2019.03.191

[5] Korzeniowski, S.H., et al. (2022), A critical review of the application of polymer of low concern regulatory criteria to fluoropolymers II: Fluoroplastics and fluoroelastomers, Integrated Environmental Assessment and Management, Volume 19, Number 2, pp. 326–354. Retrieved on: https://setac.onlinelibrary.wiley.com/doi/epdf/10.1002/ieam.4646.

[6] Veiga A. G. et al (2020), Reprocessed poly(vinylidene fluoride): A comparative approach for mechanical recycling purposes, Materials Today Communications, Volume 25. Retrieved on: https://doi.org/10.1016/j.mtcomm.2020.101269.

[7] Schuster J. et al (2022), Recycling of fluoro-carbon-elastomers – A review, Advanced Industrial and Engineering Polymer Research, Volume 5, Issue 4, 2022, pp. 248-254. Retrieved on: https://doi.org/10.1016/j.aiepr.2022.08.002.

Answer to specific info request 3:

Majority of and oil and gas Operators have not disposed of pipes with PVDF, or were not able to obtain information on how polymer from retrieved pipes has been treated, so it is not possible to obtain information regarding the effectiveness of this waste management process. Therefore, "I don't have information on this topic" is the option selected here.

Answer to specific info request 4:

No alternative has been identified to replace fluoropolymers in our products. This means that, if fluoropolymers were to be phased out, flexible pipes will have to be prematurely disposed of and will overwhelm recycling facilities or will be redirected to landfills. Reuse and recycling of flexible pipes and fluoropolymers for this system could be jeopardised by the PFAS restriction proposal, as there would be no more end-market, with the unintended consequences that the material is disposed in landfills. Data to be supplied by the Recycling Industry.

Answer to specific info request 5:

Data received from Sureflex joint industry project (JIP) covers the total PVDF supply from Baker Hughes, NOV, and TechnipFMC over the last 10- years (2012-2022). The Sureflex JIP run by Wood focuses on developing, gathering and sharing industry-wide data that competently supports the safe operations and integrity management of flexible pipe systems. The JIP has compiled global damage and failure statistics for flexible pipes across the industry and, in parallel, gathered comprehensive population statistics. This is in metres of pipe, and the data is distributed by pipe diameter (figure Sureflex attached number 4). Based on the distribution of diameters, the tonnage of PVDF can be estimated based on typical liner thicknesses. Considering 1437km of pipe in last 10 years globally, (2012-2022) this represents an average annual tonnage of between 1050 to 1500 tonnes of PVDF. Within the EEA, this equates to between 140 to 190 tonnes PVDF per annum which would be approximately 12% of the Global annual production based on the Sureflex data.

Answer to specific info request 6:

The oil and gas sector have previously responded to earlier consultations (Wood report - attached document as 'PFAS in mining_Wood_Report' and 'PFAS restriction_Wood data collection'). Despite significant research carried by Raw Materials Manufacturers (based on Solvay's Position Paper – bullet point 5), currently, there is no known substitute for extruded PVDF or current uses of PVDF and PTFE in flexible pipe design and manufacturing.

Existing alternatives like polyethylene, polyamide and polyetheretherketone are already in use when technically feasible. However, in many flexible pipe critical applications, they cannot operate at the same pressure, temperature and flexibility ranges as PVDF. As acknowledged in section 2.15 of annex E of the restriction proposal, the development of alternative products could take several decades, if even possible.

In the absence of technically feasible alternatives, established designs of safety-critical equipment might have to be changed. The lack of technically feasible alternatives will have an impact on all High Pressure High Temperature (HPHT) fields: existing fields can be severely impacted or closed and new fields not developed at all, thus impacting the energy security and affordability for decades to come.

Features of the used PFAS in flexible pipes:

As pointed out by the dossier submitters, PVDF has the following features: non-reactive inert chemically stable, flexible, and thermally resistant. In particular, fluoroplastics and fluoroelastomers are essential materials for key components in unbounded flexible pipes. When PVDF is used as a pressure sheath its primary function is to ensure the containment of fluids and gases in the bore of the pipe throughout the service life of the pipe.

PVDF flexibility enables the spooling of hundreds of meters of flexible pipe on reels, transportation on several reels per vessel trip and, fast continuous installation from reels. The flexible pipe transportation and installation from reels reduces the overall carbon footprint when compared with installation of metallic pipes of the same length requiring offshore welding of multiple ~10m-long metallic-pipe joints/segments which carries additional HSE (Health, Safety, and Environment) risks. PVDF is a chemically resistant polymer commonly used in flexible pipe design especially suitable for use at high pressure and temperatures. Sealing systems at the end fitting of flexible pipes also commonly use fluoroplastics and fluoroelastomers. Specifically, PTFE materials are used to maintain sealing systems functionality throughout pipe service life due to their unique properties such as High-temperature resistance, High mechanical strength chemical resistance, corrosion resistance Inertness Non-adhesive/low friction resistance Low permeation Flexibility/ductility Light weight and Non-flammable.

Alternatives (alternatives - their advantages & disadvantages, cost):

Steel pipelines have been used since the 1800s and many standards were developed to use them by the oil and gas industry. Corrosion has always been a challenge. This is the main reason why the industry has been working over last 40 years on alternatives to steel pipelines. Metal pipes commonly used in marine and offshore platform include copper-nickel alloy pipe, thick-walled carbon steel pipe, carbon steel pipe with anti-corrosion coating and stainless-steel pipes. These pipes are often heavy and rigid preventing movement between well and production skid when intervention is required and consume considerable installation time. A flexible, non-metallic pipe system overcomes these challenges. In the past, corrosion resistance alloy pipes were selected as an exclusive alternative for steel pipes as they provide superior corrosion resistance capability and possess equivalent mechanical strength, but they experience other problems like pitting or environmentally assisted cracking.

The restriction dossier submitters also stressed that ceramic-based materials and epoxy-based systems, either using glass fibres or carbon fibres could be good alternatives. This type of pipe material has been reported to suffer corrosive substances from premature leakage and methane seepage. As the EU is currently finalizing its work on the EU Regulation on reducing methane emissions in the energy sector, which applies to the wells of the upstream oil and gas production, access to equipment aimed at mitigating methane emissions will be critical.

The dossier submitters also stated that glass or carbon fibres can be used instead in flexible pipes. We would like to clarify that glass or carbon fibres are used as reinforcement, but they do not provide a fluid barrier. The other materials that are mentioned are nylon and polyethylene, but they have limitations on temperature and chemical compatibility. The other material referenced is polyether ether ketone (PEEK). While it should meet the pressure and temperature requirements, it is much stiffer than PVDF, which would make the whole pipe structure less flexible and not suitable for applications where flexible pipes are now used. Current thermoplastic materials such as high-density polyethylene (HDPE), polyethylene raised temperature resistance (PE-RT), polyamides (PA) are applicable at much lower temperature (60-90°C) than PVDF (90-130°C). Polyphenylene sulfide (PPS) and polyether ketone (PEEK) family are applicable at similar or higher temperature but do not have similar flexibility for continuous spooling on smaller reels for transportation on land and lead to higher carbon footprint in terms of higher manufacturing energy consumption and limitation to transport by land on much larger reels to remote locations, thus not capitalizing on the unique flexible pipe technology. In addition, extrusion of thick PPS and PEEK fluid barriers has proven to be challenging. Hence these other alternative materials are limited in their properties for the current application.

Conclusions on alternatives:

As acknowledged in section 2.15 of annex E of the restriction proposal, the development of alternative products could take several decades, if even possible. In the absence of technically feasible alternatives, established designs of safety-critical equipment might have to be changed. The lack of technically feasible alternatives will have an impact on all High-Pressure High Temperature (HPHT) fields: existing fields can be severely impacted or closed and new fields not developed.

This unique flexible pipe technology allows lower carbon footprint due to its high-volume transportation on reels and quick installation from reels, while its non-corrosive nature results in longer service life, and a lower total cost of ownership over its life cycle. As fluoropolymers, such as PVDF, are excellent candidates for new frontier applications such as CCUS, hydrogen, and energy subsurface storage, it will significantly delay sustainability and energy transition programs for another decade or more.

Additional information:

Flexible pipes (hereafter also "non-metallic pipes" or "composite pipes") are made of an assembly of polymeric barriers with corrosion-resistant steel wires, glass fibres or carbon fibres impregnated with polymeric matrix to allow load transfer and acts as fluid barrier. In many applications, they are the only viable solution for oil and gas field development. Also considered an option with a lower carbon footprint. As pointed out by the dossier submitters[8] steel pipes are more carbon-

[8] rest_pfas_annex_e_31106_en – page 506 // "it is noted that steel is considered less favourable as the pipelines or other components are heavier, less flexible, and more carbon intensive to produce."

intensive. Several reports have also concluded that choosing non-metallic, flexible pipes provides the least GHG emissions from a cradle-to-grave perspective.[9,10]

Any restriction of PVDF and PTFE would affect the manufacturing of flexible pipes in Europe resulting in the closure of numerous manufacturing facilities, severely disrupting the supply chain, and resulting in the economic impact of billions of Euros per year. Despite the proposed derogation for the petroleum and mining industry, oil and gas exploration and production would be still impacted due to disruption in the supply chain, and shortages in raw materials needed for the production of flexible pipes. The existing and new oil and gas fields rely on these products as enabling technology.

During the lifetime of a field, some replacement products and maintenance parts are required. If the industry is not able to supply necessary spares, this may lead to premature field closure which could affect energy security and energy affordability for decades to come. Materials considered as alternatives in the restriction proposal are not technically feasible replacements for the abovementioned application as it is challenging to use them in some temperatures.

Flexible pipes are used for the replacement of heavy steel pipes to high strength and lightweight non-metallic composite pipes. Thermoplastic polymers such as HDPE. PE-RT, PA, PVDF, PPS, PEEK family, etc. are potential materials for non-metallic composite pipes that can be continuously manufactured into hundreds of metres of pipes and spooled onto reels to be transported to well sites. Unlike heavy steel pipes or thermoset non-metallic composite stick pipes which require a rig for deployment and installation at well sites, thermoplastic non-metallic composite pipes can be deployed using carousels and set up that have a smaller carbon footprint than a rig site. PVDF has been used for more than 20 years in oil & gas applications which has proven to be a safe solution due to its compatibility and robustness for long term use.

Key functionalities for alternative materials in non-metallic pipes include material properties such as temperature resistance, chemical resistance, mechanical properties, etc., material availability, material compatibility, material costs, manufacturability, economic viability inclusive of the total cost of ownership throughout the lifecycle of the products. Non-metallic pipes have longer service life with the elimination of corrosion-related risks and prevention costs, which in turn reduces maintenance and pipe replacement throughout the well life cycle.

Alternatives such as PPS and PPS-CF, PEEK and PEEK-CF are proposed in applications with higher temperature range from 130°C onwards, however, they are not as spoolable (this means they are capable of being spooled, or wound onto a reel) as PVDF and PVDF-CF due to their intrinsic material properties. This contributes to a higher carbon footprint as higher energy is needed to produce the raw materials which in turn needs higher energy to manufacture the pipes, also we need more trucks to transport the same volume/length of pipes as they cannot be transported in smaller reels. All these results in a higher total cost of ownership, not fully capitalizing on the unique flexible pipe technology.

Development and Qualification Timescales:

To make them as flexible as PVDF, system design, material development and qualification will be needed for use in flexible pipes in different applications and to replace manufacturing equipment to manufacture these new material pipes for testing, qualification, and field trial, etc.

Assuming appropriate materials are available in the future, technology development must progress in stages from proof of concept, incrementally to a fully deployable and manufacturable deployed technology. This staged approach is often called the Technology Readiness Level (TRL) scale[11]. Technology development through the relevant stages will take at least 10-15 years as there is a need to requalify the materials, purchase new manufacturing equipment with training and R&D phase, requalification of new pipes, field trial, etc.

Future – flexible pipes

Flexible pipes are a good fit for the transportation of CO_2, hydrogen for energy storage, and water in the petroleum and mining sector.

9 Zubail, A. et al (2021), Carbon and energy footprint of nonmetallic composite pipes in onshore oil and gas flowlines, Journal of Cleaner Production, Volume 305, Retrieved on: //doi.org/10.1016/j.jclepro.2021.127150.
10 DNV report here, published in 2022.
11 Horizon Europe Work Programme 2023-2024, p. 13, Retrieved on: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/wp-call/2023-2024/wp-13-general-annexes_horizon-2023-2024_en.pdf

Answer to specific info request 10:

A blanket restriction on all PFAS, including fluoropolymers, looks unachievable and, furthermore, the finished products that we profile in these comments pose low risk. It would be far more impactful and cost-effective to focus regulation on the manufacture and disposal parts of the lifecycle for industrial products.

To ensure that production and use of fluoropolymers is protective of a health hazard evaluation, addressing emissions through monitoring and abatement on the basis of common standards should be a regulatory priority, as opposed to a complete ban on the materials.

The Industrial Emissions Directive could be a more appropriate regulatory tool for this. It is essential to develop a mutual standard or benchmarking system that industrial actors can use, and which can be the basis for targeted legislation on emissions. A binding monitoring, reporting and verification (MRV) system, ideally harmonised across industry and Member States, should be established, and implemented across all life stages of fluorinated materials.

For end-of-life, this includes the implementation of take-back systems regarding fluoropolymer-containing components and products of our sectors, where the circularity potential offers great opportunities.

In conclusion, IOGP does not support a blanket restriction on ALL PFASs that includes fluoropolymers due to the scale complexity and major impact on both current supply chains and the economy of the future. For these materials, a more targeted approach is recommended involving robust emission monitoring control and abatement in manufacture and in disposal, supported by material return and recycling systems wherever feasible. Data to be supplied by Materials Supplier of PVDF.

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