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DEVELOPMENT OF RESTRICTION PROPOSAL FOR PFAS

Data collection as requested by the consultant Wood preparing the assessment on the use of PFAS for Norwegian Environmental Agency

Upstream oil and gas sector

Disclaimer: The information in this report is based on the data from only few IOGP member companies, and therefore, do not represent the usage of the below substances in the entire upstream oil and gas sector in Europe.
Moreover, this high level report reflects the current understanding of the use of PFAS and is preliminary in nature given by the very short timeframe provided for submitting the requested information, making it challenging to identify, and due to the fact that PFAS may not be explicitly listed as a constituent/component of the chemicals used in the oil and gas operations.

Overall comments:

1. PFAS used in oil and gas applications and equipment play a technical role in the performance and therefore any consequences of substitution would have to be properly assessed from an environmental, safety and health perspective.
2. For the technical / maintenance products other sectors, including the suppliers of the raw materials and product manufacturers should have a better picture on the amount and substitutes. Some names of the vendors are provided in the table.
3. As a substance present below the CLP threshold (depending the actual hazard classification) and without an EU OEL, is unlikely to be listed on the SDS, we recommend contacting manufacturers to identify if PFAS may be present below labelling levels.

I. SUBSTANCES

1. Could you inform us if the following types of PFAS-based substances/products are being used in your company:

Substance	Examples	Application(s)	Answer
Fluoropolymers	PTFE/PFA/FEP Fluoroelastomers (e.g. FKM)	Lining in pipelines, sealing in valves, o-rings and other components	Not used for production purposes or hydrocarbon treatment, but substances are widely used in dozens (probably hundreds) of products for maintenance , e.g. dry lubricant sprays, friction reducers and in technical products (membranes, gaskets, sealing and insulation materials, pipe linings) for specialized applications (high pressure, wide temperature range, corrosive media contact). There is equipment for well safety (BOP control, subsea installations) using components made of FP´s or containing some special technical fluids (lube and hydraulic oils) with fluoropolymers. Main vendors include: - For pipelines / flexibles PTFE sheath (3 Vendors : Technip FMC, NOV, GE Oil and Gas / Wellstream) - PTFE umbilicals (Technip Umbilicals, Oceaneering, Aker, Nexans) - For Coating and insulating material of pipelines with PP or PE (Socotherm Group (Shawcor), Advanced Insulation Systsems LTD, Trelleborg Novolastic) - For Subseas buoys: with PU or GRE hulls with inside Polymer syntactic foam (Trelleborg, Balmoral) - For Bending restrictors and bend stiffener (Trelleborg, Balmoral, Exsto) - For anti Vibration Strakes (Trelleborg) - For other PU or PE Protective devices (Trelleborg, Langkhorst)
Fluorinated silicone/siloxane products	• Siloxanes and Silicones, di-Me, Me trifluoropropyl, hydroxy-terminated (CAS 119275-52-4) • Siloxanes and silicones, di-Me, Me 3,3,3-trifluoropropyl, vinyl	Antifoaming agent in extraction fluids	Specific CAS-numbers provided have not been identified as products currently in use. Fluorinated polysiloxanes are commonly used in defoamers in oil/water separation.

	group-terminated (CAS 68951-98-4) • Siloxanes and Silicones, di-Me, Me 3,3,3-trifluoropropyl (CAS 115361-68-7)		
PFAS-bases well stimulation fluids	Products on the market e.g. 3M™ Well Stimulant WS-1200	Enhanced oil/gas recovery	Not in use or not known to be used for the assets participating in the survey.
PFAS-based tracers or dyes	Fluorinated alkanes e.g. products marketed by F2: www.f2chemicals.com/tracing_and_tagging.html FLUTEC TG PMCP (CAS 1805-22-7) and FLUTEC TG PMCH (355-02-2)	Monitoring or mapping of oil fields; leak detection etc	Used as chemical tracers in the industry. Small amounts - usually kg levels on individual project basis – as they are very efficient and expensive. Tracer substances come in many shapes and different products, generally need to be highly persistent and detectable at some level. Fluorinated alkanes are needed depending on reservoir characteristics and the range of other tracers used. They are offshore CEFAS registered with a substitution warning, which means that the regulatory framework is already promoting substitution. However, substitutes may not be yet available.

2. If these substances are used, can you provide information about the amounts that are used, what function they perform and the value they have in this sector?

We recommend to focus on the amounts being released to the environment and not just on the amounts used.

- Fluoropolymers: The amounts cannot be easily quantified, but are likely to be present in almost all production systems, maintenance products and specialized applications.
- Fluorinated silicone/siloxane products: Use is gradually being eliminated where technical function is not compromised. Small quantities (probably few tonnes per year – to be confirmed with vendors).
- PFAS-based tracers or dyes: Sporadic use in small quantities (kg) on project basis.

3. **If these substances are not used for the applications mentioned, can you please provide any information about the non-PFAS substances that are used in these applications.**
    - Fluorinated silicone/siloxane products: polypropylene glycol, Naphthalene/1,2,4-Trimethylbenzene based products, Dipropylene Glycol Monomethyl Ether, 2,6-Dimethylheptan-4-one
    - In general, if chemicals have a substitution warning, a project is initiated with the supplier(s) to obtain substitution warning free chemicals. Priority will be if they are discharged into the sea, and discharge cannot be prevented.
    - Acid well stimulation additives can be replaced by others, however, in order to do so some redesign is needed.
    - Tracers: Use other halogenated products. Radioactive labelled/tagged tracers are used as well.
    - Defoamers: Use ethyl siloxanes instead. Higher volumes of ethyl siloxanes may be needed to match performance of fluorinated siloxanes.
    - Well-stimulations: Options exist but depends on specific needs.

II. ALTERNATIVES

1. **If PFAS-based chemicals or products are currently being used, are there any feasible alternatives?**

Feasibility of alternatives has not been studied and would need to consider functional performance, toxicity, environmental risks, availability, cost, etc. A "Yes" response indicates products are on the market, but does not indicate they are feasible as an alternative in every project.

- Fluoropolymers: No
- Fluorinated silicone/siloxane products: Yes
- PFAS-based tracers or dyes: Yes - noble gas isotopic tracer, xenon, radioactive tracers, radiolabelled compounds (d13C, d18O) are available

2. **What are the main implications for switching to these alternatives, such as:**

- **Loss of function / need for using higher quantities?**
- **Higher costs?**
- **Loss of productivity/revenue?**

ANSWER:

- Fluoropolymers: Loss of function and/or cost
- Fluorinated silicone/siloxane products:
    - Loss of function.
    - Fluorinated products often have high efficiencies and can be used in lower concentrations – thus saving tank space, transportation and purchase costs.

- PFAS-based tracers or dyes: Loss of function for some applications where there are practical handling limitations due to amount required. When tracers are not allowed, information accuracy of reservoir outflow and behaviour will be affected.
- Some alternatives could cause interference with other chemicals used on specific locations, therefore impacting productivity.

Final remarks on alternatives

The industry is ready to look for suitable alternatives. However, it is paramount that sufficient time is allowed as a detailed analysis would be required to identify them. Many factors should be taken into account for successful substitution: cross media effects, environmental footprint, energy efficiency, waste generation, disposal of existing materials, effectiveness in technical and safety performance, supply availability and need for regulatory approvals are examples of factors that need to be looked at etc. A substitution process takes time and financial resources.