Australian Government | IChEMS Industrial Chemicals Environmental Management Standard

July 2023

Chemical profile

Perfluorooctanesulfonic acid (PFOS) and related substances

Summary

- PFOS and related substances (PFOS chemicals) includes:
  - perfluorooctanesulfonic acid (PFOS)
  - PFOS salts
  - perfluorooctanesulfonyl fluoride (PFOSF)
  - substances that have the potential to degrade to PFOS in the environment.
- PFOS chemicals are recognised globally as persistent organic pollutants (POPs) and are listed on the Stockholm Convention. This group of POPs are a priority for scheduling under the Industrial Chemicals Environmental Management Standard (IChEMS).
- PFOS chemicals have historically been used in a wide variety of consumer and industrial applications. Industries that have used PFOS chemicals in Australia include hard and decorative chromium plating, medical imaging, and fire-fighting.
- These chemicals are of concern due to their persistence, bioaccumulation, toxicity, and potential for long range transport.
- They are a subset of a broad group of synthetic chemicals known as per- and polyfluoroalkyl substances (PFAS).
- An indicative list of PFOS chemical identities is included as part of the consultation package.

Introduction and use of PFOS chemicals in Australia

The 2018 Regulation Impact Statement for the National Phase Out of PFOS (PFOS RIS) identified the main industries continuing to use PFOS chemicals as hard chromium plating, decorative chromium plating (including plastics etching), medical imaging (including X-ray photography and some older medical imaging devices), and firefighting. The PFOS RIS also indicates that PFOS chemicals are not known to be intentionally imported in consumer products but could appear as a trace contaminant. The PFOS RIS cited an unpublished study that tested for perfluorinated chemicals in finished goods and components on sale in 2013. This study indicated that fluorochemical treatments of consumer products including carpets, upholstery fabrics, non-stick cookware, and children's clothing and accessories no longer commonly use PFOS.

Inventory Multi-tiered Assessment and Prioritisation (IMAP) environment and human health risk assessments and assessments on indirect precursors of PFOS have identified that there is some use in Australia of direct and indirect precursor chemicals that can release the perfluorooctanesulfonate anion into the environment. This includes in aviation hydraulic fluids, firefighting foams and as a surfactant in the photography and photolithography sectors.

In line with a global trend since the early 2000s, Australian industry has phased out most non-essential uses of PFOS chemicals following recognition of risks to the environment and potential risks to human health. Survey results reported in the IMAP assessments of PFOS chemicals and NICNAS Alerts indicate a significant decline in imports as well as a reduction in stocks of firefighting foams that may contain PFOS held at sites across the country.

The 2006 Stockholm Convention PFOS risk profile reports a wide range of historical global uses for PFOS includes in textiles, leather, food packaging, floor polishes, denture cleansers, shampoos, and coatings and coating additives.

Controls under the Stockholm Convention

PFOS chemicals are listed in Annex B of the Stockholm Convention for persistent organic pollutants, for restriction in global production and use. Restrictions on import, manufacture, use and disposal of PFOS chemicals apply in countries that have ratified the PFOS amendment to the Stockholm Convention. Australia has not yet ratified this amendment.

The only acceptable purpose for ongoing use is in insect baits containing sulfluramid for control of leaf-cutting ants. Brazil is the only country registered for this acceptable purpose.

The Stockholm Convention has specific exemptions for PFOS chemicals that allow use for a specified time in hard metal plating in closed-loop systems, and firefighting foam for liquid fuel vapour suppression and liquid fuel fires (Class B fires) in installed systems. The Convention urged parties to restrict uses to sites where all releases can be contained by the end of 2022.

The waste management requirements of Article 6 of the Stockholm Convention apply for PFOS chemicals which includes measures to manage stockpiles and waste disposal in an environmentally sound manner to eliminate or minimise releases.

Chemical identity

PFOS chemicals include:

i) Perfluorooctanesulfonic acid (PFOS), CAS RN 1763-23-1, including any of its branched isomers

ii) PFOS salts

iii) perfluorooctanesulfonyl fluoride (PFOSF), CAS RN 307-35-7

iv) substances with the potential to degrade to PFOS in the environment, including sulfonate esters of PFOS and sulfonamides of PFOS.

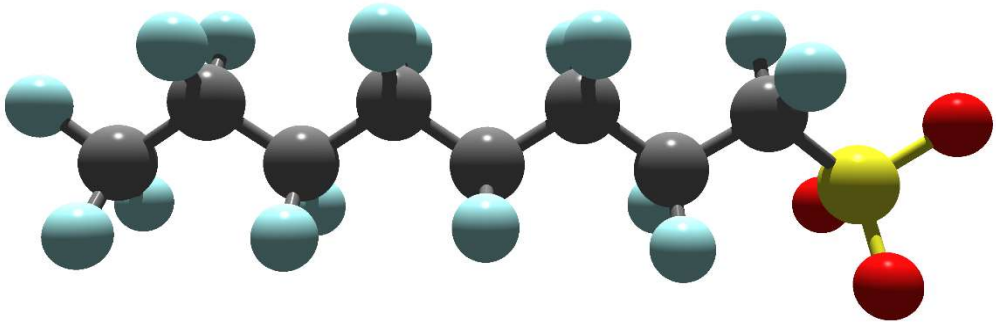

Figure 1 The perfluorooctanesulfonate anion, to which all PFOS chemicals eventually transform in the environment (Key: carbon: grey, fluorine: teal, sulfur: yellow, oxygen: red).

PFOS chemicals are highly stable due to the strength of the carbon-fluorine bond. They are a subset of a broad group of synthetic chemicals known as per- and polyfluoroalkyl substances (PFAS) that have been in use since the 1950s to make a wide variety of chemical products and goods that resist heat, other chemicals, and abrasion.

An indicative list of compounds covered by the proposed scheduling decision for PFOS is available as part of the consultation package.

Hazards and risks to the environment

PFOS chemicals pose a risk to the environment because they are persistent, can be transported long distances, have widespread occurrence in environmental compartments including at remote regions, accumulate through food chains, and can cause adverse effects to the environment and humans.

As reported in the Stockholm Convention PFOS risk profile and IMAP environmental assessment for PFOS chemicals PFOS chemicals are linked to adverse impacts on some plants and animals, with long-term toxic effects on many organisms and intergenerational effects. Laboratory studies have shown developmental effects and adverse effects on the liver, gastrointestinal tract, and thyroid hormones in mammals. Monitoring data from top predators and birds has also shown that PFOS has the potential for bioaccumulation and biomagnification.

Environmental monitoring data in the Stockholm Convention PFOS risk profile shows that PFOS can occur at high levels in water downstream of fire drill areas, landfills and wastewater treatment plants. PFOS is detected in industrial and municipal wastewater, landfill leachate and sewage sludge. Monitoring in fresh and marine waters as well as groundwater and sediment indicate that environmental exposure will occur in aquatic environments. PFOS and related fluorochemicals have also been detected in biota globally (including remote locations) with the highest levels generally found in top predators in food chains containing fish. PFOS is found in birds worldwide with diet expected to be the primary exposure route.

Toms et al in 2014 detected PFOS in breast milk and blood samples, indicating people in Australia commonly have some PFOS in their body due to widespread use and environmental exposure.

Additional information: regulation of PFOS chemicals in Australia

Regulatory and policy frameworks for PFOS chemicals include the National PFAS Position Statement, Australian Industrial Chemicals Introduction Scheme (AICIS), workplace safety and hazardous waste regulatory systems, and state and territory environmental legislation.

Key regulations and policies, noting this is not a comprehensive list, include:

- A series of advisory alerts issued between 2002 and 2008 under the National Industrial Chemical Notification and Assessment Scheme (NICNAS - since replaced by AICIS) include recommendations that industry phase out PFOS chemicals, seek out less toxic and persistent alternatives and recommend inclusion of information on safe use and handling on product labels and safety data sheets.
- Some PFOS chemicals are listed on the Australian Inventory of Industrial Chemicals, which means they can be introduced into Australia subject to any AICIS conditions on the listing.
- The National PFAS Position Statement sets out nationally agreed objectives for phasing-out the use of PFAS of concern in Australia. After the release of this policy the Australian Packaging Covenant Organisation (APCO) launched its industry-led action plan to remove intentionally added PFAS in fibre-based food contact packaging by the end of 2023, and will monitor progress of the phase-out through data reporting in early 2023 and mid-2024.
- The PFAS National Environmental Management Plan (PFAS NEMP) provides nationally agreed guidance on the management of PFAS contamination in the environment, including prevention of the spread of contamination.
- Twelve PFOS chemicals are listed in Annex III of the Rotterdam Convention (on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade). Written approval from the Director of AICIS is required to import or export these chemicals, and export may only occur if agreed to by the importing country.
- PFOS chemicals are included in Annex I of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. Wastes containing PFOS chemicals cannot be imported or exported without a permit under the *Hazardous Waste (Regulation of Exports and Imports) Act 1989*.
- PFOS, PFOS salts and PFOSF are classified as hazardous substances under the model Work Health and Safety (WHS) Regulations. While PFOS chemicals do not have workplace exposure standards under the model WHS Regulations, the regulations require that exposure to these chemicals be minimised to as low as reasonably practical and that exposure risks are managed. The chemicals must be labelled for physical and human health hazards in accordance with the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) and safety data sheets prepared by importers and manufacturers must be provided on supply of these chemicals to a workplace. The Hazardous Chemical Information System (HCIS) gives guidance on classifications for PFOS, PFOS salts and PFOSF.
- Some States have regulations on use of PFAS firefighting foams, including New South Wales's 2021 PFAS firefighting foam regulation, South Australia's 2018 regulation on use of fluorinated fire-fighting foams (PDF 328), and Queensland's 2016 Environmental Management of Firefighting Foam–Operational Policy.

Additional information: replacements for PFOS chemicals

Alternatives to PFOS chemicals are available for some applications, while for other applications technically feasible alternatives to PFOS may not be available in all countries. This includes uses in photo imaging, semi-conductor manufacture and aviation hydraulic fluids.

Alternatives for previous uses of PFOS in consumer goods (for example in non-stick, stain-resistant, water repellent and anti-corrosion coatings) include a range of fluorinated and non-fluorinated substances.

Through the National PFAS Position Statement Australian governments encouraged industry that sell or use long- or short-chain PFAS to develop a strategy for how and when they will transition away from these chemicals.

Key references

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More information

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Web www.dcceew.gov.au/environment/protection/chemicals-management/national-standard

Acknowledgement of Country

We recognise the First Peoples of this nation and their ongoing connection to culture and country. We acknowledge First Nations Peoples as the Traditional Owners, Custodians and Lore Keepers of the world's oldest living culture and pay respects to their Elders past, present and emerging.