Chemical Information Sheet
Version 2.0 | March 2021

PERFLUORINATED AND POLYFLUORINATED CHEMICALS

Other Names	Perfluorooctane Sulfonate (PFOS) and related substances Perfluorooctanoic acid (PFOA) and its salts, esters, and related substances

CAS Number	Substance
1763-23-1	Perfluorooctane Sulfonate (PFOS)
335-67-1	Perfluorooctanoic acid (PFOA)
Full List Included in "Additional Information"	

May Be Found In

- Textile or leather finishes for water, oil, or stain repellency
- Paper protection (e.g. oil resistant)
- Performance chemicals (fire-fighting foams, mining/oil well surfactants, floor polishes, insecticides)
- Mold release (injection molding process)
- Food contact materials (cups, containers)

Perfluorinated and Polyfluorinated Chemicals (PFCs) belong to the perfluoroalkyl family of substances. PFCs are synthetic substances that do not occur naturally in the environment.[1] PFCs are substances with special properties including fire resistance and oil, stain, grease, and water repellency that have hundreds of important manufacturing and industrial applications.

Uses in the Supply Chain

PFCs have been used for many years as repellent finishes applied to fabrics or garments. Fluorinated finishes provide highly durable repellent effects against water, soil, and oil. These repellent effects have historically been achieved using chemistries which have a chain of 8 carbons, each with multiple fluorine atoms attached. These "long-chain" substances can contain trace amounts of PFOA or PFOS as impurities, which come from the manufacturing process. PFOS is both intentionally produced and an unintended degradation product of related chemicals. PFOA is present, mainly at residual levels or as an unintended by-product.

In recent years, "short-chain" PFCs and non-fluorinated repellent chemistries have been in use as the long-chain variety is phased out globally due to hazard concerns. There is still some potential to find PFOA, PFOS, and related substances in formulations and products made with short-chain PFCs due to contamination, impurities, or poor manufacturing controls.

Why PFCs are Restricted

- Legislation in major markets around the world restricts the presence of PFCs in finished products. Some states in the United States, such as Washington, Maine, and Vermont, have reporting requirements for PFCs in products.
- PFOA and PFOS are toxic to aquatic organisms and may have long-term adverse effects on aquatic environments.
- PFOA and PFOS are very persistent in the environment and have the potential to bioaccumulate in humans and other mammals.
- Above certain exposure levels, PFOA and PFOS primarily affect the liver, may impair human fertility, or cause harm to unborn children.
- PFOA and PFOS may result in the development of cancer above certain exposure levels.[1,2]
- For these reasons, many brands and retailers have banned the use of long-chain PFCs. Now, short-chain PFCs are being emphasized through targeted phaseouts, including perfluorohexanoic (PFHxA), which is the next class proposed for phase-out within the European Union and other markets.[3]

- If any PFC is considered, it should be checked against criteria for "PFC of Environmental Concern", which considers small, unstable molecules that are bioavailable to be the most hazardous.[4]

Sourcing Compliant Materials from Your Suppliers

- Contact your suppliers and explain that you require their manufactured materials to be compliant with the current AFIRM RSL limits on PFCs.[5]
- Require suppliers to submit a confirmation of material compliance or a test report from a third-party laboratory.
- When materials are received, consider performing risk-based testing to ensure the current AFIRM RSL limits are met.
- Share this information sheet with your material suppliers so they have full visibility and understand your sourcing requirements.

Sourcing Compliant Formulations from Your Chemical Suppliers

- For all formulations, request SDS documentation that meets current GHS requirements.
- Contact your suppliers and explain that you require formulations to be compliant with the current ZDHC MRSL limits whenever applicable.[6]
- Discuss with your chemical supplier whether any safer alternatives are available that are suitable substitutes for your production needs.
- Prior to procuring any formulation, the chemical properties must be reviewed to ensure that proper protective equipment, chemical storage facilities, facility engineering controls, and associated treatment/disposal facilities are appropriate for the chemical(s).
- Questions that will help with substituting a new durable repellent finish:
    - Is the level of performance requested applicable to the usage of the specific material or product?
    - Is the chemistry based on long-chain (C8) or short-chain (C4, C6) fluorinated chemistry?
    - Has the chemical been assessed by a third party such as bluesign® in the bluefinder or in finished product by OEKO-TEX® 100/1000?
- If your chemical supplier cannot answer these questions, then the repellent formulation may potentially contain substances that will break down into PFOA and PFOS or related PFCs. Work with your supplier to get clear answers.

Safer Alternatives

- Alternatives to C8-based PFCs are available for most applications in apparel and footwear.
- Fluorinated polymer finishes which are based on short-chain fluorinated chemistries that cannot chemically degrade into PFOA or PFOS are also available.
- The use of non-PFC chemistries (such as wax, silicones, acrylic polymers, polyurethanes, dendrimers, and more) are additional alternatives depending on performance needs.
- Materials exist that are naturally repellent due to other chemical or mechanical properties.
- Any alternative selected must be carefully vetted to ensure a regrettable substitution is not made.
- Any chosen alternative should also be ZDHC MRSL compliant if applicable. [6]
- Some information is available through OECD on country-specific reports for alternatives, although they are not endorsed by the collective group of countries.[7]

Additional Information

Full list of CAS numbers and substance names continued from first page:

CAS Number	Substance
PFOS and Related Substances	
1763-23-1	Perfluorooctanesulfonic acid (PFOS)
2795-39-3	Perfluorooctanesulfonic acid, potassium salt (PFOS-K)
29457-72-5	Perfluorooctanesulfonic acid, lithium salt (PFOS-Li)
29081-56-9	Perfluorooctanesulfonic acid, ammonium salt (PFOS-NH_4)
70225-14-8	Perfluorooctanesulfonate diethanolamine salt (PFOS-$NH(OH)_2$)
56773-42-3	Perfluorooctanesulfonic acid, tetraethylammonium salt (PFOS-$N(C_2H_5)_4$)
4151-50-2	N-Ethylperfluoro-1-octanesulfonamide (N-EtFOSA)
31506-32-8	N-Methylperfluoro-1-octanesulfonamide (N-Me-FOSA)
1691-99-2	2-(N-Ethylperfluoro-1-octanesulfonamido)-ethanol (N-Et-FOSE)
24448-09-7	2-(N-Methylperfluoro-1-octanesulfonamido)-ethanol (N-Me-FOSE)
307-35-7	Perfluoro-1-octanesulfonyl fluoride (POSF)
754-91-6	Perfluorooctane sulfonamide (PFOSA)
PFOA and Its Salts	
335-67-1	Perfluorooctanoic acid (PFOA)
335-95-5	Sodium perfluorooctanoate (PFOA-Na)
2395-00-8	Potassium perfluorooctanoate (PFOA-K)
335-93-3	Silver perfluorooctanoate (PFOA-Ag)
335-66-0	Perfluorooctanoyl fluoride (PFOA-F)
3825-26-1	Ammonium pentadecafluorooctanoate (APFO)
PFOA-related Substances	
39108-34-4	1H,1H,2H,2H-Perfluorodecanesulfonic acid (8:2 FTS)
376-27-2	Methyl perfluorooctanoate (Me-PFOA)
3108-24-5	Ethyl perfluorooctanoate (Et-PFOA)
678-39-7	2-Perfluorooctylethanol (8:2 FTOH)
27905-45-9	1H,1H,2H,2H-Perfluorodecyl acrylate (8:2 FTA)
1996-88-9	1H,1H,2H,2H-Perfluorodecyl methacrylate (8:2 FTMA)

References

[1] Agency for Toxic Substances and Disease Registry. (2015) Toxicological Profile for Perfluoroalkyls. Retrieved August 9, 2017, from https://www.atsdr.cdc.gov/toxprofiles/tp200.pdf

[2] OECD/UNEP (2013): Synthesis paper on per- and polyfluorinated chemicals (PFCs) https://www.oecd.org/env/ehs/risk-management/PFC_FINAL-Web.pdf

[3] European Chemicals Agency. (2020) Registry of restriction intentions until outcome. Retrieved June 2020, from https://echa.europa.eu/registry-of-restriction-intentions/-/dislist/details/0b0236e18323a25d

[4] Greenpeace. (2020). Questions and answers. Retrieved June 2020, from https://detox-outdoor.org/en/faq/.

[5] Apparel and Footwear International RSL Management Group Restricted Substances List (AFIRM RSL) http://afirm-group.com/afirm-rsl/

[6] ZDHC Manufacturing Restricted Substances List (ZDHC MRSL) https://www.roadmaptozero.com/mrsl_online/

[7] OECD. (2020). Portal on Per and Poly Fluorinated Chemicals. Retrieved June 2020, from https://www.oecd.org/chemicalsafety/portal-perfluorinated-chemicals/alternatives/