W. L. Gore & Associates' Comments on Dossier Submitters' Draft EU REACH restriction on PFAS

Public consultation

Request for Derogation:
Membranes, Filaments, Fibres and Sewing Threads for Outdoor and Industrial Applications

August 2023

Gore appreciates the opportunity offered by the public consultation process to provide comments on the Proposal for a Restriction of Per- and polyfluoroalkyl substances (PFAS) (hereinafter '**Restriction Proposal**').

With this submission, we would like to explain why we believe that a derogation for **membranes, filaments, fibres and sewing threads for outdoor applications** (e.g., shade structures, awnings, marine applications, insulation cover, …), which are not covered by the derogations in the Restriction Proposal, is needed and justified. Further, we would like to explain why a derogation with a transitional period of 13.5 years is required.

The conclusions from our statement are summarized as follows:

- Protection against natural elements (sun, rain, high temperatures) in architectural, marine, and other outdoor settings is an important function for hundreds of thousands of EU users. A wide variety of outdoor textile materials are rapidly degraded by water and UV exposure leading to frequent replacement. **Increasing the longevity of such membranes, filaments, fibres and sewing threads in outdoor uses can reduce waste and the resulting carbon footprint from replacement materials.**
- Currently, **no alternative is available** that would prevent failure in long-term outdoor uses and that would not require PFAS chemistry. Alternatives that are typically used in outdoor applications are primarily used in light-duty applications where seam failure and frequent replacement is more acceptable.
- If suitable alternative materials are identified as a result of ongoing research, it would take several additional years to develop, test and produce membranes, filaments, fibres and sewing threads that can incorporate the alternative materials.
- Without a derogation, there would be a significant increase in the premature replacement of outdoor textile materials and additional maintenance costs. This would result in an increase in waste and resource consumption.

I. Derogation Request

Considering the arguments and evidence presented below as well as previously submitted evidence, Gore respectfully requests to include the following application-specific derogation in Column 2, paragraph 6 of the proposed restriction:

Membranes, filaments, fibres and sewing thread for outdoor or industrial applications until 13.5 year after EiF

II. Description of the End Use

Membranes, filaments, fibres and sewing threads are used in a wide variety of outdoor and industrial applications. Example uses include: permanent architectural elements in buildings, moveable shade structures, outdoor furniture, marine sails and covers. These materials experience years of exposure to environmental conditions such as rain, salt water, temperature variation and Ultraviolet (UV) radiation from sunlight. These conditions can quickly degrade many textile materials which requires frequent repair and, in many cases, complete replacement.

This derogation request is for the use of fluoropolymers as the actual material comprising the membranes, filaments, fibres and sewing threads. Fluoropolymers provide the structure and strength of the material. **This use is separate and distinct from non-fluoropolymer PFAS which may be applied to textiles for other purposes, such as stain resistance.** Those uses are not considered in this derogation request.

To clearly define the proposed use, detailed descriptions of the type of products and their reliance on PFAS is provided below in Table 1. The product examples are all Gore products. We believe that these products are representative of products manufactured and placed on the EU market by other companies.

Table 1. Outdoor/Industrial Application Products

Products	Industry/Broad use (non-exhaustive)	Examples of end-uses (non-exhaustive)
GORE® TENARA® Sewing Thread	Sunshades/umbrellas, outdoor furniture	**Sunshades/umbrellas** offer protection to people from rain and UV rays. This in turn improves quality of life and can help mitigate health impacts associated with excessive sun exposure. Based on our knowledge, this is the largest use of PTFE outdoor sewing thread. **Outdoor furniture** must be robust against a variety of weather conditions, and PTFE thread used in upholstering is weather resistant and less susceptible to wear and tear. This improves the product longevity, leading to fewer replacements and thereby less waste is generated.
	Marine and boating applications	**Marine sails** are continually exposed to UV radiation from sunlight as well as salt water and rain. Sails need to maintain structural integrity and loss of strength in the sail material or the seams will lead to tears and premature replacement. **Boat covers** ensure greater longevity and resistance to wear and tear, by protecting the boat from climatic impacts such as rust or splitting.
GORE® Weaving fibre/yarn	Architecture/Retractable structures	**Retractable textile structures** made from PTFE-based fibres are used by commercial architecture firms for retractable covers or shade panels. The end user benefits from high flex life, UV resistance and reduced energy bills.
	Other Industrial Uses	**Insulation/Thermal Protection Blankets** are used in industrial environments to protect machine operators and other worker from hot surfaces on process equipment. The material needs exceptional heat resistance to maintain its structural integrity and melt or degrade.

In terms of PFAS content and using Gore products as an example, these products are made of PTFE. PTFE meets the criteria for Polymers of Low Concern (PLCs), under the definition provided by the OECD Expert Group on Polymers. The materials used are shown in Table 2.

Table 2. Typical PFAS Materials used in Membranes, Filaments, Fibres and Sewing Threads for Outdoor Applications

Type of PFAS	CAS number	Is this PFAS a PLC?
PTFE	9002-84-0	Yes

III. Reference in Restriction Proposal

The Dossier Submitters (DSs) researched textiles in detail as part of the TULAC[1] uses (as presented in Annex A Table A.1, page 5) and a short section focuses on architectural membranes (composite membrane or pure fluoropolymers, Annex XV dossier, Table 8, p.109). Even though the Dossier Submitters acknowledged that alternative materials will lead to loss of functionality (less soil repellence) and reduction of lifetime, a derogation is not granted. The main reason for reduced lifetime of products is resistance to UV exposure which is not fully considered in the restriction proposal.

In this document, we provide evidence of the substantial differences of alternative materials compared to PTFE with regard to UV resistance and the consequences for products with prolonged exposure to outdoor conditions.

IV. Need and Justification for Derogation

Without a derogation, the environmental impact of textiles used in outdoor (professional/industrial) applications will increase due to premature replacement, higher maintenance needs and/or coating treatment. The increased resource consumption and societal costs could be limited by a derogation that is justified based on the following points:

- The **performance requirements** for membranes, fibres and sewing threads used for outdoor or industrial applications.
- The **lack of availability of alternatives** that would provide the required level of durability.

1. *Performance Requirements*

Membranes, fibres, filaments and sewing thread have a wide range of technically demanding requirements that allows them to offer a very long service life in harsh environmental conditions.

a. *Ultraviolet Exposure Resistance – Durability while exposed to continuous natural light*

The primary challenge is maintaining material properties under UV exposure whilst enabling flexibility and adaptability to the shape of use. The material needs maintain its strength and other key physical properties under multiple years of UV exposure without the need to apply

[1] Textiles, Upholstery, Leather, Apparel and Carpets

additional coatings or repairs. UV resistance helps extend the product's life, reducing replacement costs, waste generation, and material consumption due to replacement. Poor UV resistance can lead to insufficient tensile strength and a failure of the stitched seams.

b. *Hydrophobicity – Barrier to water and other liquids*

Hydrophobicity is the ability of a solid material to resist the spreading of water on its surface. Hydrophobicity is a key property for a material which is used in threads for outdoor applications to resist water absorption which can cause outdoor textile structure to gain significant weight or accelerate degradation. Membranes made from weaving fibres comprised of hydrophobic polymers resist wetting with water and thereby prevent weight gain, water entry, and leakage.

In many applications high pressure cleaning is required (e.g., outdoor structures or marine equipment) and lower surface tension fluids (e.g., soapy water) are often present in these kinds of applications for cleaning purposes.

c. *Tenacity, flexibility, and tension resistance – even after exposure to harsh conditions*

A significant portion of outdoor shade structures are built with high tension requirements. Unexpected seam or panel failure in highly tensioned panels can result in injury to persons in the immediate area in addition to the need for replacement. This is also true for marine applications providing exposure protection on open water and assurance of sail durability. A related performance requirement is the ability to resist creep, which is the ability to sustain continuous tension without sagging and the need to re-adjust tension over time.

d. *Resistance against salt fog*

Marine applications, such as sails or other structures installed offshore or close to the sea, result in exposure to salt fog. The materials must be able to withstand and protect over the entire lifetime (up to 50 years).

2. Assessment of Alternatives

Today, only fluoropolymer based membranes, filaments, fibres and thread can offer the durability and the performance required for long-term outdoor use. Polytetrafluoroethylene (PTFE) is the primary material used because in addition to its inherent material properties, it can also be processed into strong filaments, fibres, and membranes.

a. UV Resistance

PTFE is exceptionally stable under prolonged UV exposure which makes it able to maintain strength under continuous UV exposure. PTFE extends the useful life of outdoor application/product by a minimum of 200%-300% compared with commodity sewing threads such as PET, Nylon, and cotton. Fluoropolymers are exceptionally resistant to UV degradation due the strength of the chemical bond between carbon and fluorine.

As shown in Figure 1, durability tests performed by Gore compared PTFE thread to polyester (PET) thread. The results show that PET loses most of its tensile strength after exposure to UV. The effect of UV light on making textile materials more susceptible to breaks is well known.

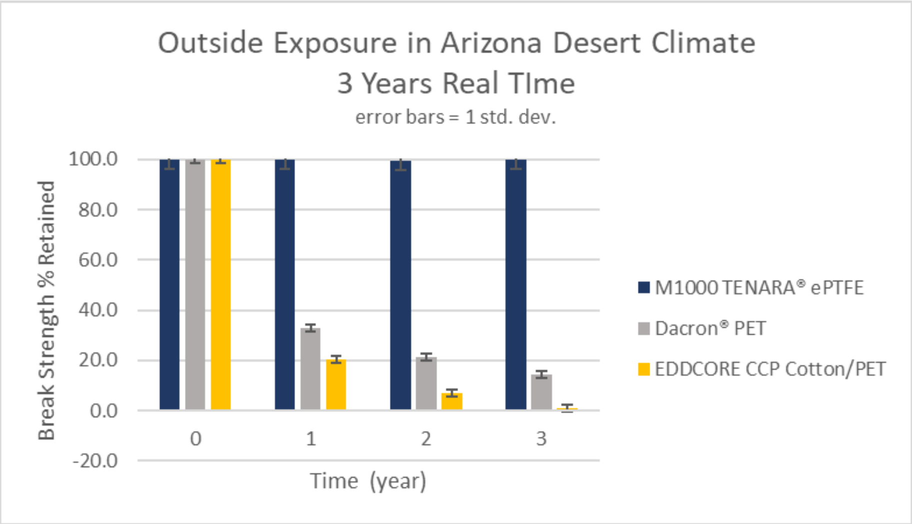

Figure 1. Long term real-time exposure difference[2]

A variety of alternative sewing threads are on the market claiming advanced UV protection. For example, treated polyester (PET) could be used (as a PTFE replacement) but the treatment uses additional chemicals and only provides a slightly improved lifespan on other non-PFAS options in static applications. Moreover, where flexible structure is required, PET has an extremely short lifespan. As shown in Figure 2, PTFE-based sewing thread is dramatically more durable while alternative materials lose significant strength from ultraviolet radiation exposure in outdoor settings.

[2] Q-Labs Blaha testing

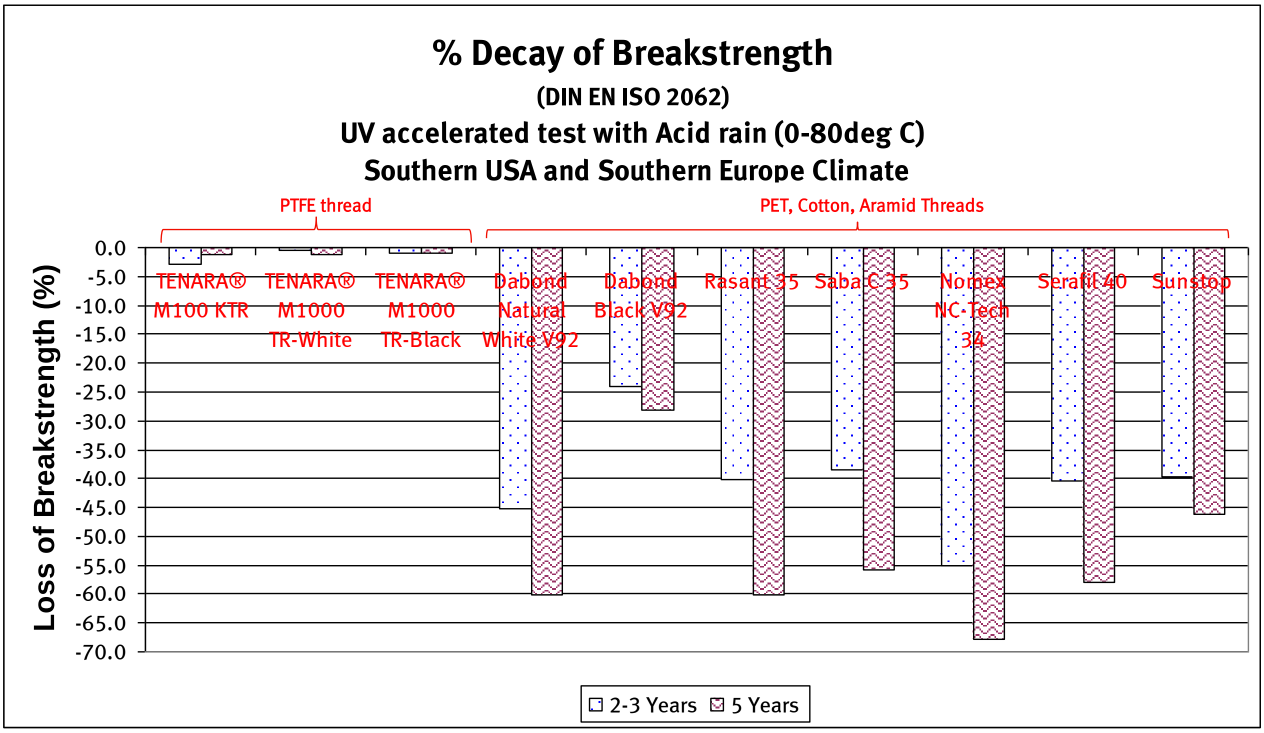

Figure 2. DIN EN ISO 2062 on Breakstrength after environmental exposure

In particular, sewing threads used in outdoor applications cannot typically benefit from textile coatings that are sometimes used to provide additional UV protection since such coatings are applied to the textiles before they are cut and sewn into the final structure. Other UV enhancements to alternative sewing threads are still substantially less durable to UV degradation and seam failure than PTFE-based thread.

This is also true for marine applications providing UV and weather exposure protection on open water and assurance of sail durability. PTFE-based fibre also provides additional thermal resistance and high flexure tolerance[3] making it an ideal insulation blanket for industrial users.

Use example: Textile structures are common features in architecture, which rely on long term performance of the membranes and sewing thread to function for 10-15 years and often much more.[4] PTFE threads were woven into a fabric used as the covering material for the 56,000 square feet retractable roof in Wimbledon's Centre Court in 2009 due to its ability to flex and fold repeatedly without cracking and durability to outdoor conditions. The roof protects the grass and provides players and audiences protection from the elements and remains in operation 14 years later.[5]

[3] Flexibility without breaking
[4] https://www.gore.com/system/files/2023-03/gore-tenara-sewing-thread-case-study-shade-sails-made-for-life-and-lifestyle-mar-2023.pdf
[5] https://www.architectmagazine.com/technology/architectural-detail/wimbledon-centre-court-retractable-roof_o

b. Hydrophobicity

Surface energy is a material property which determines its hydrophobicity, which in outdoor applications reduces weight gain, prolongs product life and prevents leakage. Lower surface energy, as described by a lower critical surface tension and a higher contact angle with water, indicates a more hydrophobic polymer which is inherently more resistant to water and water borne contaminants. Table 3 contains typical surface energy values for common polymers with some fluoropolymers highlighted in yellow.

Table 3. Critical Surface Tension and Contact Angle with Water for Various Polymers[6]

Polymer abbr.	Polymer Name	Surface Energy (dynes/cm)	Contact Angles (degrees)
PES	Polyethersulfone	46	90
	Styrene butadiene rubber	48	
PPO	Polyphenylene oxide	47	75
	Nylon 6/6 (polyhexamethylene adipamide)	46	
PC	Polycarbonate	46	75
	Nylon-6 (polycaprolactam)	38	
PET	Polyethylene terephthalate	42	76
PMMA	Polymethylmethacrylate	41	82
SAN	Styrene acrylonitrile	40	74
	Polyimide	40	83
PVC r	Polyvinyl chloride, rigid	39	90
	Polyester	41	70
	Acetal	36	85
ABS	Acrylonitrile butadiene styrene	35	82
PPS	Polyphenylene sulfide	38	87
PVA	Polyvinyl alcohol	37	10
	Polyacrylate (acrylic film)	35	
PVC p	Polyvinyl chloride, plasticized	35	89
PS	Polystyrene	34	72
	Nylon-12	36	
	Surlyn ionomer	33	80
PBT	Polybutylene teraphthalate	32	88
CTFE	Polychlorotrifluoroethylene	31	
PP	Polypropylene	30	88
PU	Polyurethane	38	85
PE	Polyethylene	30	88
PVF	Polyvinyl fluoride	28	
PVDF	Polyvinylidene fluoride	25	80
	Natural rubber	24	
PDMS	Polydimethyl siloxane (silicone elastomer)	23	98
FEP	Fluorinated ethylene propylene	20	98
PTFE	Polytetrafluoroethylene	19	120

PTFE is naturally hydrophobic and has a surface energy of 19 dynes/cm. This allows it to easily repel fluids with surface tensions such as water, but also oils and cleaners which have surface tension from approximately 22 to 25 dyne/cm and even lower for other liquids typically found in a variety of industrial and retractable structure applications. A hydrophobic PTFE base material is required to protect components from water-based contamination.

[6] https://www.tstar.com/blog/bid/33845/surface-energy-of-plastics

c. *Summary of other potential alternatives*

The Dossier submitters identified several materials as potential alternatives for PFAS applications in architectural membranes (Annex E, section E.2.13.2.7 and table E.140, page 434).

i. Cotton and other natural fibres

As Gore's experience with those materials is limited, we will refer to the DSs conclusion that they offer a *high UV resistance but in general low technical performance*. They could therefore be an alternative for outdoor uses which are temporary or expected to be replaced every few years.

ii. Polyamide (PA or nylon)

In this case, the DSs mention *high strength, stiffness and tenacity and low weight*, but their property would not them to be used in equipment that need to be reliable under outdoor conditions as they are not *dimensionally stable when wet*, and show *poor UV resistance and stretch considerably*.

iii. Polyethylene (PE)

Polyethylene (PE) thread is also commonly used in outdoor applications, but the UV degradation is significant. PTFE thread will last longer than the fabrics used for these applications. Typical PE thread degradation can happen within one year.

iv. Fibres material

Under certain conditions, fibre materials such as fibreglass, aramid, or carbon fibres have been used in the construction industry for outdoor applications due to their high strength, low weight, and sometimes UV resistance. But limitations mean that they do not show the versatility offered by PTFE as they are brittle (in the case of fibreglass and aramid), show lower UV resistance (in the case of aramid), or are expensive and will be limited to a few high tech products (as in the case of carbon fibres).

v. Conclusion

The DSs have not specifically assessed all the applications served by PTFE based membranes, filaments, fibres and sewing thread[7]. For construction and architectural uses, the DSs state that there is sufficiently strong evidence of alternative availability at EiF although no alternative can provide the sufficient performance without additional repair or replacement costs and/or top coating.

None of the alternatives mentioned by the Dossier Submitters in the restriction proposal are suitable for membrane, filament, fibres and sewing threads for long term outdoor or industrial applications. Alternatives that are typically used in outdoor applications are primarily used in light-duty applications where seam failure and frequent replacement is

[7] Sewing thread

more acceptable. No non-PFAS alternatives are available that would prevent premature replacement and increased maintenance for long duration industrial, architectural, and marine applications.

For more than 20 years, material suppliers like Gore and other membrane producers have looked for alternative materials and methods for architectural fabric structures and protecting equipment from the elements, but nothing has proven capable of meeting sufficient performance as compared to the fluoropolymer-based materials and offer sufficient durability.

3. Why a Transition Timeline of 13.5 years is Required

As described in Annex E (Table E.147, page 465), these products would fall under the default transition period of 18 months after EiF. We have demonstrated that no alternative is currently available that meets the performance requirements, and in the following we will illustrate the timeframe needed in the unpredictable case that a new material would be discovered or invented for this application.

Despite the high cost of raw materials[8] and the inherent incentive to find cheaper alternatives, no viable alternative materials have been identified and developed to date for use in threads in outdoor applications. We, and other key actors in the supply chain, estimate it could take at least another five to ten years to identify and develop possible alternative polymer materials. This first step involves discovery, to which a specific timeline cannot be predicted.

Any possible alternative materials will then need further development to optimise them for specific application requirements (e.g., flexibility, durability, resistance).

Table 4. Estimated Timeline for Substitution

Steps for substitution	What activities does this step entail?	Time required for step
Discovery	Identify and develop suitable alternative materials. Material and process development from lab discovery to prototype scale. This will involve independent development of membrane and treatment technologies, as well as confirmation of their compatibility.	**Unknown** Estimate 5-10 years for this use
Development	Optimise material for specific application requirements This may involve transitioning processes to pilot scale or small-scale manufacturing.	1-2 years

[8] The Restriction Dossier refers multiple times to higher costs of fluoropolymers (Annex E, page 285, 390, 444, 458, 504, ...)

Certification	Reliability testing of manufactured components, and initial validation of reliability in prototype device and/or representative testing. Because UV resistance is requirement and accelerated testing needs to be confirmed with actual time testing in the field where 2 years is the minimum.	2 years min
Production	Investment, installation, and qualification of new mass production capability. Establishing robust material supply chain.	1-2 years
Total		**9-16 years**

4. *Additional Information*

In March 2022, Gore provided a Use Assessment (UA) prepared by eftec and it has been shared with all five Dossier Submitters. Since this information was provided after the end of the Call for Evidence in September 2021, the UA is included as Annex I to this derogation request.

Additional information on responsible manufacturing, processing, and disposal of fluoropolymers and products made from fluoropolymers are provided in Gore's derogation request for fluoropolymers.

a. *Socio-economic impacts*

Membranes, filaments, fibres, and sewing threads provide important functionality for their end users and wider society. Consumers have come to rely on applications that provide quality protection in any environmental conditions and can help reduce energy consumption in architectural applications.

- **Environmental Impact** – Premature replacement and the resulting waste is an important priority. PFAS based membranes, filaments, fibres, and sewing threads prevent equipment degradation and damage, and increase product longevity which in turn keep a significant amount of textile waste from being disposed of each year. When an outdoor installation prematurely fails, more waste is generated and raw materials, energy, and associated greenhouse gas emissions are required to replace these materials creating a greater burden on the environment.

- **Financial Impact** – Without PFAS based membranes, the rate of failed outdoor textile installations will increase significantly, creating a significant productivity and financial burden for users who must invest each year in replacement or additional maintenance.

b. Proportionality assessment

The UA (Annex I) demonstrates that emissions from these applications as a broad category of products are low, whilst the associated costs are very high. The adverse impacts induced by a potential restriction includes significant economic impacts throughout the value chain, impacts on employment (lost jobs,) as well as adverse impacts on human health and the environment.

Although a full Socio-Economic Assessment has not been performed on the products covered by this submission, the UA shows that **restricting the use of PFAS in sewing threads and fibres for outdoor and technical applications would result in disproportionate societal costs for the EU.**

Annex I – Use Assessment of restricting use of PFAS in Outdoor and Technical Sewing Threads