PFAS (Per- and polyfluoroalkyl substances)

(CAS numbers: e.g. 335-67-1, 1763-23-1, 355-46-4, 375-95-1, 375-73-5, 307-24-4, 375-22-4, 2706-90-3, 2706-91-4, 335-76-2, 307-55-1, 2058-94-8, 375-85-9, 72629-94-8, 375-92-8, 335-77-3, 376-06-7, 67905-19-5, 16517-11-6, 62037-80-3, 958445-44-8, 647-42-7, 678-39-7, 1190931-41-9, EC numbers: e.g. 206-397-9, 217-179-8, 206-587-1, 206-801-3, 206-793-1, 206-196-6, 206-786-3, 220-300-7, 220-301-2, 206-400-3, 206-203-2, 218-165-4, 206-798-9, 276-745-2, 206-800-8, 206-401-9, 206-803-4, 267-638-1, 240-582-5, 700-242-3, 211-477-1, 211-648-0, 682-239-6 / Entry number in HELCOM list of priority substances: 31)

General sectors: Industry and commercial products

DRIVERS | ACTIVITIES | PRESSURES | STATE | IMPACTS

Why a HELCOM priority?

Main evidence

S Concentrations of PFOS exceed the applied threshold value in **37** of the 39 examined areas (assessment units) of the Baltic Sea. The threshold is exceeded in both coastal and off-shore areas (**13**/13 assessed off-shore areas). In these 37 areas, **100%** of the assessible samples in **biota** (and/or water, for which the thresholds are exceeded more rarely) exceed the threshold value. This is based on regular monitoring data gathered by HELCOM Contracting Parties and reported to the HELCOM COMBINE database for the period 2016-2021, as part of the more limited, PFOS indicator[1].

By further considering how much above or below the threshold each concentration is, and how often the substance is detected, PFAS scores **9.3/10** (confidence range: **9.3 – 9.3**) in the scale established when assessing the criticality/significance of current levels in the Baltic Sea pose, where 5 indicates concern and 10 extreme risk, and the range reflects the level of reliability and representativeness of concentrations and the thresholds.

The threshold values for PFOS, for biota and water, were acquired from the EC proposed Directive amending WFD and EQSD[2] (not yet in effect as of February 2025).

Concentrations of PFNA, PFDA, PFUnDA, PFTrDA, PFDoDA, PFDS, FOSA, and other PFAS substances also frequently exceed their respective threshold values in biota, while TFA, 6:2 FTS, PFOA, PFHxS and N-EtFOSA (and other PFAS) are in addition to previous often detected in water at high concentrations. This is based on monitoring data for the period 2015-2023 as reported by Contracting Parties (CPs) as response to a data call organized by HELCOM for PFAS.

It is noted that **high trophic magnification** has been reported, for PFAS[3].

I Current levels in the Baltic Sea indicate potential negative impacts on pelagic biota, top predators such as mammals and birds and humans via consumption of seafood.

Supporting evidence

I PFAS are considered of **especially concerning mode of toxicity**: for example some of them are toxic for reproduction and/or endocrine disruptors[4].

Overall assessment

When assessing current levels in the Baltic Sea, current inputs, and the severity of the relevant toxicity mechanism, PFOS alone scores **94-94/100** in the scale established for assessing the overall risk for impacts/threat for the Baltic Sea, where 50 indicates concern, 100 extreme risk, and the width of the span outlines the uncertainty in the assessment. Besides PFOS, thousands of other Per- and polyfluoroalkyl substances have been to shown to have hazardous properties and to exhibit concerning environmental fate/occurrence profiles[12]. This substance group entry reflects any chemical containing at least one saturated CF2 or CF3 moiety[13].

Facts relevant for management considerations

Causal chain and pathways

A Although PFOS is restricted under Annex B of the Stockholm Convention, there are specific exemptions, such as in metal plating, fire-fighting foams for liquid fuel vapour suppression and liquid fuel fires, and insect baits. It is not registered for EU REACH[5], thus likely on EU market in low tonnage as it has been notified by about 30 companies wihtout specific use information[6]. There are expected releases e.g. from legacy firefighting foams and life of products containing it.

Release estimates for the broader PFAS (non-polymeric) group: textile, upholstery, leather, apparel and carpets (80%), food contact materials and packaging (7%), electronics and semiconductors (7%)[7]. Certain cookware and paints may as well contain PFAS[8].

P Based on available estimations, PFOS appear to enter the Baltic Sea at the following amounts: **rivers** (0.2 t/y, WATERBASE[9]), atmospheric deposition (0.06 t/y), direct emissions from land-based activities (0.02 t/y, Undeman et al, 2022[10]). **WWTPs** is roughly estimated to contribute with 0.07 t/y. There is available information also about estimated inputs of further individual PFAS.

Relevant policies (existing or planned measures)

M (on A/P)

- Some sub-groups of PFAS are listed under **Stockholm Convention** on POPs (signed by all HELCOM Contracting Parties) – Annexes A (elimination) / B (restriction) – accordingly **EU POPs Regulation –** including respective **national Action Plans.**
- **Some PFAS are listed as REACH SVHC** (basis: toxicity for reproduction / PBT / endocrine disruption, depending on the case). In 2023, authorities from Denmark, Germany, the Netherlands, Norway and Sweden submitted a **REACH restriction proposal**[11].
- PFOS is listed as a priority hazardous substance under the **EU WFD** (instead, PFAS is listed as priority hazardous substance under its update proposal) – including respective national **Progammes of Measures for this**.
- PFOS is a more limited **HELCOM indicator**.
- There are provisions in EU Best Available Reference Documents for these substances

References:

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13.

[Note: Listing of detailed references will be provided in an upcoming update of the fact sheet – for a listing of the most common references among the different substances see the section at the end of the consolidated document which includes all the fact sheets]