Assessment of PFOS and PFOSF

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Abstract: Perfluorooctane-sulfonic acid (PFOS) and perfluorooctane sulfonyl fluoride (PFOSF) are pollutants covered by the Stockholm Convention on Persistent Organic Pollutants since 2009.

Because of their unique lipophobic and hydrophobic properties PFOS, PFOSF, and related chemicals were widely used in production of different industrial and consumer goods. Due to widespread use and extreme resistance to environmental breakdown, these chemicals can be found practically everywhere.

Based on data for 1998-2012 PFOS/PFOSF content was estimated at concentrations of 0.01 – 0.05% in:

- different consumer goods (paints, varnishes, washing detergents, furniture, electric/electronic equipment, etc.),

- industrial products (electric/electronic parts, fire extinguisher additives, etc.)

Mentioned products were mostly imported.

Analysis of the sectors that use PFOS and its salt shows that 70% (13 tons) of PFOSs was used in the textile and upholstery sector such as furniture, mattresses, pillows and similar products.

The second largest user of PFOSs was the coating and additive industry with 13% (2.5 tons) and the third largest user of PFOSs was the sector, which mainly includes consumer goods like washing detergents, sanitary and household items, and antioxidants. The use of PFOSs in the latter sector is not allowed as per Part III of Annex B of the Stockholm Convention.

Keywords: persistent organic pollutants, emerging pollutants, PFOS/PFOSF

1. Introduction

Because of their unique lipophobic and hydrophobic properties perfluorooctane-sulfonate, perfluorooctane sulfonyl fluoride (PFOSF) and related chemicals have been widely used in the production of different industrial and consumer goods.

Due to their widespread use and extreme resistance to environmental breakdown, the mentione chemicals can be found practically everywhere.

Scientific research proved their persistence, toxicity and bioaccumulation, therefore they have been added to the list of Annex B of the Stockholm Convention on Persistent Organic Pollutants in 2009 [*Stockholm Convention, 2010*].

In Armenia perfluorooctane-sulfonic acid (PFOS) and related chemicals have never been produced. PFOS inventory includes the estimation of the PFOS content of locally produced, imported and exported goods. The sum of imported and locally produced goods minus the exported goods provides the amount of PFOS-containing goods that were used in the country {*Guidance on Inventory, 2014; Guidance on Best available technique, 2014a*].

The inventory estimated PFOS content of the raw materials. These chemical appears in the final products of the supply chain, such as different consumer goods (paints, varnishes, washing detergents, furniture, electric and electronic equipment etc.), some industrial products (electric and electronic parts and raw materials, fire extinguisher additives etc.) typically in a concentration of 0.01 – 0.05 %.

Due to the economic and industrial situation of the country, most part of these products are imported.

It should be noted that the PFOS content of locally produced consumer goods is also based on statistical data and assumptions [*Statistical Yearbooks, 2001-2012*]. It does not mean that PFOS have been imported to Armenia and used during the manufacture of these goods, rather that PFOS might have already been in the raw material the Armenian industry uses to produce these goods.

A steady growth can be observed in the use of PFOS, which in the past decade more than doubled (Figure 1).

The import and the use trend lines follow each other representing that most of the PFOS used in Armenia is imported.

Production and export remained steady, approximately 1-2 tons/a, over the past decade.

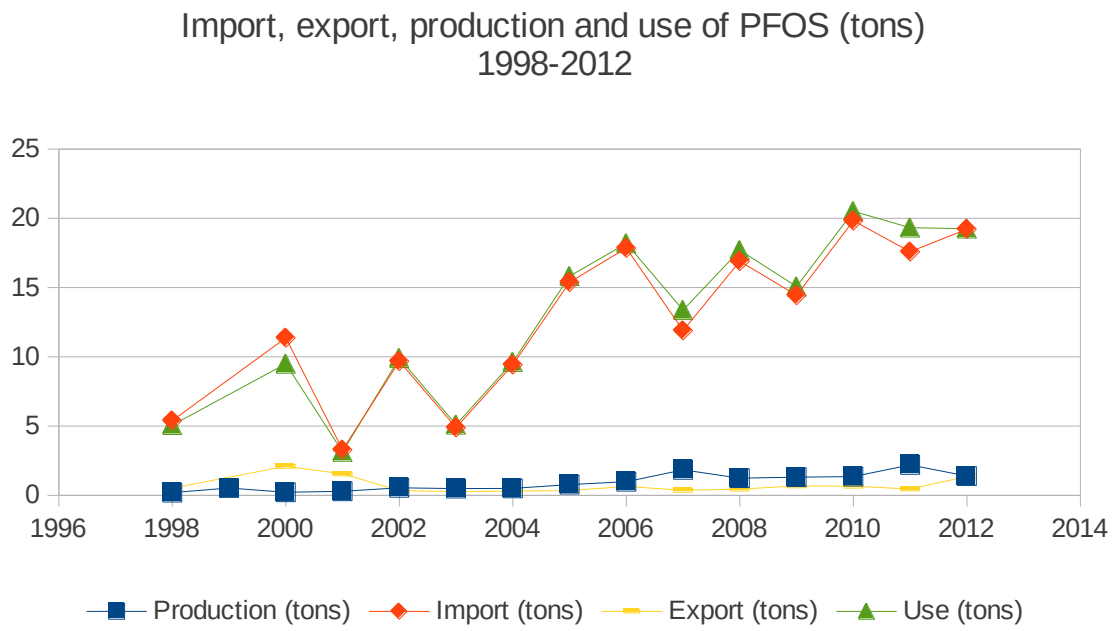

Figure 1. Time trend of Import, export, production and use of PFOS in Armenia

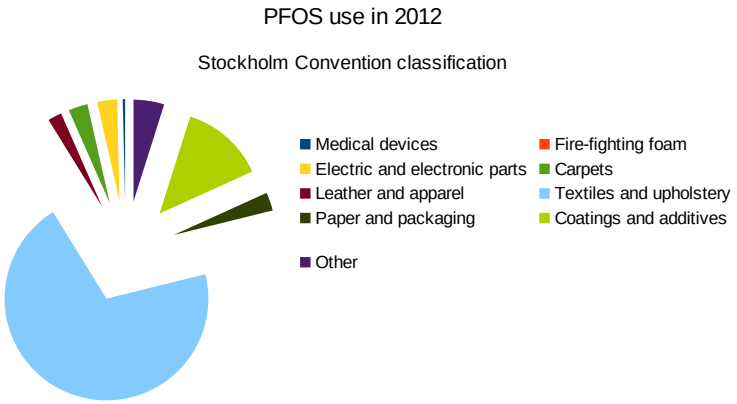

Figure 2. PFOS use in 2012 in different sectors

Table. PFOS use in 2012 in different sectors

Source sector	Use (tons)	Use (%)
Photo-imaging	0.03	0.15
Medical devices	0.07	038
Fire-fighting foam	0.00001	0.00
Electric and electronic parts	0.6	3.14
Carpets	0.58	3.06
Leather and apparel	0.42	2.20
Textiles and upholstery	13.32	69.96
Paper and packaging	0.56	2.92
Coatings and additives	2.53	13.31
Other	0.93	4.87
Total	**19.04**	**100**

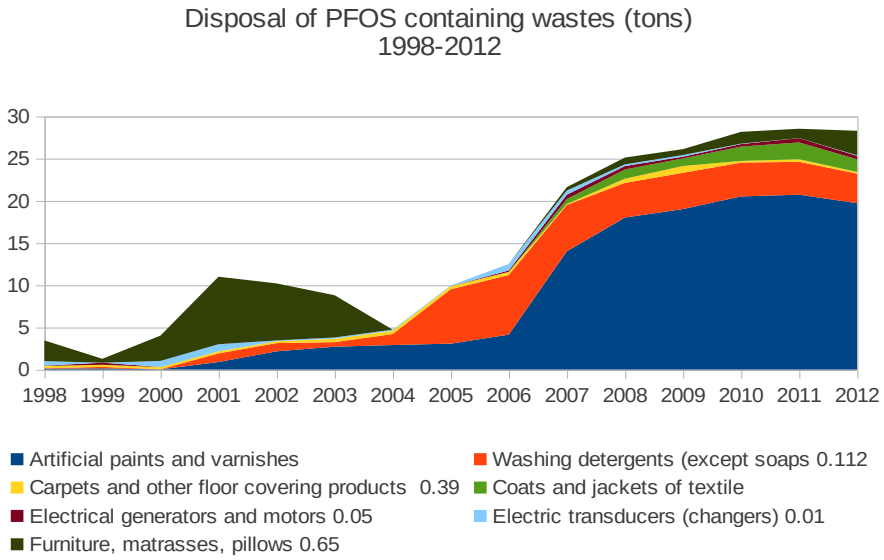

Figure 3. Disposal of PFOS containing goods in Armenia between 1997 and 2012

The second largest user of PFOSs is the coating and additive industry with 13% (2.5 tons) and the third largest user of PFOSs is the sector mainly including consumer goods: washing detergents, sanitary and household items, and antioxidants.

The use of PFOSs in the latter sector is not allowed as per Part III of Annex B of the Stockholm Convention.The PFOS inventory exercise also estimated generation of PFOS containing wastes. Time trend analysis of the most significant sectors is presented in Figure 3.

Looking at the PFOS content of the wastes which were disposed of between 1997 and 2012 (Figure 4) we can observe the same trend what we could see in the case goods and articles. Since 2004 there is a steady growth in the PFOS amount that was landfilled. The share of paints have dramatically increased. Since 2009 the share of PFOS of upholstery origin is also increasing. These are the two sectors that would require attention and actions from the government.The recent inventory shows that the most part of PFOS and PFOS containing products are imported into Armenia mostly as consumer goods. Considering the increasing demands of the population as well as the existing industrial capacities, without specific regulatory measures no significant changes are expected in this trend. It can also be concluded that regulatory measures are necessary to investigate whether PFOS and related chemicals are present in consumer goods people use regularly like washing detergents and reduce, where feasible eliminate, the import of PFOS containing products.

Based on the use of PFOSs in 2012 (Figure 2 above) the following exemptions should be requested for PFOS under the Stockholm Convention: acceptable purposes: photo imaging, medical devices; aviation fluids; specific exemptions should be requested for electric and electronic parts, carpets, leather and apparel, textiles and upholstery, paper and packaging, coatings and additives sectors. The use of PFOS can realistically be stopped/banned in fire-fighting foams, the paper and packaging and carpets sectors. Measures should be implemented to reduce the use of PFOSs in the textile and upholstery industries as they are the largest consumers of PFOSs. The use of PFOSs in the "other sector" such as consumer goods, detergents, antioxidants, etc, should be banned in case further analytical investigations confirm the use of these chemicals

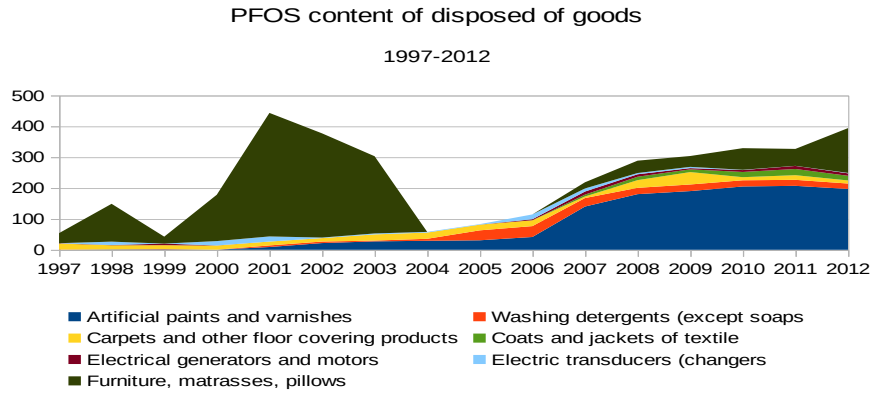

Figure 4. PFOS content of disposed of goods between 1997 and 2012

PFOS related country measures [*NIP, 2017*] should:

1. Start with development of a detailed inventory including analytical confirmation of PFOS and related chemicals use in Armenia;

2. File for acceptable purpose and specific exemption for the use of PFOS in identified sectors;

3. Introduce regulatory control on the import and export of PFOS containing products and chemicals;

4. Ban the use of PFOSs in detergents, beauty products, household chemicals and antioxidants;

5. Develop a phase-out plan for PFOSs from fire-fighting foams, paper and packaging applications and the carpet sector;

6. Provide public awareness on the environmental and health risks of PFOS and related chemicals;

7. Strengthen enforcement bodies, such as customs, environment and health inspectorates; and

8. Strengthen monitoring bodies, including laboratories for the PFOS related duties.

References

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