

Perfluorooctane sulphonates

PFOS and PFOS-related substances (a group of 96 chemicals which can degrade to PFOS) are part of the larger family of perfluoroalkyl sulphonate substances (PFAS). They are used as surface-active agents to repel water and oil in a wide range of industrial applications and consumer products. Remaining uses in Europe include PFOS-containing fire fighting foam held in stocks (estimated 122 tonnes), metal plating (8 – 10 tonnes per year) and to a much lesser extent the photographic industry, photolithography, semiconductor industry and hydraulic fluids for aviation (together ~2 tonnes per year).

What is the problem?

PFOS and PFOS related substances are toxic to aquatic organisms and through the food chain. They are extremely persistent and accumulate in animals and humans in concentrations with effects on physiology and environmental and human health. The persistency, bioaccumulation and toxicity of PFOS are considered to meet the POP (Persistent Organic Pollutant) criteria for long-range transport. PFOS are mainly released to the environment via waste water treatment effluents, sewage sludge and leachates from landfills. Other sources include atmospheric losses during combustion and from certain domestic and commercial uses, wash-off from various applications such as in fire fighting foams, or emissions from wearing PFOS-treated materials.

What has been done?

OSPAR action promoted recent EU measures which restrict the use of the commercially important PFOS compounds in most applications and products with effect from 2008. Derogations apply for the currently remaining uses; stocks of PFOS-containing fire fighting foams previously placed on the market must cease by summer 2011. The main producer worldwide ceased the manufacture of PFOS and PFOS-related substances over the period 2001 – 2003 and uses such as in cleansing products, textile-, leather- and carpet protection, flame retardants, and pesticides are suggested to have ceased since 2001. Recently PFOS and PFOS-related substances have been included for elimination under the UNEP Stockholm POP Convention.

Did it work?

Quantitative information on emissions, discharges and losses and on loads transported by rivers and atmosphere to the sea are scarce. With the sharp drop in production and consumption since 2001, releases to the environment may have decreased. With existing and currently planned measures, releases to the environment will continue beyond 2010, especially from waste streams, it is expected that good progress can be made towards the cessation target by 2020.

How does this affect the quality status?

The PFOS accumulating through the environmental food chain is perfluoroalkylated acid (PFA), which is extremely persistent and has been found toxic mainly to birds and mammals. PFA bioaccumulates in proteins (blood plasma) and liver (fatty acids) of animals and humans in concentrations with effects on physiology and environmental and human health. In 2000 – 2006, PFOS (PFA) have been reported to be found in all environmental compartments in the Arctic and Greater North Sea Regions at reference and polluted sites. Concentrations in sediments ranged from 0.5 µg/kg d.w. at reference sites to 3.7 µg/kg d.w. at contaminated sites. Concentrations of PFOS in biota (shrimp, shellfish, fish, mammals and seabird eggs) were found at levels up to 26 µg/g w.w. (guillemot egg) at reference sites and up to 2420 µg/g ww (porpoise liver) at contaminated sites. The pattern of PFAS contamination in wildlife varies greatly among species and geographical locations. Contaminant levels in mammals in the OSPAR area show a decreasing trend from south to north. Data from seabird eggs from northern Norway suggest that increasing PFOS concentrations levelled off in 1993 – 2003 and have since decreased.

Swedish time series for guillemot eggs for 1968 – 2003 suggest a continuous increase at an average of 7 – 11% per year. Concentrations in ringed seal liver (1985 – 2003) and polar bears (1984 – 2006) from Greenland suggest high annual increases. The widespread presence of PFOS in the environment and the observed levels at higher trophic levels are of concern. Due to the substance's extreme persistence PFOS legacies in the environment are expected to contribute to exposure and bioaccumulation in future. Biological and ecosystem effects of measured PFOS levels are not fully understood although there is some evidence of endocrine disruption and liver disease. Chronic exposure of seabird species to PFOS indicate adverse effects on reproductivity, hatchability and pathological changes.

Electronic navigator to OSPAR publication sources (publication number):

- ↳ Status and trend of marine chemical pollution (395/2009) – Annex 2 for monitoring data
- ↳ Towards the cessation target (354/2008)
- ↳ Background Document for PFOS (269/2005) (as updated)