

Contribution of SFEPA

In response to a proposed restriction on the manufacture, placing on the market and use of per- and polyfluoroalkyl substances (PFAS)

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Presentation of SFEPA

The French explosives and pyrotechnics manufacturers association (SFEPA), is a professional organization created in 1919. It brings together **french manufacturers for civil and defense uses**. Its members generate more than 20 billion euros in annual turnover, employ more than 55,000 employees.

SFEPA represents, supports and defends the profession of the industry working with the French and European administrations.

It deals with topics of common or specific interest, particularly in the regulatory, normative and advocacy fields: industrial safety, safety, placing on the market and use of explosive and pyrotechnic articles, transport of dangerous goods - class 1, REACH and CLP.

For this reason SFEPA catch the opportunity to respond to ECHA's consultation on the proposed restriction of the use of PFAS.

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1. Our products

SFEPA federates French manufacturers in civil and defense pyrotechnic industry.

Civil and defense pyrotechnics manufacturers design, develop, manufacture, transform, assemble, integrate substances / mixtures and detonating objects as well as pyrotechnic substances / mixtures and objects:

- **Intended for civilian use** such as mines and quarries (cartridges of explosives in bulk or in cartridges, detonators, detonating cords, ...), space launcher equipment (space launcher thrusters, launcher stage igniters, stage separation cords, launcher destruction devices in case of malfunction), satellites (separation of satellites), ...), safety pyro mechanisms (airbags, seat belt claimants, fast extinguishing systems, circuit breakers for automotive batteries, ...), powders and ammunitions for hunting and sports shooting, fireworks, ...
- **Intended for military use:** including ammunitions and ammunitions components used by aircraft (missiles, rockets, bombs, small and medium calibre ammunitions, flares, countermeasures flares, igniters, obscurants, propellants, tracers, ...), guns and tanks (explosives charges, shells, warhead anti-tank system, obscurants), missile launch systems from the ground, surface ships, submarines (surface-to-air missiles, sea-to-sea missiles, sea-to-surface missiles, underwater flares, etc.).
- **Intended to civil safety – public safety :** Used by the internal security forces like tear gas grenades, deencirclement grenades, ...

2. Performance and safety requirements of our products

- Explosives and pyrotechnic compositions are dangerous products that require a certain intrinsic stability.
- To be used, these explosives must be qualified or approved (depending on use) in order to meet the requirements of performance and safety of use but also for storage. Product qualification processes are sometimes very complex, long and expensive: several years and more than a million euros when it involves complete and sensitive weapons systems (guns, tanks, planes, ships, submarines, space launchers, etc.).
- Production tools used for manufacturing, processing, assembly or integration must be proven and reliable.
- Explosives and pyrotechnic compositions must be stable to be stored sometimes for several decades.

Example for the qualification of a munition intended for military use:

In general, rules of art, internal or external procedures, request for us to qualify the evolutions which are applied to a product, whether minor or major. The qualification degree depends on the complexity of the product, on the type of evolution, the weapon system that uses it and it can be more or less complex depending on the circumstances and the associated performance and safety issues.

A substitution of a substance in an explosive or pyrotechnic mixture is not an easy thing: it is first necessary to ensure the chemical compatibility between all the constituents, to make compositions, to characterize them before introducing them into the ignition devices.

They must then be tested as sub-assemblies under reference conditions and after testing in climatic and mechanical environments representing the life cycle constraints of the object (example -30 to +50 ° C in a few minutes for certain uses). Finally, their performance must be validated in the products in which they are included, the validation being done by firing the weapon system (land gun, fighter jet gun, ship gun, ...). When all the steps are successfully completed, an approval of the new substance thus defined and produced is launched according to the guidelines of the French instruction DGA 17500 edition 6. The entire process can take 2 to 3 years depending on the product, with testing on associated weapon systems being particularly complex, expensive and time-consuming to plan.

Example of qualification of a pyrotechnic object used in aerospace industry:

In the launcher industry (civil and defense), concerns about the legacy of launcher systems, components and materials are extremely important. After the development phase, the system configuration is fixed, each system of a launcher being identical to the next, this makes the configuration of the operational systems rather rigid with little flexibility in change situations.

Therefore, once validated, material or technology is produced with the aim of not implementing changes to protect the validity of the qualification status. These Viton® and Teflon® technologies were developed more than 30 years ago and still meet the requirements of the space launcher field. That is the reason why these products are still used in production. Developing and qualifying an alternative would require long-term development studies and qualification. This duration is always difficult to estimate because of the low feedback. However, an example is the qualification of an inhibiting material (replacing the previous one retaining asbestos fibres) used in the manufacture of a pyrotechnic igniter. The qualification of this igniter of a few tens of grams of propellant to ignite one of the last stages of Ariane IV took nearly 10 years. The malfunction of such an igniter during the flight causes the failure of the mission: loss of the launcher and satellites, for a minimum cost of several hundred million euros and will occurred delays in programs of several years (satellite reconstruction).

3. PFAS used in our industry

PFAS are a large family of nearly 5,000 chemical compounds with a wide variety of properties. Among the different families identified, our industry mainly uses fluoropolymers and more specifically:

- PTFE (Teflon®)
- PVDF
- Fluorocarbon elastomers (Viton®)
- HFP
- FKM

Fluoropolymers shall be considered as a distinct subset of PFAS because of their chemical risk. Fluoropolymers are inherently safe, non-mobile, non-bio accumulative and non-toxic. Fluoropolymers are different from other PFAS as they do not share the toxicological properties and environmental profiles of concern associated with PFAS. Fluoropolymers have a unique set of physicochemical properties, meet the OECD criteria for polymers of low concern criteria and are therefore considered to have an insignificant impact on the environment and human health.

For this reason, there have been no previous regulatory alerts and therefore no substitution dynamic exists.

In the civil or defence pyrotechnic industry, they are found both:

- In formulations of explosive compositions (detonating), pyrotechnic compositions (non-detonating) as well as in explosive or pyrotechnic articles.
- In the surface treatments of the components of pyrotechnic objects;
- In the process unit equipment and tools for the production of explosives, pyrotechnic compositions and explosive or pyrotechnic articles.

4. Use in formulations of explosive or pyrotechnic compositions

Regarding our industry in particular:

- Low quantities are used each year per production site: from a few kilos to less than 5 tons.
- No transformation or chemical degradation of fluoropolymers takes place during the manufacturing process (composition pre-mixing under medium or wet phase)
- No emission of particles or dust occurs during the manufacturing process (composition pre-mixing in a wet environment or dissolution in a solvent).
- No waste or pollution of the water network results from the process.
- No PFAS emission result from the ignition of the ammunition or pyrotechnic object.
- The decomposition products are fluorometal, carbon and HF (source : Metal-Fluorocarbon based Energetic Materials by Ernst-Christian Koch from NATO Munitions Safety)

The properties of fluoropolymers are essential to ensure the stability of explosive or pyrotechnic compositions.

The characteristics of fluoropolymers, including their excellent resistance to thermal agents or chemical attack, are particularly suitable for the severe environments required by applications in the civil pyrotechnics, defense and space industries.

These polymers also have optimal compatibility with the high sensitivities of explosive or pyrotechnic substances or mixtures.

In addition, fluoropolymers are the only molecules chemically compatible with all families of explosive or pyrotechnic mixtures, ensuring the highest level of safety during the manufacture, handling, operation and storage of ammunition and ammunition components under all conditions related to their uses (on land, on the seas, under the seas, in the air).

For all these reasons, since the 1980s, companies in the civil, defense and space pyrotechnic industry have been using fluoropolymers in explosive or pyrotechnic compositions and in components that are in contact with these compositions. There is currently no research that has led to alternatives.

More details in the appendix reference 1362A1 submitted in the "confidential documents" section : Table 1 - Fluoropolymers in the formulation of energetic materials require these properties. This table concerns the key properties of fluoropolymers used to formulate pyrotechnic compositions.

5. Use in surface coatings and process unit equipment of explosives and pyrotechnic compositions

Many pieces of equipment or tools containing PFAS are common to the entire industry.

Fluoropolymers are mainly used by our industry for their following properties:

- High resistance to corrosion
- Inert: materials that degrade very little over time and thus avoid impurity contamination of manufactured compositions
- Permeation resistance and capacity to prevent migration through equipments
- Thermal properties with resistance to high temperatures without degradation
- Pressure resistance
- Non stick properties

We therefore use them for the coatings of certain manufacturing tools, pipes, gaskets, valves, ammunition bodies and pyromechanisms, ...

Fluoropolymers have an extremely low coefficient of adhesion which gives them the essential qualities to allow the shaping of certain explosive or pyrotechnic objects, necessary to obtain the performance required by certain weapons systems (example: strategic missiles and tactical missiles).

Even if substitution work has been undertaken by the manufacturers of these process unit equipments, the properties of the identified alternative substances do not correspond to the properties required and obtained by the original substances.

Beyond the actual performance of the production equipment, there are also industrial safety problems when possible needs to modify manufacturing processes and tools are required by substitutions.

Finally, banning the use of fluoropolymers in production equipment would also require obligations to requalify the means of production for all matters relating to defence and space uses. These reskills would also generate very significant investments and impose deadlines that are totally incompatible with European projects on PFAS.

➔ *More details in the appendix reference 1362A2 submitted in the "confidential documents" section – Table 1 - Fluoropolymers in direct contact with energetic materials require these properties . This table lists the properties of fluoropolymers fulfilling the whole scope of requirements in the case of a contact with energetic materials during the process (tools and surface treatment) as well as in the finished product.*

6. The proposal of the French civil and defense pyrotechnic industry

Considering:

- The major role of fluoropolymers on the sensitivity of explosives and pyrotechnic compositions, the reliability of production tools and therefore their direct impact on the industrial safety of manufacturing, processing, assembly, integration operations, as well as safety of use and storage
- The challenges in terms of availability for European States, in particular certain explosive or ammunitions or pyrotechnic articles in a particularly destabilized and sensitive international geopolitical context (Military Programming Law 2024-2030)
- Demonstrated low toxicity of fluoropolymers
- The lack of feedback and unavailability of reliable alternative technical data within deadlines and budgets compatible with the financial resources of manufacturers but also of States, to guarantee the absence of disruption to the activities of a significant part of our industry
- The unavailability of production tools generating shortages but also requiring extremely significant investments may lead manufacturers to choose to relocate their production outside Europe for at least their non-European markets.

We are asking for an exemption of fluoropolymers from the scope of the restriction proposal given their ubiquity in the pyrotechnical industry uses and the absence of alternatives that fulfil the performance requirements for reliability and safety.