IPEN GUIDE TO PFHxS AND THE CASE FOR A CLASS-BASED LISTING

BACKGROUND

The aim of the Stockholm Convention is to protect human health and the environment from Persistent Organic Pollutants (POPs). Parties to the Convention have therefore committed to take precautionary action on POPs, recognizing that they are toxic, resist degradation, and bioaccumulate, and that they are transported across international boundaries and deposited far from where they are released. Impacts on indigenous communities, women, and future generations are acknowledged in the Treaty as of special concern.

The Convention has an established, science-based evaluation process for adding new POPs to the Convention. The scientific expert committee under the Convention, the POPs Review Committee (POPRC), evaluates candidate POPs to ensure that they fulfill the Convention criteria, while still recognizing that full scientific certainty shall not prevent a candidate substance from proceeding in the evaluation or listing.

The POPRC has evaluated and recommended one new substance for listing under the Convention at COP 10 for global elimination: **Perfluorohexane sulfonic acid (PFHxS), its salts, and related substances**. This includes a group of at least 79 commercially available compounds that can form PFHxS, further strengthening the case for addressing per- and polyfluoroalkyl substances (PFASs) through a group approach under the Convention.

PFHxS AND RELATED SUBSTANCES

Perfluorohexane sulfonic acid (PFHxS) and its related substances has been used as a regrettable substitute for another PFAS, perfluorooctanesulfonic acid (PFOS), that was listed for global restriction (Annex B) in 2009. After its evaluation, the POPRC concluded that PFHxS is, as a result of long-range environmental transport, likely to lead to significant adverse effects on human health and the environment such that global action is warranted.

PFHxS is extremely persistent in the environment but is relatively water soluble. This means that it adsorbs less to soils and sediments and has a high mobility in the environment, leading to widespread, long-term contamination. It also means that standard adsorption and filtering methods to remove PFHxS from water are generally ineffective and that it is not removed during standard wastewater- or drinking water treatment processes.

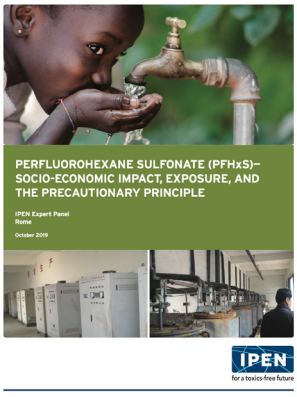
There is widespread PFHxS contamination globally, and it is detected in water, snow, air, and biota (including humans) at remote locations due to long-range environmental transport. It has the longest half-life in humans determined for any PFAS and is one of the most frequently detected PFAS in human blood, including maternal and infant cord blood.

A range of adverse effects have been associated with PFHxS, including impact on liver function, lipid and lipoprotein metabolism, endocrine disrupting effects related to changes in serum thyroid hormones, and immune system impairment. Endocrine disrupting effects can occur at very low concentrations, meaning that all exposure levels are of concern.

Similar to PFOS, PFHxS has been used intentionally for a wide range of applications, including in consumer products, firefighting foams, metal plating, textiles, leather and upholstery, polishing agents and cleaning/washing agents, coatings, impregnation/proofing, and the manufacturing of electronics and semiconductors.

PFHxS can also be present in products containing PFOS and PFOA, since it is unintentionally formed when the Electro Chemical Fluorination (ECF) process is used to produce other PFAS substances. The significance of this contamination and the association between PFHxS, PFOS, and PFOA is seen in the unacceptably elevated blood levels of these three PFAS in firefighters that have been using fluorine-based aqueous film-forming foams (AFFF).

The POPRC evaluation concluded that there are no justifications for any continued production and use of PFHxS since cost-effective alternatives are already in use. Therefore, the POPRC recommend listing PFHxS, its salts and relates substances for global elimination with no exemptions.



More information about PFHxS can be found in IPEN's report ***Perfluorohexane Sulfonate (PFHxS)— Socio-Economic Impact, Exposure, and the Precautionary Principle.***

CLASS BASED APPROACH TO LISTING PFAS

No one knows how many PFAS substances are in use today, and consumers have no way of knowing if the products they purchase contain PFAS. The Organisation for Economic Co-operation and Development (OECD) includes 4,730 PFASs in their Global Database of Per- and Polyfluoroalkyl Substances. However, considering the information gaps noted by the OECD in relation to confidential business information and unintentionally produced PFAS, the actual number is likely to be higher.

As PFAS with longer carbon-chain lengths have increasingly been regulated and phased out, the chemical industry has moved to substitute these with shorter-chained alternatives. This is an example of so-called regrettable substitution, where one chemical is substituted with another equally or more harmful chemical. The European Union (EU) has, for example, listed the regrettable PFAS substitutes known as GenX and PFBS as Substances of Very High Concern because of their persistence, mobility, and toxicity. These and other short-chained PFAS substitutes have now become widespread global pollutants. Taken together with their health and environmental impacts, this underscores the urgent need to strictly regulate the production and use of all PFAS globally.

The recommendation from POPRC for the PFHxS listing includes the following recommendation:

> *"Recognizing that a transition to the use of short-chain per- and polyfluoroalkyl substances (PFASs) for dispersive applications, such as fire-fighting foams, is not a suitable option from an environmental and human health point of view"*

The nominations of PFHxS and long-chained perfluorocarboxylic acids (PFCAs) for listing under the Stockholm Convention includes several hundred "related substances". This shows that the class-based approach is feasible under the Stockholm Convention. In addition, while little information is available for many PFAS substances, the precautionary foundation of the Stockholm Convention to protect human health and the environment calls for broad action on groups of PFAS.

Preventing PFAS exposure through a class-based approach is already utilized in other types of regulations and recommendations. Many European countries and US states have adopted recommended maximum drinking water levels of all PFAS, or groups of selected PFAS substances. The European Food Safety Authority has issued a group tolerable weekly intake (TWI) for four PFAS substances in food.

In 2020, the EU adopted its Chemicals Strategy for Sustainability (CSS) that includes additional actions that aim to ensure that the use of PFAS is phased out in the EU, unless it is proven essential for society. These includes actions targeting all uses of PFAS, starting with firefighting foams. The Commission states that they "*...will also address PFAS with a group approach, under relevant legislation on water, sustainable products, food, industrial emissions, and waste.*"[1]

The consequences of the persistence of PFAS also provides justification for addressing all PFAS as a class based on precaution, as detailed further by Cousins *et al.* They state that "*The continuous release of persistent chemicals will lead to widespread, long-lasting, and increasing contamination, which will inevitably result in increasing probabilities of known and unknown adverse effects on human health and the environment.*"

Noting that exposure to both long- and short chained PFAS has been shown to have developmental and other endocrine-disrupting impacts related to the thyroid and that endocrine disruption can occur at very low exposures, the intrinsic hazard of PFAS combined with their persistence and detection at remote locations serve as a group listing justification under the Stockholm Convention.

SELECTED REFERENCES

Cousins, I. T., DeWitt, J. C., Glüge, J., Goldenman, G., Herzke, D., Lohmann, R., Miller, M., Ng, C.A., Scheringer, Vierke, L., M., Wang, Z. (2020). Strategies for grouping per-and polyfluoroalkyl substances (PFAS) to protect human and environmental health. Environmental Science: Processes & Impacts, 22(7), 1444-1460. https://doi.org/10.1039/D0EM00147C

Gore, A. C., Crews, D., Doan, L. L., La Merrill, M., Patisaul, H., & Zota, A. (2014). Introduction to endocrine disrupting chemicals (EDCs). A guide for public interest organizations and policy-makers. https://www.endocrine.org/topics/edc/introduction-to-edcs

Post, G. B. (2021). Recent US state and federal drinking water guidelines for per-and polyfluoroalkyl substances. Environmental toxicology and chemistry, 40(3), 550-563. https://doi.org/10.1002/etc.4863

Spaan, K. M., van Noordenburg, C., Plassmann, M. M., Schultes, L., Shaw, S., Berger, M., . . . Benskin, J. P. (2020). Fluorine Mass Balance and Suspect Screening in Marine Mammals from the Northern Hemisphere. Environmental science & technology, 54(7), 4046-4058. https://pubs.acs.org/doi/10.1021/acs.est.9b06773

Wang, Y. F., Kim, J. H., Huang, C. H., Hawkins, G. L., Li, K., Chen, Y. S., & Huang, Q. G. Occurrence of per- and polyfluoroalkyl substances in water: a review. Environmental Science-Water Research & Technology. https://doi.org/10.1039/D1EW00851J

Yu, S., Ren, J., Lv, Z., Li, R., Zhong, Y., Yao, W., & Yuan, J. (2022). Prediction of the endocrine-disrupting ability of 49 per- and polyfluoroalkyl substances: In silico and epidemiological evidence. Chemosphere, 290, 133366. https://doi.org/10.1016/j.chemosphere.2021.133366

STOCKHOLM CONVENTION DOCUMENTS:

UNEP/POPS/POPRC.14/6/Add.1
Risk profile on perfluorohexane sulfonic acid (PFHxS), its salts and PFHxS-related compounds

UNEP/POPS/POPRC.15/7/Add.1
risk management evaluation on perfluorohexane sulfonic acid (PFHxS), its salts and PFHxS related compounds

UNEP/POPS/COP.10/12
Recommendation by the Persistent Organic Pollutants Review Committee to list perfluorohexane sulfonic acid (PFHxS), its salts and PFHxS-related compounds in Annex A to the Convention and draft text of the proposed amendment

1 https://ec.europa.eu/environment/chemicals/pfas/index_en.htm