Baltic Marine Environment Protection Commission

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PRESSURE 5-2016

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Background

PRESSURE 3-2015 identified that the priority list of the hazardous substances for the HELCOM area contains many compounds the use of which was banned or strongly restricted in the area. That is why PRESSURE 4-2016 decided to launch a revision of the priorities established by HELCOM Recommendation 31E/1 in 2017 and collect required information meanwhile.

The first step to collect the information on priority substances was made by circulating to the countries, contracting parties to the Helsinki Convention, a questionnaire regarding the pollutants of high concern. The questionnaire revealed a number of groups of substances identified as of the highest level of concern in the region (document 7-4). One of the identified groups of organic chemical compounds is perfluorinated alkylated substances.

The conclusion of the questionnaire is supported by a preliminary result of ongoing HELCOM work on core indicators of ecosystem health of the Baltic Sea. One of the agreed core indicators – PFOS - belongs to the above mentioned group of substances. The preliminary assessment included in the core indicator report reveals increasing trends of the PFOS concentrations in biota observed at some of the locations. The working materials on the indicator are available at the PRESSURE 5-2016 meeting site (**7-9-Att PFOS_HELCOM core indicator 2016_web version**). The information is not published due to ongoing work.

The Swedish Environmental Protection Agency presented a comprehensive screening study on PFAS in the Swedish environment in March 2016. The study includes a description of sources, pathways to the environment, measured concentrations in the environment and risks for human and environmental health. Information collected in this study may be of value for the process of discussing substances of concern and monitoring within HELCOM.

This document on PFAS is to support the discussions on hazardous substances of concern presented in Doc. 7-4 A suggestion to compile data on POPs of concern in the Baltic Sea area.

Action requested

The Meeting is invited to take note of information on the screening study on PFAS and utilize it identifying the next practical steps toward assessment of the input of the organic pollutants of high concern into the Baltic Sea.

Highly fluorinated substances - PFAS

PFAS have been used since the early 1950's in various products and industrial processes because of their fat and water repellent properties, their film forming properties, as well as their temperature resistance. Today about 3000 various PFAS are in use.

PFAS are hazardous to human health and the environment as many of them bioaccumulate and are toxic. They are persistent pollutants, but also relatively water soluble and mobile. These properties are unique compared to many other environmental pollutants.

Swedish screening of PFAS in the environment

The Swedish Environmental Protection Agency (SEPA) was in 2015 commissioned by the government to conduct a screening for the presence of hazardous substances, including highly fluorinated substances, in surface water and groundwater, to analyse the results and if necessary propose measures. In this context screening includes both the compilation of already existing (i. e. previously measured) data on concentrations of these substance groups in the environment, as well as new measurements. The aim was to give a picture of where the substances occur and their risk to humans and the environment.

Within the assignment the results of about 6000 measurements of PFAS in the environment have been compiled. Of these, about 500 are a result of the new screening of PFAS in surface water and groundwater conducted within this assignment by SEPA and the County Administrative Boards.

Risk for adverse effects especially in areas affected by point sources

Results show that PFAS are widespread in the environment and found in surface water throughout Sweden. In areas with only atmospheric deposition the levels are generally very low. PFAS substances are found in groundwater but mainly in contaminated areas.

Measured concentrations in the environment show that humans and the environment risk exposure to PFAS at levels that may cause adverse effects. Exposure occurs both through water and through fish. Fish sampled in the vicinity of point sources may contain the substance PFOS[1] at levels which in many cases are so high that there may be a need for local dietary advice. Moreover, in many of these areas, the levels in fish are so high that there is also a risk that fish eating predators are affected. Even in surface water, concentrations of PFOS are sometimes at levels posing a risk for adverse effects on aquatic organisms.

PFAS have been analysed in raw water or drinking water from 35% (660 units) of the public water supplies in Sweden. In 144 (22%) of them, measured average concentrations of PFAS7[2] were higher than 1 nanogram per litre. In around ten public water supplies and two private, the levels of PFAS7 exceeded 90 nanograms per litre at least at one occasion. All the water supplies with confirmed levels above 90 nanograms per litre are located close to either an airport with a fire training site or a fire training site.

A total of approximately 300 000 people may have been exposed to PFAS7 concentrations of 90 nanograms per litre in drinking water from public water supplies at least at some occasion. The number of people that have been exposed via water from private water supplies, such as private water wells, is unknown.

Known and potential sources and pathways

PFAS can reach the environment from production of PFAS (not in Sweden), production of products containing PFAS, industrial processes where PFAS is used, the use of products containing PFAS, and from waste (Figure 1). In addition, PFAS can reach the Swedish environment from sources outside the country via long range transport and atmospheric deposition.

[1] PFOS, perfluorooctane sulphonate, one of approx. 3000 different PFAS on the market

[2] Sum of the 7 PFAS included in the action limit and health based limit values derived by the National Food Agency in Sweden.

Over 2000 potential local sources have been identified in the compilation of data carried out in this assignment. Use of fire extinguishing foam is the largest direct point source, while wastewater treatment and disposal and treatment of waste are likely to be significant secondary point sources. Other potential sources include various types of industrial activities.

An estimation of amounts

For some sources the amount of PFAS released to the environment was estimated; the estimates are generally very rough, based on a small data set. For most sources, knowledge is not sufficient for making even a rough estimate. The total amounts refer to the whole country and *cannot* be connected with effects from local emissions. The number of PFAS substances from which the estimates were done (sum-PFAS) varies between 2 and 15 and can therefore not be easily compared. In conclusion, the estimation shows a large lack of data about emitted amounts and a lack of knowledge about sources.

Generally, the use of PFAS-containing firefighting foams is the biggest local source of PFAS to the Swedish environment over time. The use results in very high local emissions, contaminating ground, ground water and surface water. About 50 000 liters of PFAS-containing firefighting foams are used in Sweden every year, however, due to the lack of information about the content of PFAS it is not possible to calculate how much PFAS is currently emitted from this source. The accumulated historic emission (ca 1970-2000s) of PFAS and PFOS from fire training sites at civil and military airports, is roughly estimated to 11,300 kg PFAS and 2,680 kg PFOS. Other fire training sites could not be estimated.

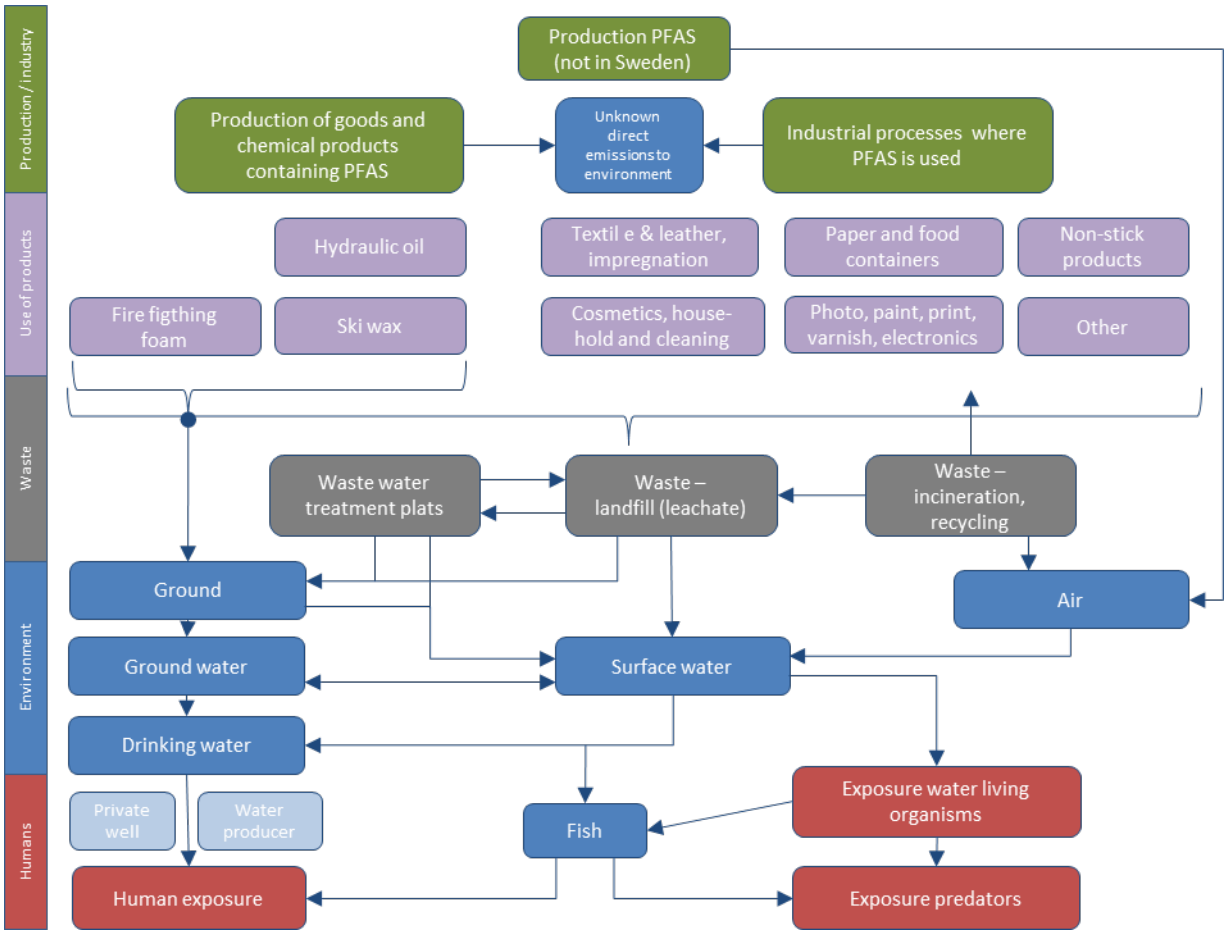

Figure 1. Schematic figure of sources and pathways of PFAS from production and use of PFAS-containing products to the environment, including routes of exposure to humans and environmental organisms.

Emissions from waste water treatment plants (336 plants) were estimated to about 70 kg PFAS per year (of which PFOS 20 kg/y) in treated effluent water, and about 5 kg/y in sludge. The concentration of PFAS in effluent water has increased since 2009, probably due to increasing use in consumer products. Emissions via landfill leachate were estimated to about 70 kg/y (PFOS 4 kg/y).

PFOS is used for specific metal processing industries and up to 2013 about 40 kg PFOS/y was estimated to be released to air and waste water. Direct emissions from other industrial activities in Sweden are unknown.

Atmospheric deposition of PFAS over the whole surface area of Sweden, probably mainly with international origin, was estimated to between 650 and 1,700 kg/y (PFOS 25-30 kg/y).

Shortage of measurements close to known potential point sources

Despite about 6000 measurements of PFAS in the environment, only a small proportion of Sweden's fire training sites have been investigated for environmental contamination of PFAS.

PFAS levels are also poorly investigated in connection with other possible point sources, such as major fires, sewage treatment plants, waste treatment plants and industries from which environmental discharges can occur. The few existing measurements of PFAS in the vicinity of waste treatment plants and fires suggest that these sources also can cause a local risk for adverse effects on human health and the environment.

For more than 1 200 public water supplies, no results of PFAS analyses are available. Among these, there are some 20 water supplies located less than 1 kilometer from the nearest known potential source of PFAS. The proximity to a source does not necessarily entail that the supply is polluted, but the proportion of water supplies with measurable PFAS levels have been shown to be higher within 1 km of a potential source of PFAS. PFAS occur, however, also in water supplies far from known point sources.

Private water wells can be contaminated due to the contamination of the surrounding soil. Around 50,000 drinking water consumers get their water from private wells located within a few kilometers from a potential source of PFAS. The number of these wells that are contaminated is unknown.

Newer types of PFAS also occur in the environment

PFOS is in some types of samples (e.g. in animals higher in the food chain such as seals, otters and mink) the dominant PFAS. In other cases (for example in surface water, groundwater and leachate water) other types of PFAS are present in the highest concentration, usually more short-chained PFAS including the fluorotelomer 6: 2 FTSA. This may reflect a change in use.

In total there are results on measurements of almost 40 different PFAS, but for the majority the toxicity is not sufficiently investigated in order for quality standards to be established. The risk for human health and the environment has therefore only been assessed based on the levels of PFOS and PFAS7, which may mean that the risk of adverse effects is underestimated. The lack of information on environmental concentrations of those PFAS that have not been measured may possibly also lead to an underestimation of the risk to human health and the environment.

Possible measures to reduce risks to human health and the environment and to increase knowledge of PFAS

Following consultation with relevant authorities, SEPA recommends the following potential measures and commitments.

- REDUCE HUMAN EXPOSURE THROUGH FOOD
- RESTRICT THE RELEASE AND DISTRIBUTION FROM POINT SOURCES
    - *Strengthen regulatory guidance on PFAS and other hazardous substances in the environment.*
        - Guidance for airports in terms of PFAS
        - Guidance on PFAS in the use of waste in construction works

        - Guidance on PFOS / PFAS for contaminated sites
    - *Development of techniques for handling of PFAS contamination*
    - *Limit the use of PFAS-containing firefighting foam*
        - Existing proposal on national legislation for PFAS in firefighting foam
        - Investigation on the need for notification of use of all types of firefighting foam
        - Information and education efforts directed to Emergency Services
        - Evaluation and development of alternative fire extinguishing methods
    - *Limit the use of PFOS containing firefighting foams at sea*
    - *Minimise levels of PFAS in effluent wastewater*
        - Investigation of conditions for advanced treatment of wastewater
        - Requirements for operations connected to municipal sewage systems
        - Quality standard for PFOS in sludge for spreading on agricultural land
    - *International measures to limit the use in and emissions from industrial activities*
        - Follow-up of the use of PFOS under the exemptions listed in the Stockholm Convention
        - Take action through the Industrial Emissions Directive where relevant
- REDUCE THE USE OF PFAS
    - *Reduce the use of PFAS in articles and chemical products as well as industrial processes*
    - *Improve information on the content of PFAS in articles and chemical products*
- COLLABORATION AND GUIDANCE IN COOPERATION WITH OTHER AUTHORITIES
- ENHANCED NATIONAL ENVIRONMENTAL MONITORING
    - *Extended monitoring of organic pollutants, including PFAS, in surface water*
    - *Monitoring of organic contaminants, including PFAS and pesticides in groundwater*
    - *Screening of the less well-known PFAS*
    - *Analysis of oxidisable precursors and organic fluorine*
    - *Investigation regarding monitoring of PFAS in air and atmospheric deposition*
- IMPROVED HANDLING OF ENVIRONMENTAL DATA
    - *Long-term, quality-assured data hosting and management.*

Action plan for highly fluorinated substances

The Swedish Chemicals Agency has a government assignment to provide a national action plan for PFAS, including suggesting measures to reduce human exposure and emissions to the environment.

See also: Poly- and perfluoroalkyl substances on the market and in the Swedish environment; Stellan Fischer, Karl Lilja, Ahrens Lutz, Karin Wiberg (2016). NORMAN Bulletin. http://www.norman-network.net/sites/default/files/files/bulletins/NORMAN_Bulletin_n5_September%202016_vfinal_0.pdf