RECOMMENDATIONS FOR THE REDUCTION OF HAZARDOUS SUBSTANCES IN LITHUANIA

2011

The project "Baltic Actions for the reduction of Pollution of the Baltic Sea from Priority Hazardous Substances" (BaltActHaz) is co-financed with the contribution of the LIFE+ financial instrument of the European Community /Project nr. LIFE07 ENV EE 000122/.

Funded by:

This study is prepared in the frame of the project "Baltic Actions for the Reduction of Pollution of the Baltic Sea from Priority Hazardous Substances" (BaltActHaz) supported by LIFE+ financial instrument of the European Community /Project no. LIFE07 ENV EE 000122/, Estonian Environmental Investment Centre, Ministries of Environment of Lithuania and Latvia, Ministry of Social Affairs of Estonia.

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A. Introduction

A.1. Introductory overview

One of the key issues within the project "Baltic Actions for the Reduction of Pollution of the Baltic Sea from Priority Hazardous Substances" (BaltActHaz) was to investigate the **occurrence** of selected WFD, HELCOM priority substances and nationally important pollutants in the environment as well as to track them down to the **sources** in order to work further on the **reduction of discharges or phase out of hazardous substances from the sources**.

The results of screening of hazardous substances in the environment, WWTPs as well as investigation of potential sources of hazardous substances in Estonia, Latvia and Lithuania are described in the separate reports, which are available for download on the project website ***www.baltacthaz.bef.ee***.
In addition to other available data, this information has further served as background for the analysis of hazardous substances of concern and investigation of their reduction measures.

This report focuses on several major issues:

- legal references towards the reduction of the emission of hazardous substances,
- assessment of relevance of hazardous substances to Lithuania based on monitoring/screening data, available information on use, emissions, regulatory status as well as existing measures for the management of those substances,
- detailed analysis of the emissions of relevant hazardous substances/ substance groups,
- identification of potential general and substance specific measures for the reduction of those relevant hazardous substances/ substance groups,
- compilation of data sheets to present the available information on substances in a compact form (i.e. nomenclature and substance features, substance specific regulations, production and application, approaches for emission abatement measures and literature).

The report is mainly targeted to the authorities that are responsible for the implementation and enforcement of policies for the control of hazardous substances (WFD and HELCOM BSAP), especially those developing emission reduction programmes and setting the specific reduction measures for the hazardous substances.

A.2. Summary

A.2. 1. Background and objectives

Background

The Water Framework Directive (WFD) requires that surface waters in Europe must reach a good status by 2015. The prerequisite for this is achieving a good chemical status. It means that the environment quality standards for surface waters established for the selected priority substances (PS) and priority hazardous substances (PHS) by the directive 2008/105/EC should not be exceeded.
Furthermore, the **Baltic Sea Action Plan (BSAP) under HELCOM** is also aiming at achieving good ecological status of the Baltic marine environment.
These aims are targeted by implementing **specific emission control measures** on the national level by Member States to progressively reduce discharges, emissions and losses of priority substances and by stopping or phasing out discharges, emissions and losses of priority hazardous substances. WFD requires to identify and implement those measures through River Basin Management Plans, while BSAP targets it through the development and implementation of specific national programmes for the implementation of BSAP.

There are also other important documents, which address the reduction of hazardous substances either in the Baltic Sea Region or in whole Europe, e.g.:

- EU Strategy for the Baltic Sea Region,
- Authorisation of substances of very high concern (SVHC) under REACH regulation.

Objective of the study

The objective of this study was **to analyse the emission situation of the selected hazardous substances** and **to elaborate proposals for limiting emissions** under specific consideration of the situation in Lithuania.

A.2. 2. Main conclusions on the relevance of hazardous to Lithuania

The relevance of the substances results mainly from the available monitoring/screening results on the pollution of Lithuanian waters. There are detailed data for some of the substances (e.g. heavy metals), but only few checks for others (e.g. chloroalkanes, brominated diphenyl ethers, octylphenols etc.). Therefore, when assessing the relevance, the existing information on production, application and emission situation was evaluated as well.

The evaluation showed that at present:

- Organotin compounds, phenols and their ethoxylates, phtalathes and their ethoxylates, polybrominated diphenylethers, chloralkanes (SCCP and MCCP) are relevant for Lithuania, e.g. may result in or contribute to potential failure of WFD, BSAP objectives,
- PFOS and PFOA are not very relevant, e.g. they do not contribute to potential failure of WFD, BSAP objectives.

The emission pathways (urban areas, municipal sewage plants, industrial discharges, agricultural areas, old hazardous sites, products, atmospheric deposition) were analysed in detail for the substances classified as relevant for Lithuania.

A.2. 3. RESULTS ON THE PROPOSED MEASURES

The resulting emission focal points as well as possible starting points for mitigation measures are summarized in Table 1.

Table 1. Summary table

Priority Substance	Action type required (according to WFD and "Wastewater regulation")	Relevant source	Control of emissions, discharges and losses
Organotin compounds (mainly TBT)	Emissions, discharges and losses of TBT (cation) should be ceased	***Industry:*** Yes, found in discharges from 10 industry branches. ***Agricultural areas***: Yes, if organotin compounds containing sludge is applied to the soils (see WWTP). ***Products:*** Yes, mainly from ship hulls. From other products – other than TBT compounds found in effluents from households and supermarkets. ***WWTPs***: For TBT – no: it is dealkylated to MBT, or end up in sludge. For other organotin compounds – yes. ***Landfills:*** For TBT – perhaps no, for other organotin compounds – yes. ***Historical pollution:*** TBT accumulates in sediments.	Chemical substitution. Proper handling of shipyards wastewaters. Proper dredging and disposal of sediments. Situation analysis in shipyards. Ban the use of TBT contaminated sludge as soil improver.
Nonylphenols and their etoxylates (NP/NPE)	Emissions, discharges and losses of 4-n-NP should be ceased	***Industry:*** Yes, found in discharges from 16 industry branches. High concentrations detected from paint production. ***Agricultural areas***: Yes, if NP(E) containing sludge is applied to the soils. ***Products:*** Yes, also maybe from imported articles (textiles, cleaners). Found in effluents from households and supermarkets. ***WWTPs***: Yes. Found in discharges. ***Landfills:*** Yes. Found in landfill's leachate.	Chemical substitution. Ban of NP(E) containing textiles. Ban the use of NP(E) contaminated sludge as soil improver. Market surveillance for NP(E) in cleaning agents.
Octylphenols and their ethoxylates (OP/OPE)	Progressively reduce emissions, discharges, and losses of n-tert-OP	***Industry:*** Yes, found in discharges from 15 industry branches. ***Agricultural areas***: Yes, if OP(E) containing sludge is applied to the soils. ***Products:*** Yes. Found in effluents from households and supermarkets. ***WWTPs***: Yes. Found in discharges. ***Landfills:*** Yes. Found in landfill's leachate.	Chemical substitution.
Phtalathes and their ethoxylates (mainly DEHP)	Progressively reduce emissions, discharges, and losses of DEHP	***Industry:*** Yes, found in discharges from 6 industry branches. High concentrations detected from car washing. ***Agricultural areas***: Yes, if phthalates containing sludge is applied to the	Chemical substitution. Ban of phthalates in products. „DEHP free" labels.

		soils. ***Products:*** Yes. Found in effluents from households and supermarkets. ***WWTPs***: Yes. Found in discharges during screening in 2006. ***Landfills:*** Yes. Found in landfill's leachate.	
Polybrominated diphenylethers (PBDE)	Emissions, discharges and losses of pentaBDE should be ceased	***Industry:*** Yes, although the relevance has diminished due to bans for PBDE. The use of DecaBDE may still continue (at least in plastic industry). PBDE are present in discharges from at least 10 different industry branches. ***Agricultural areas***: Yes, if PBDE containing sludge is applied to the soils. ***Products:*** Yes, from older articles and maybe from import of articles. Found in emissions from households. ***WWTPs***: No: PBDEs are adsorbed to the particles and end up in sludge. PBDE were determined in sewage sludge of several WWTP during screening in 2006. ***Landfills:*** Yes, historical uses contained substantial amounts of PBDE. Landfills are a gate for PBDE to the environment: they were found to be present in landfill's leachate.	Improved use of DecaBDE in production processes (VECAP Code of Good Practise). Chemical substitution. Market surveillance for PBDE in articles (plastics of EEE, textiles, etc.). Ban the use of PBDE contaminated sludge as soil improver. Setting requirements for flame retarded textiles to be designed more wash-resistant. Establishing of ELV for DecaBDE.
Chloralkanes (SCCP, MCCP)	Emissions, discharges and losses of SCCP should be ceased	***Industry:*** Yes, SCCP found in discharges from 5, MCCP – from 11 industry branches. High concentrations detected from laundries. ***Agricultural areas***: No data. ***Products:*** Yes. Also, washing of textiles might be the reason for high emissions from laundries. ***WWTPs***: Cannot be excluded. ***Landfills:*** Little relevance.	Chemical substitution.
Perfluortensides (PFOS, PFOA)	PFOS is subject to review under the WFD	***Industry:*** Yes, but does not seem to be widespread in Lithuania. PFOS/ PFOA were found in emissions from three industry branches. ***Agricultural areas***: No data. ***Products:*** Probably from older articles. However, not found in emissions from households. ***WWTPs***: Little relevance ***Landfills:*** Yes, currently the major source in Lithuania: PFOS/ PFOA were found in most of the analyzed samples. Historically PFOS and PFOA were more widely and in higher concentrations used in products.	Chemical substitution. Advanced treatment of PFOS/ PFOA contaminated waters. Consumer awareness raising and labelling of products.
General measures for all			Source analysis.

substances:			Proper implementation of IPPC. Extending the scope of permitting. Inclusion of environmental criteria in public procurement procedures. Control/ treatment of landfill effluents. Advanced municipal waste water treatment and pretreatment of industrial waters. Obtaining an official confirmation on the absence of priority substances. Informing industries and society.

B. Legally binding Strategic Aims towards the reduction of Hazardous substances

The Water Framework Directive (2000/60/EC)

The Water Framework Directive (2000/60/EC) was issued to establish a new, comprehensive regime for the protection of inland surface waters, transitional waters, coastal waters and groundwater inter alia through measures against chemical pollution by priority (hazardous) substances (Article 1, c). The WFD Article 16 requires the Commission to bring forward specific proposals for priority substances in surface waters. The WFD specifies the long-term goals for priority substances, which are:

- to prevent deterioration for surface and groundwater,
- to achieve **good chemical status** for surface water and groundwater in **2015** by protection, enhancement and restoration of all surface water and groundwater bodies;
- to progressively **reduce pollution from priority substances** and **ceasing or phasing out emissions, discharges and losses of priority hazardous substances** to surface waters by **2020** (i.e. within 20 years after adoption of the Commission's proposals).

The WFD considers the objective of "**good chemical surface water status**" to be achieved in a water body if concentrations of pollutants do not exceed the relevant EQS established at Community level by the directive **2008/105/EC**.
Environmental quality standard (EQS) means *"the concentration of a particular pollutant or group of pollutants in water, sediment or biota which should not be exceeded in order to protect human health and the environment"* (Article 2 (35)).
Environmental quality standards (EQS) are differentiated for inland surface waters (rivers and lakes) and other surface waters (transitional, coastal and territorial waters). Two types of EQS are set:

- **annual average concentrations** for chronic effects, i.e. protection against long-term irreversible consequences;
- **maximum allowable concentrations** for short-term ecotoxic effects due to the direct and acute exposure.

HELCOM Baltic Sea Action Plan

The environment ministers of the countries bordering the Baltic Sea and the European Commission on 15 November 2007 decided on a joint action programme - **HELCOM Baltic Sea Action Plan** to achieve the good ecological status of the Baltic marine environment by 2021.

This objective consists of four intermediate objectives:

- a Baltic Sea unaffected by eutrophication,
- **Baltic marine life unaffected by hazardous substances**,
- favourable conservation status for the biodiversity of the Baltic Sea and
- environmentally friendly shipping in the Baltic Sea.

The ecological objectives set out for hazardous substances in BSAP:

- to reach concentrations of hazardous substance close to natural levels,
- to ensure that all Baltic fish are safe to eat,
- to safeguard the health of wildlife, and
- to reach pre-Chernobyl levels of radioactivity.

The actions on hazardous substances in the action plan focuses on nine organic hazardous substances/ groups of substances, and two heavy metals. According to the plan, the Baltic Sea countries were required to draw up **national implementation plans by 2010**.These plans will then be assessed at a ministerial meeting in 2013.

There are also other important documents, which address the reduction of hazardous substances either in the Baltic Sea Region or in whole Europe, e.g.:
- EU Strategy for the Baltic Sea Region
- Authorisation of substances of very high concern (SVHC) under REACH regulation.

EU Strategy for the Baltic Sea Region

On 14 December 2007, the European Council in its Presidency conclusions invited the European Commission to present an EU Strategy for the Baltic Sea Region (EUSBSR). Prior to this, the European Parliament had called for a strategy to address the urgent environmental challenges arising from the increasingly visible degradation of the Baltic Sea. With its adoption by the European Council on 29 and 30 October 2009, the EUSBSR became the first macro-regional strategy in the EU[1]. This is an integrated framework to address the challenges and opportunities of the Baltic Sea Region on the regional level as the responses at national or local level may be inadequate.

Four key challenges have been identified as requiring urgent attention:
- **to enable a sustainable environment**,
- to enhance the region's prosperity,
- to increase accessibility and attractiveness,
- to ensure safety and security in the region.

The pillar 'to make the Baltic Sea Region an environmentally sustainable place' covers the following priority areas:
- to reduce nutrient inputs to the sea to acceptable levels;
- to preserve natural zones and biodiversity including fisheries;
- **to reduce the use and impact of hazardous substances;**
- to become a model region for clean shipping;
- to mitigate and adapt to climate change.

The priority areas are implemented through detailed actions which are described in the action plan. The actions to be designed to address specific important issues and to bring very concrete results. In most cases they are implemented through the so-called flagship projects. The highlighted actions are targeting the following issues:
- full implementation of the key Directives and Regulations relating to chemicals (in particular in the aquatic environment), i.e. **REACH Regulation EC No 1907/2006** and **Directive 2008/105/EC on environmental quality standards** in the field of water policy,
- full implementation of already decided international agreements and realted actions, i.e. **Stockholm Convention** on Persistent Organic Pollutants, the Convention on **Long-range Transboundary Air Pollution**, **Antifouling Convention** by the International Maritime Organisation (IMO),
- the **Helcom Baltic Sea Action plan** should be a basis for actions for environmental improvements,
- **restriction of the input of hormone-like substances**, i.e. further analysis of the sources, flows and impacts of pharmaceutical products in the marine environment,
- **assessment of the need to clean up contaminated wrecks and chemical weapons**,

[1] The 'EU Strategy for the Baltic Sea Region' is described in three documents: (1) a Communication from the European Commission to the Council and the European Parliament, (2) an associated Action Plan which complements the Communication, presented to the Council and European Parliament at the same time and (3) a Working Document of the European Commission's Services which presents the background, approach and content of the strategy.

- **continue the research on hazardous substances** of specific concern to the Baltic Sea, as this is an area where there is a need to improve further the knowledge basis (e.g. on their interaction and cumulative effects).

Regulation EC No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemical substances (REACH)

One of the key elements of REACH – authorization, specifically addresses the substances of the very high concern (SVHC), among which also the ones hazardous to the environment are included.
SVHC are defined in Article 57 of Regulation (EC) No 1907/2006 ("the REACH Regulation") and include substances which are:

- Carcinogenic, Mutagenic or toxic to Reproduction (CMR), meeting the criteria for classification in category 1 or 2 in accordance with Directive 67/548/EEC. This directive was recently replaced by the new EU regulation (EC) No 1272/2008 on classification, labelling and packaging of chemical substances and mixtures, the so-called CLP Regulation. According to the new CLP Regulation these substances shall be classified as 1a or 1b.
- **Persistent, Bioaccumulative and Toxic (PBT)** or **very Persistent and very Bioaccumulative (vPvB)** according to the criteria in Annex XIII of the REACH Regulation,
- Identified, on a case-by-case basis, from scientific evidence as causing probable serious effects to human health or the environment of an equivalent level of concern as those above (e.g. **endocrine disrupters**).

The aim of the authorisation process under REACH is to assure that the risks from substances of very high concern (SVHC) are properly controlled and that these substances are progressively replaced by suitable alternatives where these are economically and technically viable.
Substances on the Authorisation List cannot be placed on the market or used after the so called "sunset date". Unless specific exceptions apply, these substances may be placed on the market only if an authorisation has been granted for a specific use, or the use has been exempted from authorisation.

Currently on the **Authorization List**[2] there are some substances of concern for the Baltic Sea, e.g. **hexabromocyclododecane (HBCDD), phthalates, musk xylene**. Their use will not be allowed without authorization from 2014 or 2015 dependant on the substance.
Some more substances of concern for the Baltic Sea are still included into so-called **Candidate list[3]** for the authorization, e.g. **Short Chain Chlorinated Paraffins, Bis(tributyltin)oxide (TBTO).** These substances are the candidates for possible inclusion in the Authorisation List (Annex XIV of REACH) in future.
Furthermore, ECHA invites interested parties to comment whenever Member State Competent Authorities or ECHA propose a substance to be identified as a SVHC and to be placed on the Candidate List[4].

Therefore if country has some specific data or concerns regarding one or another hazardous substance to environment, the authorization procedure could serve as a tool for the emissions reduction of that substance, i.e. Member State can propose substance for identification as SVHC and inclusion to Authorisation list or can contribute with available data, information on concerns during the commenting phase of proposals made by others.

[2] http://echa.europa.eu/reach/authorisation_under_reach/authorisation_list_en.asp
[3] http://echa.europa.eu/chem_data/authorisation_process/candidate_list_table_en.asp
[4] http://echa.europa.eu/consultations/authorisation/svhc_en.asp

C. Analysis of the situation

C.1. Assessment of Relevance of hazardous Substances to Lithuania

The assessment of the relevance of hazardous substances to Lithuania covered the following substances and substance groups, prioritized under the various frameworks:

Substance groups / Individual substances:
Organotin compounds (mainly TBT)
Phenols and their ethoxylates (NP, NPE, OP, OPE)
Phthalates and their ethoxylates (mainly DEHP)
Brominated diphenylethers (Penta-BDE, Octa-BDE, Deca-BDE)
Chloralkanes (SCCP and MCCP)
Perfluortensides (PFOS and PFOA)

Overview of environmental concentrations is presented for a wider range of substances/ groups of substances, and in addition to those mentioned above includes also heavy metals, chlorinated organic pesticides, endosulfan, and volatile organic compounds (mainly chloroform).

Priority substances are very diverse in their use and formation, emission pathways, share of emissions into water as well as with regard to the quality and coverage of the available information.
Therefore in order to be able to make an up-to-date assessment of the relevance of the substances for the country, different aspects were analysed for each substance:

1. Assessment of current monitoring data (what is the current level of pollution of waters with regard to the priority substances?).
2. Assessment of the available information with regard to production and use as well as the emission situation in the country. This evaluation is of particular relevance for those substances for which there are insufficient monitoring data.
3. Assessment of regulatory status.

C.1. 1. Assessment of monitoring data

Some hazardous substances have been investigated in surface waters for a long time and there are detailed monitoring results available for these substances in Lithuania (e.g. heavy metals, PAHs, some pesticides). Other substances have not been examined more closely and were targeted only through some screening exercises within different projects because of lacking laboratory capacities, inadequate methods of analysis or lack of resources (e.g. short-chain chloroparaffins, brominated diphenyl ethers, nonyl- and octylphenol etc).

National monitoring

A new State environmental monitoring program was started in 2011, and it will last till 2016. The other recent programs were valid for the years 2006-2010 and 1997-2004. Heavy metals were among the traditionally monitored parameters. Since 2010, the number of monitored substances has increased; among the measured substances were TBT, 4-n-nonylphenol, 4-n-octylphenol, 4-tert-octylphenol, and DEHP. There were 14 sampling sites in rivers (Nemunas, Neris, Mūša-Nemunėlis, Venta, Akmena, Bartuva, Šventoji, Minija, Varduva). The latter monitoring program since 2011 was further extended. In addition to the previous substances and their groups, it mentions also a technical mixture of nonylphenols, bisphenol A, dibutylphthalate (DBP), hexachlorobutadiene (HCBD).
In general, the monitoring covers rivers, lakes and Curonian lagoon including their sediments.

“Screening of dangerous substances in the aquatic environment of Lithuania”

The project has been carried out by Lithuanian Environmental Protection Agency, Finish Environmental Institute, Baltic Environmental Forum, and Centre of Environmental Protection Policy. The main objective of the project was to investigate the occurrence of selected WFD priority substances and some other pollutants in wastewater, sewage sludge and the receiving environment (surface water and sediments) and obtain measurement data on their concentrations. All together the project covered 44 sites, where 9 hazardous substance groups were analyzed. Also ecotoxicity tests were performed for 37 sites: 25 WWTP and 12 for the surface water. Samples were taken in 2006.

“Screening study on occurrence of hazardous substances in the eastern Baltic sea”

A screening study was performed in the eastern Baltic Sea environment (fish and sea water) on the occurrence of eight of the substances/ substance groups identified as hazardous under the Baltic Sea Action Plan. The sampling was carried out by institutes in various countries (Center of Marine Research in Lithuania), and analysis performed by IVL and NILU. Samples were taken in 2008. Two of the sampling sites were in Lithuania:

- coastal area north from Klaipėda (3 samples of flounder, 3 samples of herring, and 2 samples of water), and
- open sea area north-east from Klaipėda (1 sample of flounder, 1 sample of herring and 2 samples of water).

- ***Metals***

Heavy metals are among the most systematically monitored hazardous substances. However, concentrations of Cd, Hg, Pb and Ni in most cases do not exceed environmental quality standards. There are just separate cases and well-known problematic water bodies. E.g. Kulpė, Sidabra, Nevėžis below Panevėžys, etc.

Metals (Cd, Ni, Pb, As, Cu and Zn) and their compounds were investigated in 31 site (different than monitoring sites) during the “Screening of dangerous substances in the aquatic environment of Lithuania”. Their concentrations in wastewater and surface water in most cases were below the established limit values (ELV) and environmental quality standards (EQS), correspondingly. There was just one case for Zn (408 µg/l in wastewater from “Dzūkijos vandenys”), were ELV was slightly exceeded, and one case for Cu (13 µg/l in surface water in the port territory near Klaipėda channel), were EQS was slightly exceeded. The most contaminated site (with regard to metals) of the investigated water bodies was sediments of Nevėžis below Panevėžys for Cd (1,8 µg/kg), Pb (63 µg/kg), Ni (11 µg/kg), Cu (57 µg/kg), Hg(0,53 µg/kg) and Zn (240 µg/kg). Zn concentrations in bottom sediments of water bodies are the highest of all investigated metals as well (4,4 – 240 µg/kg). Sewage sludge accumulates the biggest amounts (compared to other metals) of zinc: 199 - 1140 µg/kg. Thus, metals were present in all sites, but their concentrations in most cases were not of concern.

- ***Organotin compounds***

According to the annual average data of the State monitoring, TBT was not found in 2010.

Organotin compounds (TBT, TBT cations, DBT, MBT, also compounds of tetrabutyltin, monooctiltin, dioctyltin, tricyclohexyltin, monophenyltin, diphenyltin, and triphenyltin) were investigated during the “Screening of dangerous substances in the aquatic environment of Lithuania”. Organotin compounds were found in surface waters below big towns – Kaunas, Sovetsk, Panevėžys (0,004 µg/l of TBT, 0,01 – 0,006 µg/l of DBT, and 0,008 µg/l of MBT). These concentrations are above environmental quality standards (0,0015 µg/l for TBT according to Wastewater Regulations in Lithuania). High TBT and its transformation product concentrations, exceeding EQS (0,02 µg/kg for TBT), were also found in bottom sediments of rivers. TBT were up to 8,3 - 585 µg/kg, DBT up to 1,9 – 100 µg/kg, MBT up to 1,4 – 150 µg/kg. Especially high TBT, DBT and MBT concentrations were determined in sediments of Klaipėda channel and in the port territory. Of other organotin compounds, octyltin was present in bottom sediment samples.

Organotin compounds were investigated in fish during the screening in the eastern Baltic sea. TBT was present in 3 samples of herring in both investigated sites (3,1 – 6,4 ng/g f.w.). DBT was present in one sample of flounder in coastal area (2,1 ng/g f.w.). DPhT was present in all 4 samples of flounder and in 2 samples of herring (2,3 – 4,6 ng/g f.w). Other organotin compounds were not found.

- ***Phenols and their ethoxylates***

According to the average annual data from State monitoring, 4-n-nonylphenol, 4-n-octylphenol, and 4-tert-octylphenol were not found in 2010.

A rather big variety of phenols and their ethoxylates, among them nonylphenols and their etoxylates, and octylphenols and their ethoxylates, were investigated during the "Screening of dangerous substances in the aquatic environment of Lithuania". Iso-nonylphenol was present in water of Nevėžis below Panevėžys (373 µg/l). Of other compounds, only 4-t-octylphenol was present in surface water (7 sites), but in low concentrations. High iso-nonylphenol concentrations were found in sediments of the river Nemunas near Rusnė (3220 µg/kg), and in sediments of Nevėžis below Panevėžys (373 µg/kg). NPEs were not detected neither in water, neither in sediments.

NP was found in water samples (29 – 50 ng/l) and in one (out of eight) sample of biota (12 ng/g f.w.) during the screening in the eastern Baltic sea. OP was found in one water sample (1,2 ng/l). No other phenols or their ethoxylatyes were present in waters. However, nearly all biota samples contained bisfenol A (0,95 – 3,9 ng/g f.w.).

- ***Phthalathes and their ethoxylates***

According to the average annual data from State monitoring, DEHP was not found in 2010. However, both DEHP and DBP were found in majority of investigated sites during the monitoring in 2011.

DEHP was found (0,09 – 3,45 µg/l) in nearly all samples of surface water during the "Screening of dangerous substances in the aquatic environment of Lithuania", often being close or exceeding the environmental quality standards. It was also found in bottom sediments. Surface water contained also DBP (0,07 – 1,25 µg/l) and DIBP (0,24 – 5,6 µg/l).

- ***Brominated diphenylethers***

Various brominated compounds were determined in sediments of the Nemunas river below Rusnė during the "Screening of dangerous substances in the aquatic environment of Lithuania". However, the limit of detection of the method applied for pentabromdiphenylether was too high to make certain judgements.

Polybrominated diphenyl ethers were present in nearly all biota samples (0,014 – 0,18 ng/g f.w. of individual BDEs). BDE47, BDE99, BDE100 andBDE154 were also found in coastal area and in open sea near Klaipėda during the screening in the eastern Baltic sea.

- ***Chloralkanes***

Short chain chlorinated paraffins (SCCP) were investigated during the "Screening of dangerous substances in the aquatic environment of Lithuania", but not detected in any sample. However, the limit of detection of the method applied was quite high in order to make a certain judgement.
MCCP were not investigated.

SCCP were present in all biota samples (6,5 – 62 ng/g f.w.). At the same time MCCP were not detected in any of two sampling places in the Baltic Sea near Lithuania during the screening in the eastern Baltic sea.

- ***PFOS and PFOA***

Not investigated during the “Screening of dangerous substances in the aquatic environment of Lithuania”.

During the screening in the eastern Baltic sea, PFOS was found in all biota samples (6,1 – 20 ng/g f.w.); PFOA was not detected. The flounder sample from the open sea area north-east from Klaipėda contained quite a big variety of different perfluorinated substances during the screening in the eastern Baltic sea.

- ***Chlorinated organic pesticides***

There are individual cases, when organic pesticides (DDT, Aldrine, Dieldrine, Endrine, Hexachlorbenzene, Pentachlorbenzene, Lindane, Simazine) are detected in some sites, although they are not detected in other sites in most cases of the State monitoring. However, a substantial exceedance of EQS was registered in Nemunas above Druskininkai and in Nemunas below Smalininkai in 2009. Average annual concentrations of aldrine, dieldrine and endrine were 2,5 µg/l for each of them, 0,002 µg/l – for izodrine. Average annual concentrations of other chlorinated organic pesticides were: 0,238 µg/l for simazine and 0,002 µg/l for both pentachlorbenzene and hexachlorbenzene.

Aldrine, dieldrine, endrine, DDT, hexachlorbutadiene, hexachlorcyclohexane, and lindane were investigated in surface water and sediments of 11 sites during the “Screening of dangerous substances in the aquatic environment of Lithuania”. The only finding was hexachlorbenzene in sediments of Šventoji below Anykščiai (22 µg/kg).

- ***Endosulfan***

According to the State monitoring, endosulfan was once detected in Merkys below Puvočiai – 0,001 µg/l in surface water (2005). Concentrations in the Baltic sea in 2006 were the following:

- In Klaipėda strait sediments: beta-endosulfan – 1,7 µg/kg dry w.
- In sediments of other sites of the Baltic sea/Curonian lagoon: alfa-endosulfan – 0,3 µg/kg dry w.; beta-endosulfan – 0,4 µg/kg dry w.

α- and β-endosulfan was not detected in any of biota samples during the screening in the eastern Baltic sea. However, endosulfan sulphate was present in all samples (0,011 – 0,12 ng/g f.w., or 1,5 – 2,7 ng/g l.w.).

- ***Volatile organic compounds***

VOC were investigated in different than monitoring sites during the “Screening of dangerous substances in the aquatic environment of Lithuania”. Benzene, 1,2-dichloetane and tetrachlormetane were not found. Dichlormetane, tetrachlorethylene and trichlorethilene were found, but not in high concentrations. Just chloroform in Venta below Mažeikiai was very high (388 µg/l) and substantially exceeded permissible concentrations (12 µg/l).

- ***Hexabromocyclododecane (HBCDD)***

HBCDD was not detected during the “Screening of dangerous substances in the aquatic environment of Lithuania”.

Summary

Table 2. Summary of environmental occurrence of hazardous substances in the aquatic environment in Lithuania.

Substance groups/ substances	Results of surveys			Overall assessment
	State monitoring	Screening 2006	Screening in the eastern Baltic Sea 2008	
Metals	+	+	No data	**+**
Ni	+	+	No data	+
Cd	+	+	No data	+
Hg	+	+	No data	+
Pb	+	+	No data	+
Organotin compounds	—	!	+	**+ (!)**
TBT	—	!	+	+ (!)
DBT	No data	!	+	+ (!)
MBT	No data	!	—	+ (!)
Octyltin	No data	+	—	+
DPhT	No data		+	+
Phenols and their ethoxylates	— / No data	+	+	**+ (!) / —**
NP	—	+ (!)	+	+ (!)
NPE	No data	—	—	—
OP	—	+	+	+
OPE	No data	—	—	—
Phtalathes and their ethoxylates	— / No data	+	No data	**+/ ! / —**
DEHP	—	!	No data	!
DBP	No data	+	No data	+
DIBP	No data	+	No data	+
Brominated diphenylethers	No data	+	+	**+**
PentaBDE	No data	+	+	+
HBCDD	No data	No data	—	No data
Chloralkanes	No data	—	+	**+ / —**
MCCP	No data	No data	—	—
SCCP	No data	—	+	+
PFOS and PFOA	No data	No data	+	**+ / —**
PFOS	No data	No data	+	+
PFOA	No data	No data	—	—
Chlorinated organic pesticides	+ (!)	—	No data	**+ (!)**
Hexachlorbenzene	+	+	No data	+
Endosulfan	+	No data	—	**+**
α- and β-Endosulfan	+	No data	—	+
Endosulfan sulfate	No data	No data	+	+
Volatile organic compounds	+	+ / —	No data	**+ / ! / —**
Chloroform	+	!	No data	+

! relevant: high environmental concentrations;
+ detected during investigations (however, EQS either not exceeded or not defined);
+ (!) detected during investigations, and high environmental concentrations in some sites of investigation;
? unclear (e.g. too high LOD of the method applied);
— not relevant (not detected during investigations);
No data no statement possible;
+/!/— overall assessment summarizes results from various investigations, which might have contradicting results: a substance was found, was present in high concentrations, or was not detected at all.

C.1. 2. Assessment of Production, Use & Emissions

The production of chemical substances is of a very limited variety in Lithuania. Majority of companies are importers or users of chemical substances. However, data on use and import of chemical substances are rather scarce. Some data are available from the Database on Chemical Substances and Preparations (Infochema) at the Lithuanian Environmental Protection Agency (EPA). However, their dataset is not complete and practically complicated to search. The targeted request on production, use and import was sent to the Lithuanian EPA regarding 7 substances and their groups (organotin compounds, polybrominated diphenylethers, chlorinated paraffins, phthalates, nonyl/octylphenols and their ethoxylates, perfluorotensides, trichloromethane (chloroform)). Partial data were received only regarding trichloromethane, medium chain chlorinated paraffins, and various phthalates. Additionally, Infochema database was searched online for the same mentioned substances plus nickel.
Some data should be available from IPPC permits, but again – information on the use of hazardous substances is not always present in the permits, and there is no electronic search possibility. One more potential data source is the database on discharges – “Vanduo” (engl. “Water”). However, it is rather poor, because it is related to analysis of emissions, which cannot be analysed in Lithuania due to the absence of analytical capacities.
Some information regarding the use, production and import of hazardous substances as such and in the preparations in Lithuania were found available from the previous studies and scientific literature.

Thus, the best possibility to judge about the extent to which hazardous substances are used in Lithuania is via the **emissions situation**. Emissions of hazardous substances were quite comprehensively investigated during the measurement campaign of BaltActHaz project (Report “Investigation of sources of hazardous substances in Lithuania, Latvia and Estonia”, BaltActHaz, 2011). Wastewater and sludge from WWTPs were also analyzed during some previous projects (e.g. “Screening of dangerous substances in the aquatic environment of Lithuania” and COHIBA). By the way, Dir. 2008/105/EC requires from Member States to establish an inventory of emissions, discharges and losses of all priority substances and pollutants listed in Part A of Annex I. These data should be reflected in River basin management plans.

Heavy metals

Production and use
There is no metallurgical industry and metal production from ores in Lithuania. However, metals and their compounds are used widely by various industries (construction materials, batteries, pigments, fluorescent lamps, galvanization processes, fertilizers production and others) and analytical laboratories. Metals and their compounds are present in a huge variety of products as well.

- ***Emissions***

According to Infochema database, Cd was used by analytical laboratories. Placing on the market and use of nickel chloride was reported by 1 company (for metal coating purposes).

Nickel sulphate was used in galvanization, electronic, surface coating and other industrial processes. 1 company has reported about placing on the market of nickel sulphate.

- ***Relevance***

Heavy metals may be considered as relevant substances due to their widespread use and emissions. At the same time, no problematic cases were identified.

Organotin compounds

- ***Production and use***

There is no production of organotin compounds in Lithuania. No information (data) about use of organotin compounds is available.

- ***Emissions***

Survey by BaltActHaz project showed that a variety of organotin compounds are present in effluents from different industries. Especially high TBT concentrations were found in all samples from shipyards: 0,0037 – 14 µg/l, while ELV to sewage system is 0,4 µg/l, to the natural environment – 0,02 µg/l, and AA-EQS is 0,0015 µg/l. Also other organotin compounds – DBT and MBT – were found in samples from shipyards. Since the use of organotin compounds is banned to prevent antifouling of ships, their origin might be not necessarily a new use, but rather the historical pollution from the previous uses.

Emissions from metal processing and leather industries contained a big variety of organotin compounds, and they were present in nearly all the samples, indicating the possibility of quite widespread use of organotin compounds in these industry branches.

A variety of organotin compounds, except TBT, were also present in emissions from pharmaceutical, wood pulp and paper, textile industries.

A smaller variety of organotin compounds, although again in the majority of samples, were present in effluents from plastic and rubber industries, from production of cement/concrete/ asphalt, and from production of panels/ boards.

Apart from industry, organotin compounds were present in effluents of supermarkets and households, indicating their presence in products, also in leakage from landfills. TBT, however, was not found in these samples.

Table 3. Overview of emission sources of organotin compounds in Lithuania.

Industry	No of samples	Substance was found in the following No. of samples				
		TBT Tributyltin	DBT Dibutyltin	MBT Monobutyltin	MOT Monooctyltin	DOT Dioctyltin
Pharmaceutical industry	4		3	3	1	1
Wood pulp and paper production	3		2	2	1	
Metal processing and galvanics	4	1	3	4	2	1
Production of cement/concrete/ asphalt	2			2		
Textile	6		3	3	1	
Leather	4	1	2	3	2	2
Production of panels/ boards	2		1	2		

Plastic	4		1	2		
Rubber	1		1	1		
Shipyards	10	10 (high conc.)	9	10		
Leakage from landfills	4		2	2	1	1
Supermarkets	2		2	2	1	1
Household effluents	4		2	2	2	2
WWTPs	7		1	6		
Surface run-off from car shredding	1		1	1		
Surface runoff from industrial areas	1			1		

"Screening of dangerous substances in the aquatic environment of Lithuania" in 2006 also showed that organotin compounds were present in most of sewage sludge samples. TBT compounds were found in 22 out of 25 samples of sewage sludge (1,5 – 53,2 µg/kg). Also MBT and DBT were found in many samples (37,8 – 886 µg/kg of MBT, and 5,9 – 382 µg/kg of DBT). Of other organotin compounds, octyltin was present in many sewage sludge samples. However, TBT was absent in wastewater samples. This can be explained by the absorption of butyltin compounds, and also by further transformation of TBT (dealkylation to MBT).

In the frame of Cohiba project, analyses of selected organotin compounds were performed in wastewater, sludge, landfill leachate and storm water samples. MBT was found in all samples, except storm water. The obtained concentrations of MBT were in the range from <1,0 to 59,0 ng/l. DBT was found in the waste water samples in the range 0,97 – 1,4 ng/l. All organotin compounds were found in sludge samples (MBT – 450 µg /kg, DBT – 215 µg /kg, TBT – 3,95 µg /kg).

- ***Relevance***

Emissions data show the relevance of organotin compounds. They are emitted from various industry branches, households, are present in effluents from WWTPs, in surface run-off, and in landfill's leachate. Shipyards are of special concern because of high concentrations. The other relevant industries seems to be metal processing, leather, pharmaceuticals, wood pulp and paper, textile, also perhaps plastic, rubber, production of cement/concrete/ asphalt, and production of panels/ boards. The more seldom finding of TBT compared to DBT and MBT compounds may probably be explained by further transformations of TBT, and not necessarily by the more rare use.

Phenols and their ethoxylates

- ***Production and use***

Phenols and their ethoxylates are not produced in Lithuania.
Online search in Infochema database showed that nonylphenol ethoxylates are used by at least three companies in formulation of various cleaners intended for: engines, car windows, cars, dishes, etc. No information about amounts is available.

- ***Emissions***

Survey by BaltActHaz project showed that phenols and their ethoxylates are present in effluents from different industry branches. The following phenols and their ethoxylates were investigated: 4-n-NP, 4-NP, 4-tert-OP, NP1EO, NP3EO, OP1EO, OP2EO, OP3EO. Of them, 4-n-NP was not found in any of the investigated samples. All the others were present in effluents from at least some of the surveyed industry branches, WWTPs, leakage from landfills, household effluents, supermarkets, surface run-off. The highest 4-NP concentration equal to 1100 µg/l was found in emissions from paint industry (no ELV for this substance for comparison; however, ELV for 4-n-NP is 400 µg/l if discharged to the sewage system, and 20 µg/l if discharged to the environment). Concentrations up to about 40 µg/l were also found for various NP and OPE from pharmaceutical, textile and leather industries.

Table 4. Overview of emission sources of phenols and their ethoxylates in Lithuania.

Industry	No of samples	Substance was found in the following No. of samples							
		4-NP	4-tert-OP	NP1EO	NP2EO	NP3EO	OP1EO	OP2EO	OP3EO
Pharmaceutical	4	2	2					2	
Household and industrial cleaning	13	6	6	4	2	1	3	4	2
Wood pulp and paper production	3	2	2	2			1		
Paint production	1	1	1	1					
Metal processing and galvanics	7	4	5	3			2	1	
Printing houses	3	2	3	1			2	1	
Production of cement/ concrete/ asphalt	2	2	1	1			1		
Textile	6	6	4	3	1	1	4		
Leather	4	4	3	4	1	1	2	1	1
Production of panels/ boards	2		1					1	
Plastic	4	2	2	1			3	2	
Rubber	1	1	1	1	1		1	1	
Shipyards	10	5	3						
Oil refinery industry	1								
Laundries	4	4		2	2	2	1	2	2
Car washing	2	2	1	2			1		
Chemical	2								
Regeneration of used oil	1	1	1	1	1	1	1	1	1
Leakage from landfills	4	3	3	2	1			1	1
Supermarkets	2	1		1			1		
Household effluent	4	3	3	2			1		
WWTPs	7	3	5				1	1	1
Surface run-off from car shredding	1		1						
Surface run-off from industrial areas	1	1	1	1	1		1	1	1

"Screening of dangerous substances in the aquatic environment of Lithuania" in 2006 also showed that various phenols and their ethoxylates were present in WWTPs. Nonylphenols and their ethoxylates were found in 23 samples of sewage sludge (145-58000 µg/kg of NP). Iso-nonylphenol was also present in 9 wastewater samples (0.059-1,84 µg/l). Iso-nonylphenolmonoethoxylate was detected in two cases (0,41 and 2,2 µg/l). Some wastewaters contained 4-t-octylphenol, NP1EO, and OP1EO.

During Cohiba project, NP was detected in wastewaters, landfill leachate and also in storm water. Measured concentrations of 4-NP varied from <0,10 µg /l to 0,75 µg /l. All phenolic substances were also found in sludge samples. The results of performed analyses showed that concentrations of 4-nonylphenol and octylphenol did not exceed the limit values at any monitored point in any sampling campaign.

- ***Relevance***

Emissions data show the clear relevance of phenols and their ethoxylates. They are used by formulators of cleaning/ washing products. In addition, phenols and their ethoxylates are extremely widely emitted from various industries (pharmaceuticals, household and industrial cleaning, wood and paper, paint production, metal processing and galvanics, printing houses, production of cement/ concrete/ asphalt, textile, leather, production of panels/ boards, plastic, rubber, shipyards, laundries, car washing, regeneration of used oil, car shredding). There was a case of high concentration emitted from paint production.
Apart of industry, phenols and their ethoxylates are emitted from households, are present in WWTP effluents, in surface run-off, and in landfill's leachate. All this suggest the presence of these substances in products, not just in industrial processes.

Phthalates and their ethoxylates

- ***Production and use***

There is no production of phthalates and their ethoxylates in Lithuania.

Both online search in "Infochema" database, and their provided information show that phthalates were supplied to the Lithuanian market and used by some industrial enterprises during 2008-2010. As a pure substance, DEHP was supplied by two suppliers, DBP – also by two, and DOT – by one. DEHP containing preparations were supplied at least by two, DBP – also by two companies. DEHP was used by at least one company in formulation of water based dyes and in sealants. DBP as a plasticizer was used by two companies in formulation of dyes and coatings, and by one company in the production of PVAD (glues). DOT was used in the production of water based dyes and sealants by one company. No information about amounts is available.

The quantitative investigation of the use of DEHP in Lithuanian furniture industry has been carried out in 2004 (J. Kruopienė and J. Šemetienė, 2004). According to the investigation, Lithuanian furniture industry could have consumed approximately 94,2 tons of preparations containing DEHP in 2003. This included about 1,9 tons of pure DEHP. DEHP was present in a prime and polish, used for furniture finishing.

Phthalates in toys are surveyed by the State Non-Food Products Inspectorate during the Joint market Surveillance action on toys. According to information from Rapex (the EU rapid alert system for all dangerous consumer products, with the exception of food, pharmaceutical and medical devices), about 25 different types of toys (what results in tents of thousands of toy units) were found to contain various phthalates. There was also 1 case of false finger nails containing phthalates. Origin of majority of these articles was China.

- ***Emissions***

Survey by BaltActHaz project showed that of all phthalates namely DEHP is the most often present in effluents from various industry branches, also from households and WWTPs. DEHP was found in effluents from paint production (up to 3,5 – 26 µg/l), shipyards (up to 2,3 – 6,5 µg/l), car washing (20 and 71 µg/l), household effluents (up to 2,3 – 12 µg/l), supermarkets (17-36 µg/l), leakage from landfills (2,3 – 59 µg/l), etc. For comparison – emission limit value to sewage collection system for DEHP is 40 µg/l, and emission limit value to the environment is 2 µg/l (according to Wastewater Regulation in Lithuania).

In some samples from paint production, shipyards, car washing, household effluents, supermarkets and leakage from landfills also other phthalates, such as dietylphthalate, di-isobutylphthalate, di-nbutylphthalate, butylbenzylphthalate, were found. A case of high concentrations was registered for DIBP in emissions from car washing (68 μg/l).

Table 5. Overview of emission sources of phthalates and their ethoxylates in Lithuania.

Industry	No. of samples	Substance was found in the following No. of samples			
		DEHP	DEP	DIBP	DBP
Paint production	1	1	1	1	
Metal processing	4	4	1		
Plastic	4	1			
Rubber	1				
Shipyards	10	3	1	1	1
Production of building materials	1	1			
Car washing	2	2 (high conc.)	2	1 (high conc.)	1
Chemical industry	2				
Regeneration of used oil	1	1			1
Leakage from landfills	4	4 (high conc.)	1	1	1
Supermarkets	2	2	1	1	1
Household effluents	4	2	2		
WWTPs	7				
Surface run-off from car shredding	1				

"Screening of dangerous substances in the aquatic environment of Lithuania" in 2006 also showed that various phthalates and their ethoxylates were present in WWTPs. DEHP was found the most often and in the highest concentrations. In total, phthalates were found in 22 wastewater samples out of 25 investigated, and in all 25 samples of sewage sludge. The following phtalathes were found the most often: di-2-ethylhexylphtalathe (DEHP), dibutylphtalathe (DBP), diisobutylphtalathe, and diiso- nonylphtalathe. The highest concentration was for DEHP (0,42 – 53,2 μg/l in wastewater), with 4 cases of exceeded permissible concentration.

- ***Relevance***

Emissions data show the relevance of phthalates and their ethoxylates, especially of DEHP. They are emitted from various industry branches, households, are present in landfill's leachate. Paint production due to wide presence of phthalates, and car washing due to wide presence and high concentrations seem to be of special concern. Household effluents and presence of phtalathes in effluents from supermarkets suggest the possibility of wide-spread presence of phthalates in products. One of the samples from supermarkets contained 36 μg/l of DEHP, what is very close to ELV (40 μg/l). Also, DEHP was widely present in landfills leachate, including cases of high concentration.

Brominated diphenylethers

- ***Production and use***

There is no production of brominated diphenylethers in Lithuania.

According to Infochema database, no use of BDEs in Lithuania has been documented. The Institute of textile in Lithuania has ensured that HBCDD is not used for textile production in Lithuania: if flame retardants are used, these are other than brominated substances.

- ***Emissions***

Survey by BaltActHaz project showed that some PBDE are present in effluents from wood pulp and paper production, printing houses, textile industry, leather industry, plastic industry, shipyards, production of building materials, laundries, car washing, leachate from landfills, etc. The most often were found the following PBDE: PBDE47, PBDE99, PBDE100, in plastic industry, shipyards and laundries – also PBDE196, PBDE197, PBDE203, NBDE, PBDE209, and HCBDD. Of the industry branches, laundries seem to be the most relevant due to rather widespread presence of various PBDE in their emissions, and also plastic industry, where concentration of PBDE209 was recorded 34 µg/l in one sample (no ELV is established for comparison). PBDE47 and PBDE99 were present in all analyzed samples from landfills.

Table 6. Overview of emission sources of brominated diphenylethers in Lithuania.

Industry	No. of samples	Substance was found in the following No. of samples			
		PBDE47	PBDE99	PBDE100	PBDE209
Wood pulp and paper	3	2	2		1
Metal processing and galvanics	7		1		
Electronic industry	1				
Printing houses	3	1	2		
Textile	6	1	1		
Leather	4	3	2		1
Plastic	4	1	1	1	1
Rubber	1				
Shipyards	10	3	3		1
Production of building materials	1	1	1		
Laundries	4	4	4	2	1
Car washing	2	2	1		
Chemicals					
Regeneration of used oil	1				
Leaking from landfills	4	4	4	1	
Supermarkets	4		1		
Household effluents	4	2	2		
WWTPs	7				
Surface run-off from car shredding	1	1	1		
Surface run-off from industrial areas	1	1	1	1	1

"Screening of dangerous substances in the aquatic environment of Lithuania" in 2006 also showed that various brominated diphenylethers were present in WWTPs. They were found in sewage sludge of several WWTPs, in the range of 5,1 – 3410 µg/kg for different congeners. However, the limit of detection of the method applied for pentabromdiphenylether was too high to make certain judgements.

Also during Cohiba project, brominated diphenyl ethers were detected in industrial wastewaters, municipal wastewaters, sludge and landfill leachate.

- ***Relevance***

Polybrominated diphenylethers may be considered as a group of substances relevant to Lithuania according to their emissions. This group contains a rather big variety of substances, and not all of the substances are present in effluents of the target industries. However, certain industry branches (mainly laundries, car washing, plastic industry, also others) emit a variety of PBDE (PBDE47, PBDE99, PBDE100, PBDE209).

Chloralkanes

- ***Production and use***

There is no production of chloralkanes in Lithuania.

MCCP is recorded in Infochema database. One company has imported 68,93 t MCCP in 2007, and 70,82 t MCCP in 2008 for a wholesale.

- ***Emissions***

Emissions of both short and medium chain chlorinated paraffins were investigated during the BaltAct Haz project. It was shown that MCCP were present in samples from nearly all the investigated industry branches. SCCP were present in fewer samples. There was one case of high SCCP concentration: it was 53 µg/l from a laundry, while emission limit value for SCCP to the sewage collection system is 40 µg/l (according to Wastewater Regulation in Lithuania). There is no established standard for MCCP for comparison, but MCCP concentration was also very high (170 µg/l) in the same sample from a laundry.

Table 7. Overview of emission sources of chloralkanes in Lithuania.

Industry	No. of samples	Substance was found in the following No. of samples	
		SCCP	MCCP
Wood pulp and paper	3	2	2
Metal processing and galvanics	7	3	3
Electronics	1		
Printing houses	3		3
Textile	6	1	2
Leather	4		2
Plastics	4		1
Rubber	1		1
Shipyards	10	3	7
Production of building materials	1		1
Laundries	4	3 (1 case of high conc.)	3
Car washing	2		1
Chemicals	2		
Regeneration of used oil	1		
Leakage from landfills	4		
Supermarkets	2	1	1
Household effluents	4	1	3
WWTPs	7	1	
Surface run-off from car shredding	1		
Surface run-off from industrial areas	2	1	

SCCP were investigated in discharge from WWTPs and in sewage sludge, but not found in any of the samples during the screening in 2006.

During Cohiba project, SCCP were found in all samples. Concentrations of SCCP varied from 0.14 µg /l to 1.95 µg /l. Both the highest concentration value of SCCP (1.95 µg /l) and the highest mean value (1.14 µg /l) was found in sample taken at municipal WWTP, whereas the lowest mean values were recorded at industrial WWTP (0.73 µg /l) and storm water sample (0.75 µg /l).
Observed concentrations of MCCP were in the range from <0.6 µg /l to 31.5 µg /l. The mean values at industrial WWTPs, storm water and landfill leachate sample were similar and varied from 2.25 µg/l to 3.11 µg /l. The highest mean values were found in samples taken at municipal WWTPs (8.32 µg /l and 4.36 µg l).

- ***Relevance***

Chloralkanes, both SCCP and MCCP may be considered as relevant hazardous substances in Lithuania due to their presence in effluents from various industry branches. Laundries seem to be of special concern.

PFOS and PFOA

- ***Production and use***

There is no production of PFOS and PFOA in Lithuania.

- ***Emissions***

11 different perfluortensides were investigated during the survey by BaltActHaz. Analysis of emissions from industrial sites does not suggest a widespread use of these compounds in Lithuania. Emissions of PFOS were found only from plastic industry. PFOA was found from two more industry branches: in addition to plastic industry, they were found in emissions from semiconductors production and laundries. For all these industries, PFOS and PFOA were found just in single cases.
Currently the main emissions pathway of perfluortensides to the environment is via the landfills. Leakage from landfills contained the biggest variety of compounds in the biggest number of samples: PFOA, PFHpA, and PFBS were present in all 4 samples; PFNA and PFDA were present in 3 samples; PFOS and PFHxS were present in 2 samples.

Table 8. Overview of emission sources of PFOS and PFOA in Lithuania.

Industry	No. of samples	Substance was found in the following No. of samples	
		PFOS	PFOA
Metal processing and galvanics	7		
Printing houses	3		
Textile industry	6		
Leather industry	4		
Plastic industry	4	1	1
Production of building materials	1		
Oil refinery industry	1		
Production of semiconductors	1		1
Laundries	4		1
Leakage from landfills	4	2	4
Supermarkets	2		
Household effluents	4		
WWTPs	7		
Surface run-off from car shredding	1		
Surface run-off	1		

During Cohiba project, measured concentrations of PFOS were in the range from 0,06 ng/l to 3,90 ng/l. The highest concentration of PFOS (3,90 ng/l) was found in storm water sample, whereas the lowest value (0,06 ng/l) was found at industrial WWTP. PFOS was not detected in landfill leachate samples.
Observed concentrations of PFOA were in the range from 0.48 ng/l to 6.43 ng/l. The highest concentration (6.43 ng/l) was found at industrial WWTP. At municipal WWTP, the mean values of PFOA were similar (about 3.00 ng/l).

- ***Relevance***

Based on emissions data, PFOS and PFOA do not seem to be of a real relevance in Lithuania. The main source of emissions to the environment is landfills. PFOS and PFOA were not found in wastewater from WWTPs; they were present in very few samples from the investigated industry branches.

Summary

Table 9 summarizes the most important information on emissions situation for the individual substances in Lithuania. The information on production and use is extremely scarce and cannot be properly evaluated.
The following criteria were used to rank the importance of the substances:
- Comparison of concentrations in emissions against the ELV to wastewater collecting system and to surface waters in Lithuania;
- The number of industry branches from which substance is emitted;
- The share of samples, in which substance was present, against the number of analyzed samples.

Table 9. Overview on the most important uses and emission sources for the priority substances in Lithuania.

Substance	Use	Emissions	Relevance
Ni	Yes	Construction materials, batteries, pigments, fluorescent lamps, metal processing, fertilizers, laboratories	Medium
Organotin compounds			High
TBT, DBT, MBT, DOT, MOT	No information	*From industry:* Shipyards - high conc.; Metal processing industry and galvanics; leather industry – a big variety of organotin compounds, including TBT; Pharmaceutical, wood pulp and paper, textile industries - a big variety of organotin compounds; Plastic and rubber industries, production of cement/concrete/ asphalt, and production of panels/ boards - a smaller variety of organotin compounds, although in the majority of samples. *From other sources:* Supermarkets, households, leakage from landfills, effluents from WWTP, surface run-off.	*- Evidence of high TBT concentrations in shipyards;* *- Emissions from at least 10 different industry branches, also several other sources;* *- Presence (of* TBT, DBT, MBT, DOT, and MOT*) in about 40 % of investigated samples.*

Phenols and their ethoxylates			High
NP, NPE, OP, OPE	Used in formulation of cleaning/ washing products by at least three companies	*From industry:* From many industry branches: paint production – high conc. , pharmaceuticals, household and industrial cleaning, wood and paper, metal processing and galvanics, printing houses, production of cement/ concrete/ asphalt, textile, leather, production of panels/ boards, plastic, rubber, shipyards, laundries, car washing, regeneration of used oil, car shredding). *From other sources:* Households, WWTP effluents, surface run-off, landfill's leachate.	 *- Evidence of high concentrations from paint production;* *- Emissions from at least 16 different industry branches, also several other sources;* *- Presence () in about 26% of investigated samples.*
Phthalates and their ethoxylates			High
DEHP, DEP, DIBP, DBP	DEHP, DBP and DOP supplied to the market by 3 companies; used in formulation of chemical products by at least 4 companies	*From industry:* Car washing – high conc., paint production, plastic, metal processing, shipyards, production of building materials, regeneration of used oil. *From other sources:* Landfill's leachate – high conc. and widespread presence, supermarkets (close to ELV), households.	*- Evidence of high DEHP (probably also DIBP) concentrations from car washing, also from landfills;* *- Emissions from at least 7 different industry branches, also several other sources, widespread from landfills;* *- Presence (of* DEHP, DEP, DIBP, DBP) *in about 22 % of investigated samples.*
Brominated diphenylethers			Medium
PBDE47, 99, 100, 196, 197, 203, 209, NBDE, HBCDD	No information	*From industry:* Laundries – found the most widespread presence of PBDE: probably from washing of PBDE flame retarded textiles; plastic industry – apparently high concentration of PBDE209, although no ELV is established for comparison: probably from the use of DecaBDE; also leather (widespread presence of PBDE47), car washing, wood pulp and paper, printing houses, textiles, shipyards, production of building	 *- Probably high PBDE209 concentration from plastic industry;* *- Emissions from at least 10 different industry branches, also several other sources;* *- Presence (of* PBDE47, 99, 100, and 209*) in about 23 % of investigated samples.*

		materials. *From other sources:* Landfill's leachate (PBDE47 and PBDE99 in all analyzed samples), household, supermarkets, surface run-off from car-shredding and industrial areas.	
Chloralkanes			Medium
SCCP, MCCP	Wholesale of MCCP by 1 company: 68,93 t in 2007, and 70,82 t in 2008.	*From industry:* Laundries –high concentration of SCCP, and also probably MCCP (no ELV established for the latter); also wood pulp and paper, metal processing and galvanic, printing houses, textiles, leather, plastic, rubber, shipyards, production of building materials, car washing *From other sources:* Household, supermarkets, WWTP, surface run-off from industrial areas.	*- Evidence of high SCCP (probably also MCCP) concentration from laundries;* *- Emissions from at least 5 industry branches for SCCP, and at least from 11 different industry branches for MCCP, also from several other sources;* *- Presence in about 33 % of investigated samples.*
PFOS and PFOA (perfluorten-sides)			Low
PFOS, PFOA	No information	*From industry:* Plastic, production of semiconductors, laundries. *From other sources:* Landfills – seems to be the most important source.	*- Emissions from some 3 industry branches, mainly – from landfills;* *- Presence in about 10 % of investigated samples.*

C.1. 3. OVERVIEW OF REGULATORY STATUS

Heavy metals

On EU level:

Dir. 2000/60/EC (WFD): Ni and Pb and their compounds are priority substances; Hg and Cd are priority hazardous substances.
Dir. 2008/105/EC defines EQS for Ni, Hg, Cd, Pb and their compounds.
The Baltic Sea Action Plan: Hg and Cd are defined as hazardous substances of specific concern to the Baltic Sea.

REACH regulation: list of candidate substances for authorisation includes Pb-H arsenate, lead styphnate, lead diazide, lead azide, lead dipicrate, lead chromate, lead sulfochromate.
REACH regulation Annex XVII:

- ban on placing on the market and use of nickel and its compounds in articles intended to come into direct and prolonged contact with the skin;
- restrictions on placing on the market and use of lead carbonates and lead sulphates in paint (Member States may permit the use on their territory of the substance or mixture for the restoration and maintenance of works of art and historic buildings and their interiors);
- ban on placing on the market and use of mercury compounds:
  - for preventing the fouling by micro-organisms, plants or animals;
  - in the preservation of wood;
  - in the impregnation of industrial textiles and yarn;
  - in the treatment of industrial waters.
- ban on use of mercury in fever thermometers and in other measuring devices intended for sale to the general public.
- ban on use of cadmium:
  - in mixtures and articles produced from synthetic organic polymers (from 2012),
  - in paints,
  - for cadmium plating metallic articles or their components in the defined sectors/applications,
  - in brazing fillers,
  - in metals for jewellery making (from 2011).
- ban for placing on the market and use by general public of certain substances classified as CMR, among them: NiO, NiO2, Ni2O3, NiS, Ni tetracarbonyl, Pb H arsenate, Pb hexafluorosilicate, Pb alkyls, Pb azide, Pb chromate, Pb di(acetate), Tri-Pb bis(orthophosphate), Pb acetate, Pb(II) methanesulphonate, Pb 2,4,6-trinitroresorcinoxide, Pb styphnate, Cadmium oxide, Cadmium fluoride, Cadmium chloride, Cadmium sulphate, Cadmium sulphide, Cadmium (pyrophoric), Cadmium fluoride, Cadmium chloride, Cadmium sulphate.

Dir. 76/768/EEC and Regulation 1223/2009 on cosmetics: Ni and some its compounds, and lead are included into the List of substances which must not form part of the composition of cosmetic products.

On national level:

Wastewater regulation: priority substances: Ni, Pb.
Wastewater regulation: Hg and Cd - priority hazardous substances; Ni and Pb – priority substances.

Organotin compounds

On EU level:

Dir. 2000/60/EC (WFD): TBT compounds and TBT cations are priority and priority hazardous substances.
Dir. 2008/105/EC defines EQS for TBT compounds.
Helcom recommendation 31/5 (1998) includes organotin compounds.
Helcom recommendation 20/4 (1999) on antifouling paints: TBT is a substance of concern.
The Baltic Sea Action Plan: Tributyltin (TBT) and triphenyltin (TPhT) compounds are defined as hazardous substances of specific concern to the Baltic Sea.

Table 10. Bans and restrictions set for organotin compounds vs emissions situation

Existing bans and restrictions	Theoretical possibility of emissions	Known emissions in Lithuania
Dir. 98/8/EC: **TBT** and **TPhT** are banned for biocidal uses since 2006.	No from biocides	
Commission Decisions 2002/478/EC and 2002/479/EC: the use of **TPhT hydroxide and acetate** as pesticides are no longer authorised in the EU.	No	
REACH list of candidate substances for authorisation includes bis(tributyltin) oxide (**TBTO**).	Reduced possibility of emissions in case TBTO will be included into Annex XIV of REACH	
REACH regulation Annex XVII:		
Ban on placing on the market and use of **organostannic compounds** : ○ acting as biocide in free association paint; ○ acting as biocide to prevent the fouling by micro-organisms, plants or animals ; ○ for use in the treatment of industrial waters.	No	Yes from shipyards
Ban on placing on the marketing and use of tri-substituted organostannic compounds (such as **TBT and TPT**) in articles (in conc. > 0,1%) (since 2010).	No (emissions possible from articles where TBT is present in conc. < 0,1%)	No
Ban on placing on the marketing and use of dibutyltin (**DBT**) compounds in mixtures and articles for supply to the general public (in conc. > 0,1%) (from 2012).	Currently – yes. From 2012: No (emissions possible from articles supplied not to the general public, or if DBT is present in articles in conc. <0,1%)	Yes from households and WWTPs
Ban on placing on the marketing and use of dioctyltin (**DOT**) compounds in the defined articles (textile, gloves, footwear, wall and floor coverings, childcare articles, female hygiene products, nappies, two-component room temperature vulcanisation moulding) for supply to the general public (in conc. > 0,1%) (from 2012).	Currently – yes. From 2012: no (emissions possible from articles supplied not to the general public, when DOT is present in articles not defined here, or if present in articles in conc. <0,1%)	Yes from households

On national level:

Wastewater regulation: TBT compounds and cations are priority hazardous substances.

Phenols and their ethoxylates

On EU level:

Dir. 2000/60/EC (WFD): nonylphenol and 4-nonylphenol are priority and priority hazardous substances. Octylphenol is a priority hazardous substance.
Dir. 2008/105/EC defines EQS for NP and OP.
Helcom recommendation 31/5 includes 4-nonylphenol and nonylphenol ethoxylates and their transformation products.
The Baltic Sea Action Plan: NP, NPE, OP and OPE are defined as hazardous substances of specific concern to the Baltic Sea. The need was expressed to initiate adequate measures such as the introduction of use restrictions and substitution in the most important sectors for OP and OPE by 2009, and to start to work for strict restrictions on the use of NP/NPEs by 2008.

Table 11. Bans and restrictions set for phenols and their etoxylates vs emissions situation

Existing bans and restrictions	Theoretical possibility of emissions:	Known emissions in Lithuania
REACH regulation Annex XVII (since 2005):		
Restrictions and ban on placing on the market and use of **NP and NPE** (in conc. ≥0,1%):		
for industrial and institutional cleaning, except: o controlled closed dry cleaning systems where the washing liquid is recycled or incinerated, o cleaning systems with special treatment where the washing liquid is recycled or incinerated.	Very low (emissions possible if defined conditions are not followed, or when NP/NPE are in conc. <0,1%)	Yes
for domestic cleaning	No (emissions possible if NP/NPE are present in conc. < 0,1%)	Yes from households (origin unknown)
for textiles and leather processing, except: o processing with no release into waste water, o systems with special treatment where the process water is pre-treated to remove the organic fraction completely prior to biological waste water treatment (degreasing of sheepskin);	Very low (emissions possible if defined conditions are not followed, or when NP/NPE are in conc. <0,1%)	Yes
as emulsifier in agricultural teat dips;	No (emissions possible if NP/NPE are present in conc. < 0,1%)	
for metal working, except: o uses in controlled closed systems where the washing liquid is recycled or incinerated;	Very low (emissions possible if defined conditions are not followed, or when NP/NPE are in conc. <0,1%)	Yes
for manufacturing of pulp and paper;	No (emissions possible if NP/NPE are present in	Yes

	conc. < 0,1%)	
in cosmetic and personal care products, except o spermicides;	Low (emissions possible if NP/NPE are present in conc. < 0,1%, and from spermicides)	Yes from households (origin unknown)
as co-formulants in pesticides and biocides.	No (emissions possible if NP/NPE are present in conc. < 0,1%)	
Regulation 2076/2002 and Dir. 91/414/EEC: use of **NPE** as an ingredient of plant protection products banned since 2004.	No	
Dir. 76/768/EEC and Regulation 1223/2009 on cosmetics: **NP (4-NP)** is included into the List of substances which must not form part of the composition of cosmetic products.	No	

On national level:

Wastewater regulation: nonylphenols (4-(para)-NP) are priority hazardous substances; octylphenol ((4-(1,1',3,3'-tetramethylbutyl)phenol) and pentachlorphenol (PCP) are priority substances.

Phthalates and their ethoxylates

On EU level:

Dir. 2000/60/EC (WFD): DEHP is a priority hazardous substance.
Dir. 2008/105/EC defines EQS for DEHP.
HELCOM recommendation 31/5 includes DEHP and DBP.

Table 12. Bans and restrictions set phthalates and their ethoxylates vs emissions situation

Existing bans and restrictions	Theoretical possibility of emissions	Known emissions in Lithuania
REACH regulation Annex XIV: authorisation is required for bis (2-ethylhexyl)phthalate (**DEHP**), benzyl butyl phthalate (**BBP**), and dibutyl phthalate (**DBP**).	Strictly reduced possibility of DEHP, BBP and DBP emissions	Emissions from industries (paint, plastics, shipyards, building materials, car washing), households, supermarkets.
REACH regulation Annex XVII:		
Ban on use in toys and in childcare articles, and on placing on the market of toys and childcare articles, containing >0,1% of **DEHP, DBP** and **BBP**.	No (emissions possible if DEHP, DBP and BBP are present in conc. < 0,1%)	
Ban on use in toys and in childcare articles, and on placing on the market of toys and childcare articles, which can be placed in the mouth by children, containing >0,1% of	No (emissions possible if DINP, DIDP and DNOP are present in conc. <	

DINP, DIDP and **DNOP**.	0,1%)	
Dir. 76/768/EEC and Regulation 1223/2009 on cosmetics: **DBP** and **DEHP** are included into the List of substances which must not form part of the composition of cosmetic products.	No	

On national level:

Wastewater regulation: DEHP is a priority substance.

Brominated diphenylethers

On EU level:

Dir. 2000/60/EC (WFD): brominated diphenylethers are priority substances; pentaBDE is defined as a priority hazardous substance.
Dir. 2008/105/EC defines EQS for brominated diphenylethers.
The Baltic Sea Action Plan: pentaBDE, octaBDE and decaBDE are substances, for which the need was expressed to initiate adequate measures such as the introduction of use restrictions and substitution in the most important sectors by 2010, and for decaBDE – by 2009.

Table 13. Bans and restrictions set for brominated diphenylethers vs emissions situation

Existing bans and restrictions	Theoretical possibility of emissions	Known emissions in Lithuania
REACH regulation Annex XVII (since 2004):		
Ban on placing on the marketing of **octaBDE** as a substance or as a constituent of other substances, or in mixtures (in conc. >0,1%);	No (emissions possible if octaBDE is present in conc. < 0,1%)	Yes for some congeners (from printing houses, wood pulp and paper, textile, leather and plastic industry, shipyards, laundries, car washing, households, in surface run-off from car shredding and industrial areas)
Ban on placing on the market of articles if they, or flame-retardant parts thereof, contain this substance (**octaBDE**) in concentrations greater than 0,1 % by weight. Exceptions: - articles that were in use in the Community before 15 August 2004, - EEE within the scope of Dir. 2002/95/EC	Reduced (emissions possible if octaBDE is present in articles in conc. < 0,1%, also from old articles and from WEEE)	
Dir. 2002/95/EC (RoHS Dir.): restrictions on use of **pentaBDE** (since 2002) and **decaBDE** (since 2008) in electrical and electronic products. New EEE placed on the market are no longer allowed to contain pentaBDE or decaBDE.	No – from new equipment, yes – from the older	
Stockholm convention: **tetraBDE**, **pentaBDE**, **hexaBDE** and **heptaBDE** in the list since 2010; production and placing on the market are prohibited.	Strictly no	

On national level:

Wastewater regulation: brominated diphenylethers and pentaBDE are priority hazardous substance.

Chloralkanes

On EU level:

Dir. 2000/60/EC (WFD): SCCP are priority and priority hazardous substances.
Dir. 2008/105/EC defines EQS for SCCP.
HELCOM recommendation 31/5 includes chloralkanes.
The Baltic Sea Action Plan: SCCP and MCCP are defined as hazardous substances of specific concern to the Baltic Sea. The need was expressed to initiate adequate measures such as the introduction of use restrictions and substitution in the most important sectors for MCCP by 2009, and to start to work for strict restrictions on the use of SCCP by 2008.

Table 14. Bans and restrictions set for chloralkanes vs emissions situation

Existing bans and restrictions	Theoretical possibility of emissions	Known emissions in Lithuania
REACH list of candidate substances for authorisation includes **SCCP**.	Reduced possibility of emissions in case SCCP will be included into Annex XIV of REACH	Yes from various industries (wood pulp and paper, metal processing and galvanic, textile, shipyards, laundries).
REACH regulation Annex XVII:		
Ban on placing on the marketing and use of **SCCP** as substances, or as constituents of other substances or in mixtures (in conc. >1%), where the substance or mixture is intended for metalworking, or fat liquoring of leather.	No (emissions possible if SCCP is present in mixtures in conc. < 1%)	Emissions found from metal processing and galvanic industry.
Dir. 76/768/EEC and Regulation 1223/2009 on cosmetics: alkanes, C_{10-13}, chloro (**SCCP**) are included into the List of substances which must not form part of the composition of cosmetic products.	No	

On national level:

Wastewater regulation: SCCP are priority hazardous substances.

PFOS and PFOA

On EU level:

Dir. 2000/60/EC (WFD): PFOS is under the review.
The Baltic Sea Action Plan: PFOS and PFOA are defined as hazardous substances of specific concern to the Baltic Sea. The need was expressed to initiate adequate measures such as the introduction of use restrictions and substitution in the most important sectors for PFOA by 2009, and to start to work for strict restrictions on the use of PFOS by 2008.

PFOS is listed in annex III of the daughter directive (on priority substances, 2008/105/EC) to the Water Framework Directive (2000/60/EC) as a substance subject to review for possible identification as a priority substance (or priority hazardous substance). This review process is currently on-going (WFD CIRCA).

Table 15. Bans and restrictions set for perfluortensides vs emissions situation

Existing bans and restrictions	Theoretical possibility of emissions	Known emissions in Lithuania
Stockholm convention: **PFOS** in the list since 2010; production and placing on the market are prohibited.	Strictly no	Found only in emissions from plastic industry.

On national level:

No national measures.

Summary

All groups of the analysed hazardous substances are subject to some degree of bans and restrictions. The most strict bans are set for:

- tetraBDE, pentaBDE, hexaBDE and heptaBDE
- PFOS

} production and placing on the market prohibited due to inclusion into the Stockholm convention in 2010

Ban for certain uses is valid for:

- Organotin compounds (as biocide in paints, to prevent the antifouling, in the treatment of industrial waters);
- Penta- and decaBDE in electric and electronic equipment.

Restrictions, when a concentration of a hazardous substance shall not exceed the established amount, for certain uses are valid for:

- Organotin compounds in articles (some requirement will enter into force in 2012);
- NP and NPE (cleaning processes, textile and leather processing, agricultural teat dips, metal working, pulp and paper, cosmetic and personal care products, pesticides and biocides); the exceptions are textile and leather processing, and metal working, where use is still allowed in closed systems, with non-release into waste water, or complete removal of organic fraction.
- Phthalates (in toys);
- OctaBDE (as a substance or in mixtures, in articles, except EEE);
- SCCP (metalworking and fat liquoring of leather).

No bans and restrictions are established for OP and OPE, MCCP, and PFOA yet.

C.2. Priority substances relevant for Lithuania

The relevance of the analysed hazardous priority and priority substances was assessed considering the following criteria:

Presence in the environment:

Detected in water bodies (waters or sediments);

Detected in biota;

There are cases of exceeded EQS;

Emissions situation:

Discharged from industry;

Discharged from a big variety of industry branches (at least 10);

Discharged from households or supermarkets;

Found in discharge or sludge from WWTPs;
Found in the big share of potentially relevant samples (at least a quarter);
There are cases of exceeded ELV, or apparently high concentrations (in case ELV is not established).

The available information on the use was not taken into consideration because of its incompleteness.

The more signs ”X” substance/ group of substances collects, the more relevant it is (see Table 16). A sign “?” means relevance unknown do to absence of data.

PS relevant to Lithuania

Nonylphenols and their etoxylates can be evaluated as being of the biggest relevance to Lithuania. Organotin compounds also got signs “X” according to all criteria of evaluation of relevance, however, the main representative of this group of substances has a little bit lower score because of being present in a not big share of potentially relevant samples, and also being emitted from a limited variety of industry branches.
The other obviously relevant substances/ groups of substances are phthalates (DEHP), octylphenols and their etoxylates, and brominated diphenylethers.

MCCP is perhaps also of a similar high relevance. According to emissions situation, they are obviously relevant. However, the absence of data on their occurrence in water bodies does not allow making a final judgement.

SCCP, and mainly PFOS and PFOA seem to be of lower relevance. However, the fact that both SCCP and PFOS were found to be present in biota does not allow the exclusion of these substances either.

It is relevant to evaluate the need for further measures in order to reduce emissions and environmental concentrations of all these substances/ groups of substances.

Table 16. Relevance of hazardous substances in Lithuania

Substance/ group of substances	**Presence in the environment**			**Emissions situation**						**Comments**
	Found in water bodies (waters and/ or sediments)	**Found in biota**	**There are cases of exceeded EQS**	**Discharged from industry**	**Discharged from a big variety of industry branches (at least 10)**	**Discharged from households and supermarkets**	**Found in discharge or sludge from WWTPs**	**Found in the big share of potentially relevant samples (at least 1 / 4)**	**There are cases of exceeded ELV / high concentrations**	
Organotin compounds	X	X	X	X	X	X	X	X	X	
TBT	X	X	X	X			X		X	Transformation of TBT into MBT and DBT takes place.
NP(E)	X	X	X	X	X	X	X	X	X	Only NP found in environmental samples due to break down of NPE into NP.

OP(E)	X			X	X	X	X	X		Only OP found in environmental samples.
Phthalates and their ethoxylates	X	?	X	X		X	X		X	
DEHP	X		X	X		X	X	X	X	
PBDE	X	X		X	X	X	X		X	
SCCP		X		X		X	X		X	
MCCP	?			X	X	X	X	X	X	
PFOS	?	X		X			X			
PFOA	?			X			X			

D. Actions map for the reduction of PS in Lithuania

D.1. Analysis of the emission pathways of relevant substances and substance groups for Lithuania

Emission pathways are relatively divided into industrial, agricultural, from products, WWTPs, landfills, historical pollution, urban areas, and air emissions. Some of these pathways do overlap. For example, industrial emissions may be discharged directly to the environment, as well as to the sewage system and WWTPs. Sewage system may receive waters from industrial enterprises, from households, also run-off waters from urban areas. Historical stocks of substances may be accumulated in products that are still in use, as well as be discarded in landfills, or accumulate in sediments, etc.
However, the main aim is to show both origin and gates of substances to the environment. As long as there are no exact data on distribution of substance flows, the qualitative information may also be of value when deciding about the measures for reduction of priority substances in Lithuania.
The pathway "historical pollution" covers other sources than landfills or old products, i.e. mainly contaminated sites or sediments.

TBT and other organotin compounds (DBT, MBT)

Table 17. Overview on the potential emission pathways of organotin compounds (TBT)

Emission pathway	Emissions relevance	Comments
Industry	Yes	Emissions from metal processing and leather industries contained a variety of organotin compounds. A variety of organotin compounds, except TBT, were also present in emissions from pharmaceutical, wood pulp and paper, textile industries. A smaller variety of organotin compounds, although again in the majority of samples, were present in effluents from plastic and rubber industries, from production of cement/concrete/ asphalt, and from production of panels/ boards. During screening in 2006, organotin concentrations in surface waters below big towns were found to exceede EQS.
Agricultural areas	Yes	Most of sewage sludge in Lithuania seems to be contaminated with TBT. By use of this sludge as a soil improver (fertilizer), the TBT will be again introduced to the environment (see also the pathway WWTPs).
Products	Yes	Maritime activities (leaching of antifouling paints containing TBT from ship hulls) are the main diffuse source of TBT. Another probable source is from impregnated wood, although emission factors from production and service of impregnated wood are low (Helsinki Cimmission, 2009). Also, TBT may be present as an impurity in products such as textiles, materials in contact with food, PVC products using DBT or MBT as stabilizer. However, effluents from households and supermarkets contained a variety of organotin compounds, but not directly TBT (possibility of transformations?).
WWTPs	No: mainly via the sewage sludge, or in the form of MBT	WWTPs are expected to receive TBT with incoming effluents. However, TBT is not released in significant quantities via WWTPs to recipient aquatic environment: TBT was not found in discharges from WWTPs neither during the screening in 2006, nor during BaltActHaz. TBT is dealkylated to MBT in WWTPs: nearly all the investigated samples from WWTPs during the BaltActHaz project contained MBT. Also, in WWTPs, butyltins are significantly eliminated from wastewater by adsorption onto suspended matter and further by sedimentation to the sludge. TBT compounds were found in 22 out of 25 samples of sewage sludge during screening in 2006.
Urban areas	Yes	
Landfills	Perhaps no	Investigations during BaltActHaz project showed a presence of DBT, MBT and other organotins, but not TBT, in landfill's leachate (possibility of transformations and

		adsorbtion onto particles?).
Historical pollution	Yes	TBT accumulates in sediments. Results of investigation during the screening performed in Lithuania in 2006 showed high concentrations of organotin compounds in riverine sediments, especially in Klaipeda channel in the port territory.
Air emissions	No	

Nonylphenols and their ethoxylates (NP, NPE)

Table 18. Overview on the potential emission pathways of NP and NPE

Emission pathway	Emissions relevance	Comments
Industry	Yes	Emission analyses from Lithuanian industrial enterprises show the presence of NP/NPE in effluents from many industry branches: paint production – high concentrations, pharmaceuticals, household and industrial cleaning, wood and paper, metal processing and galvanics, printing houses, production of cement/ concrete/ asphalt, textile, leather, plastic, rubber, shipyards, laundries, car washing, regeneration of used oil, car shredding. According to Annex XVII, use of NP(E) in some of these industry branches is allowed only in if there is a closed process and there are no emissions to the waters. Apparently, the established restrictions are not efficient, and these industry branches still are pathways of NP(E) to the environment. The main known industrial uses are for NPE, not NP. Thus, the primary source for NP is probably NPE, which can break down into NP.
Agricultural areas	Yes	NP(E) were found in most of sewage sludge samples during the screening in 2006. If NP(E) containing sludge is applied to the soils, NP will enter the environment.
Products	Yes	The wide variety in use makes products containing nonylphenol ethoxylate very potential sources for diffuse emissions of NP(E)s. NP(E) presence is probable in imported products, mainly textiles, but maybe also cleaning agents etc. NP(E) were found in effluents from household and supermarkets.
WWTPs	Yes	A part of samples during screening in 2006, during BaltAct Haz, and during COHIBA projects contained NP(E). WWTPs are expected to receive NP(E) containing water both from industry and households. (See also the pathway Agricultural areas.)
Urban areas	Yes	
Landfills	Yes	NP(E) were present in leachate from landfill.
Historical pollution	No	
Air emissions	No	Possible air emissions of NPE during scouring treatment in wastewater treatment plants.

Octylphenols and their ethoxylates (OP, OPE)

Table 19. Overview on the potential emission pathways of OP and OPE

Emission pathway	Emissions relevance	Comments
Industry	Yes	Emission analyses from Lithuanian industrial enterprises show the presence of OP(E) in effluents from many industry branches: pharmaceuticals, household and industrial cleaning, wood and paper, paint production, metal processing and galvanics, printing houses, production of cement/ concrete/ asphalt, textile, leather, production of panels/ boards, plastic, rubber, shipyards, laundries, car washing, regeneration of used oil, car shredding.
Agricultural areas	Yes	OP was found in sludge of during the screening in 2006. If OP containing sludge is applied to the soils, OP will enter the environment.
Products	Yes	OP is used in the production of phenolic resins (tyres), paints and some other products. It may also be as an impurity in NP. The fact of emissions of OP(E) from

		products was confirmed by finding OP(E) in effluents from household (three times found 4-NP, and 2 times found NP1EO, out of 4 sampes) and supermarkets (once found 4-tert-OP, and once found OP1EO, out of 4 samples).
WWTPs	Yes	A part of samples during screening in 2006, during BaltAct Haz, and during COHIBA projects contained OP(E). WWTPs are expected to receive OP(E) containing water both from industry and households. (See also the pathway Agricultural areas.)
Urban areas	Yes	OP(E)-containing products (tyres, paints) are considered to be the main source for emissions in urban areas. Probably the same is valid for Lithuania.
Landfills	Yes	Investigations during BaltActHaz project showed a wide presence of OP and OPE in landfill's leachate.
Historical pollution	No	
Air emissions	No	

DEHP and other phthalates (DIBP, DBP)

Table 20. Overview on the potential emission pathways of phthalates (DEHP)

Emission pathway	Emissions relevance	Comments
Industry	Yes	Emissions from industry (paint, metal processing, plastics, shipyards, building materials, car washing).
Agricultural areas	Yes	DEHP were found in all 25 samples of sewage sludge during the screening in 2006. If DEHP containing sludge is applied to the soils, DEHP will enter the environment.
Products	Yes	DEHP can be expected to be present in a variety of plastic products. They are found in children toys during the Survey Program of phthalates in toys. As the plasticiser doesn't form a chemical bond to the polymer, it can easily migrate out of the compound. DEHP, DEP, DIBP, and DBP were found in discharges from supermarkets, DEHP and DEP – also in household effluents.
WWTPs	Yes	During the screening in 2006, phthalates were found in 22 wastewater samples out of 25 investigated, and in all 25 samples of sewage sludge. The following phthalates were found the most often: DEHP, DBP, DIBP, and diiso- nonylphthalate. The highest concentration was for DEHP (0,42 – 53,2 µg/l in wastewater), with 4 cases of exceeded ELV. However, phthalates were not found in discharges from WWTP during investigations of BaltActHaz.
Urban areas	Yes	
Landfills	Yes	Investigations during BaltActHaz project showed a wide presence of DEHP in landfill's leachate, even in high concentration in some cases. DEP, DIBP, DBP were also detected.
Historical pollution	No	
Air emissions	No	

PBDE

Table 19. Overview on the potential emission pathways of brominated diphenylethers

Emission pathway	Emissions relevance	Comments
Industry	Yes	Because of bans and restrictions on production, use and placing on the market of PentaBDE and OctaBDE, partly also DecaBDE (for electric and electronic equipment), the relevance of industrial use as a source for PBDE has diminished. However, use of DecaBDE may still continue (there is no legal ban or restriction on it, except for electric and electronic equipment), at least in plastic industry in Lithuania. Emission analyses from Lithuanian industrial enterprises show the presence of various PBDE in effluents. PBDE can probably originate either from old articles that are still

		used by industrial enterprises, either e.g. from imported plastics used in production processes. Rather widespread occurrence of PBDE in emissions from laundries may originate from washing of PBDE flame retarded textiles (see also the pathway Products).
Agricultural areas	Yes	If PBDE containing sludge is applied to the soils, PBDEs will enter the environment. PBDE were found in sludge of several WWTPs during the screening in 2006 (in conc. 5,1 – 3410 µg/kg) (see also the pathway WWTPs).
Products	Yes	PBDEs are not chemically combined with but physically added to the material, so that during the product lifetime, there is a possibility that PBDEs may escape and be released. Although there are bans and restrictions for inclusion of PBDEs into the composition of new articles, these substances may still be released from the older articles. Rather widespread occurrence of PBDE in emissions from laundries may originate from washing of PBDE flame retarded textiles (see also the pathway Industry). Also, it is probable that PBDE is present in imported plastic articles (although legal bans and restrictions exist for PentaBDE and OctaBDE, partly DecaBDE (in electric and electronic equipment)).
WWTPs	No: mainly via the sewage sludge	PBDEs are not degraded in wastewater treatment plants (expected degradation is <1% according to EU RAR), but PBDEs are adsorbed to the particles and most of them (> 90%) end up in the sludge (EU RAR). However, various PBDE were found in effluents from WWTPs during screening in 2006. (See also the pathway Agricultural areas).
Urban areas	Yes	
Landfills	Yes	Usual waste treatment practice in Lithuania till now was landfilling of mixed waste. Historical uses contained substantial amounts of PBDE. Thus, landfills are a gate for PBDE to the environment. All the analyzed samples (during BaltActHaz) contained PBDE47 and PBDE99.
Historical pollution	No	
Air emissions	No	

SCCP and MCCP

Table 20. Overview on the potential emission pathways of MCCP

Emission pathway	Emissions relevance	Comments
Industry	Yes	SCCP was found in emissions from 5 industry branches, MCCP – from 11 different industry branches. The most widespread occurrence of both SCCP and MCCP was observed in discharges from wood pulp and paper, metal processing, and laundries, for MCCP also from printing houses, leather industry, and shipyards. One of the samples from laundries contained high concentrations of SCCP and MCCP (see also the pathway Products). In general, MCCP seems to be used and emitted more widely than SCCP: there are more restrictions on SCCP, and MCCP is even used as a substitute for SCCP.
Agricultural areas	No data	
Products	Yes	MCCP is leaching from polymeric materials to some extent. Discharges from laundries contained high concentrations of both SCCP and MCCP, perhaps originating from textiles (see also the pathway Industry).
WWTPs	Cannot be excluded	Contradictory results were obtained for discharges from WWTPs and sewage sludge. SCCP were not found during the screening study in 2006, and found in just 1 sample during investigations of BaltHazAct, but found during investigations of COHIBA project.
Urban areas	Yes	
Landfills	Little relevance	Neither SCCP, nor MCCP were detected in landfill's leachate during BaltActHaz investigations. At the same time during COHIBA project, both SCCP and MCCP were found in leachate.

		However, for example MCCP are expected to adsorb strongly into soil and so leaching and volatilization from landfill would not be expected to be significant processes (EU RAR, 2005).
Historical pollution	No	
Air emissions	Yes	The vapour pressure of MCCP is not so low to preclude the possibility of volatilization from plastics and other polymers during their service life. This is particularly true for the MCCP with lower chlorine contents (EU-RAR 2005). Furthermore, there are indications that these chemicals are effectively transported over long distances.

PFOS and PFOA

Table 21. Overview on the potential emission pathways of PFOS and PFOA

Emission pathway	Emissions relevance	Comments
Industry	Yes (partly)	Industrial use of PFOS/PFOA does not seem to be widespread in Lithuania. Recent inclusion of PFOS into the list of substances of Stockholm Convention has further reduced importance of industrial emissions of PFOS. However, PFOA seems to be in use in production of semiconductors in Lithuania, and at the same time literature shows the absence of suitable substitutes for this use at the moment. Thus, emissions of PFOA from semiconductor industry might continue.
Agricultural areas	Unclear	No data in Lithuania. In other countries, PFOS has been detected in sediment and in sewage sludge. Thus, its presence in sewage sludge could lead to soil exposure if spread on agricultural land.
Products	Yes (perhaps)	Historical use of PFOA in products was in much higher concentrations than today, and may contribute to the urban stock. However, neither PFOS nor PFOA were found in discharges from household or supermarkets during BaltActHaz project.
WWTPs	Little relevance	In case of PFOS and PFOA, the uncertainty is heightened by the fact, that precursor substances can be transformed to PFOS and PFOA during conventional waste water treatment. The effluent concentrations of WWTP therefore exceed influent concentrations. The identity of precursors and their emission sources and environmental fate processes are largely unknown. Another factor adding to uncertainty at this source is the partitioning rate between water and solid phase. However, during investigations of BaltActHaz, neither PFOS nor PFOA were found in discharges from WWTPs. Little concentrations, up to 0,81 ng/l for PFOS, and 3,0 ng/l for PFOA, were found during investigations of COHIBA project.
Urban areas	Yes	
Landfills	Yes	PFOS and PFOA were more widely and in higher concentrations used in products, which later were discarded to the landfills. Investigations during BaltActHaz project showed a wide presence of both PFOS and PFOA in landfill's leachate. Thus, landfills seem to be a major source.
Historical pollution	No	
Air emissions	No	

Summary

Table 24 presents a summary of emission pathways that are relevant to the investigated substances or groups of substances.

Table 24. Overview on the relevant HS emission sources/pathways

PS	Industrial emissions	Agri-culture	Products	Municipal discharges		Landfills	Historical pollution	Air emissions
				WWTPs	Urban areas			
TBT	X	X	X	—		— (?)	X (sediments)	—
NP(E)	X	X	X	X	X	X	—	—
OP(E)	X	X	X	X	X	X	—	—
DEHP	X	X	X	X	X	X	—	—
PBDE	X	X	X	—	X	X	—	—
SCCP/ MCCP	X	?	X	(X)	X	—	—	X
PFOS/ PFOA	(X)	?	(X)	—	X	X	—	—

D.2. PROPOSAL OF MEASURES FOR THE REDUCTION OF EMISSIONS OF HS FROM THE RELEVANT EMISSION SOURCES

D.2.1. GENERAL MEASURES

Table 25. The proposed general measures for the reduction of emissions of hazardous substances

Main measures available	Application and level of implementation of measure in the country
Source control measures	
Wider market surveillance	Perform checks of hazardous substances in products. Nowadays it is mainly metals, VOC, and phthalates that are looked for. Extend market surveillance to other substances: NP(E) in domestic cleaners (and in textiles, if such a ban will be introduced), also PBDEs in articles (plastics of EEE, textiles), organotin compounds.
Source analysis	- Introduce less different threshold volumes and having lower values for information supply. Amendment of "Order on Provision of Data on Production, Import, Distribution, Export and professional use of chemical substances and preparations, their properties, health and environmental effects". The current threshold of 1000 kg (in normal case, when a substance does not have a more severe classification) can maybe be acceptable for the biggest producers/ importer, but in user companies majority of chemicals remain not covered by it. Most of priority hazardous and priority hazardous chemicals fall under the threshold of 100 kg in the companies – users of chemicals. These substances are mainly used as additives, and therefore their amount seldom reaches the established threshold. Even more – many different thresholds brings a confusion to those providing information.
	- Make it simple to provide the information. One of the ways can be electronic supply of information, preferably in a format as close as possible to the one companies are required to have as a chemicals register at their site. Implement this in the scope of AIVIKS.
	- Process the received information

	The information received needs to be checked (e.g. 5-10% of the received reports) and processed to be able to use it for further purposes.
Regulatory measures	
"Instructions for issuing, review and repeal of integrated pollution prevention and control permits", Order of Lithuanian MoE	Annex IV, Chapter IV, Point 16. Change a table of raw materials in the application form of IPPC permit. The possible format see presented Table 26. Information shall be provided only about hazardous substances and products, *not all* the substances used in installation. Do not require immediate provision of all SDS. Instead, include a clause in "Instructions for… IPPC" to provide SDS on request of permit granting authority.
"Instructions for issuing, review and repeal of integrated pollution prevention and control permits", Order of Lithuanian MoE	Establish a reference list of environmentally hazardous substances (may be the one in "Wastewater regulation"). Ask the applicant to make a formal statement that: — The substances on the list are not used and /or generated during the process, — If they are used or generated that there is no release to the environment — If applicant cannot make such a statement, he would be obliged to demonstrate in the application that the substance cannot be replaced by a less hazardous substance and that measures have been taken to minimize emissions to the environment on all relevant pathways.
"Rules for preparation of program and report on Environmental Impact Assessment", Order of MoE ""Rules for EIA screening procedure", Order of MoE	Ask the applicant to make a formal statement that: — Priority hazardous substances are not used and/ or generated during the process.
The idea: No installation discharging priority hazardous or priority substances shall operate without a permit:	
"Instructions for issuing, review and repeal of integrated pollution prevention and control permits", Order of Lithuanian MoE	Action should not be limited to permitting of IPPC sites, since also smaller installation or types of activities not falling under IPPC at all (e.g. plastic converters, car washing) can be a relevant sources of emission, losses and discharges of environmentally hazardous substances. However, the requirements to the applicant must be more limited - simply for reasons of practicability, and there should be a cut-off releasing micro companies from the duties listed below. The cut-off can be based on a number of employees, the amount of chemicals used, or the amount of waste water discharged. For the non-IPPC and non-micro companies, the corresponding legal duties should be established and enforced.
"Instructions for issuing, review and repeal of integrated pollution prevention and control permits", Order of Lithuanian MoE	Annex II, Article 3: Consider extending the scope of IPPC permits to all dischargers (both to natural environment and to sewage system) of priority hazardous/ priority substances.

"Wastewater regulation" (Lithuanian MoE, No. D1-236, D1-261, D1-416)	Extend the scope of permitting the wastewater discharges (Article 15 of Wastewater Regulation) to the natural environment by covering all cases of priority substance's discharges instead of just cases where ELV is exceeded.
"Requirements for use of sewage sludge for soil improvement and recultivation", LAND 20-2005	Establish standards for hazardous organic substances, when determining categories of sewage sludge (e.g. include TBT, NP(E), DEHP).
	Ban the use of sludge contaminated with priority hazardous/ priority substances as a soil improver.
Promote restrictions and bans on use with special focus on uses having high emissions / discharges to environment	See details in substance specific information for DEHP and NP(E).
"Law on procurement procedures"	Encourage inclusion of absence of priority hazardous/ priority substances (along with other environmental criteria) in products as a criterion during procurement procedures by State institutions and enterprises. For example: DEHP-free medical devices (by medical institutions), PBDE-free electric meters (by LESTO).
End of pipe measures	
Control / treatment of landfill effluents.	Attention needs to be paid to the treatment and discharges of landfill's effluents due to the wide presence of hazardous substances in the leachate. The careful check is needed to see whether treatment systems of new and functioning landfills are reaching the planned degree of removal. The problematic situation is caused by transporting of effluents to the municipal WWTPs, since they are not constructed to treat hazardous organic substances.
Advanced waste water treatment	The conventional waste water treatment processes have low removal efficiency for many of hazardous organic substances. Therefore an advanced treatment, at least in WWTPs of bigger towns, shall be considered: active carbon treatment, oxidative, NF/ RO treatment. See substance specific information.
	Put demands on industry using priority hazardous/ priority substance and connected to sewers to apply an enhanced waste water pre-treatment with special focus on uses having high emissions / discharges to the environment.
Other measures	
Obtaining an official confirmation from suppliers of raw materials / products that priority hazardous/ priority substances are not contained (if they are not) in the products supplied	Educate and train industries on the issue of hazardous substances ⇒ inform, which priority hazardous/ priority substances might occur in what raw materials and products ⇒ advise to obtain an official confirmation from suppliers about the absence of priority hazardous/ priority substances in the products (e.g. for decaBDE there is no harmonized classification and labelling yet at EU level. Thus, suppliers of master baches or other flame retardant preparations are likely not to provide information on these components to their customers. Then, companies in textile finishing and plastic conversion sector (e.g. polystyrene converters) may be unaware of the hazardousness of these products)
Informing industries	Update "The list of Hazardous substances that might be discharged in

Informing industries	Update "The list of Hazardous substances that might be discharged in emissions from certain industries" ("Wastewater regulation" (Lithuanian MoE, No. D1-416). Include more detailed information to make it more useful and understandable: — Sources/ processes (where substances can be used); — Type of products (where substances can be present); — CAS numbers (to look for in SDS or to ask from supplier for confirmation of presence/ absence) *For example:* Industry : Metal (Ship building); Substance: TBT Source/ process: shipbuilding and repairing – removing paint and painting. Leaching to marine environment from sea ship hulls; Type of products: antifouling paint; CAS number: 688-73-3 (tributyltin compounds), 36643-38-4 (tributyltin cation);
	Short, preferably branch or substance-specific, seminars on the latest developments in the field of chemicals control: Updates of national legal acts and their interpretations; HELCOM news – new and updated recommendations, new findings with regard to hazardous chemicals; REACH news – restrictions, authorization.
Informing society	Support public information campaigns, publications, internet pages, participate and support projects, participate in the events, present information via mass-media (TV, press), provide info in home-pages of concerned state institutions about the hazardous substances: their properties, presence in products, possibilities to avoid these substances

Table 26. Proposal for revision of table on raw and auxiliary materials (Annex IV, Chapter IV, Point 16 of "Instructions on issuing, renewal and withdrawal of IPPC permits", Order of Lithuanian MoE of 27 02 2002, with the subsequent amendments).

Hazardous substances and mixtures used in production processes as raw and auxiliary materials, or those that become an intermediate or final product

General information about a chemical substance or mixture			**Information about hazardous chemicals substance (pure or a component of a mixture)**							**Storage, use and disposal**				
Product name	**Substance or mixture**	**Date of SDS**	**Name of hazardous substance**	**Concentration of substance in mixture %**	**EC and CAS No.**	**Danger category and indication of danger ***	**R phrases***	**Hazard class and category****	**Hazard statements****	**Maximum stored amount t/year and the way of storage**	**Used amount t/year**	**Field of usage, technological process**	**Emissions of chemical substance or mixture and residues (presence) in the product**	**Way of disposal**

* classification according to Directives on dangerous substances and preparations (67/548/EEC; 99/45/EC)
** new classification according to Regulation on classification and labelling (CLP) 1272/2008

D.2.2. SUBSTANCE SPECIFIC MEASURES

Organotin compounds (TBT)

Table 27. The proposed measures for the reduction of emissions of organotin compounds

Measures	Description of possible measures
Source control measures	
Proper handling of shipyards wastewaters	Avoid process water getting directly to the surface waters (arrange edgings, full collection of process water, removal of paint residues, leftovers etc from the dock before flooding)
Proper handling of TBT coatings	Avoid disposal of TBT coatings
Chemical substitution	Substitution of TBT (choice of plastics without TBT, TBT-free wood preservatives etc)
Regulatory measures	
Review of "Requirements for use of sewage sludge for soil improvement and recultivation", LAND 20-2005	Ban the use of TBT contaminated sludge as soil improver. Rather, sewage sludge can be used as a secondary fuel.
End of pipe measures	
Treatment of shipyards wastewaters	Optimization of waste water treatment, application of suitable efficient technology (e.g. coagulation/ flocculation with sand filtration, clarification, solvent extraction, etc.)
Other measures	
Proper dredging and disposal of sediments	Enhancement of implementation for HELCOM regulations / recommendations with regard to dredging and disposal of dredged material in order to minimise the resuspension of hazardous substances (e.g. TBT, TPhT, PAHs, PCBs and heavy metals) from bottom sediments. Dredging should be performed in an environmentally friendly way. Prohibit dumping at sea of TBT containing sediment.
Situation analysis in shipyards	Perform situation analysis in all Lithuanian shipyards: the used technologies, chemicals inventory, wastewater and sludge treatment technologies and their efficiency.

Nonylphenols and their ethoxylates (NP, NPE)

Table 28. The proposed measures for the reduction of emissions of nonylphenols and their ethoxylates

Measure	Description of possible measure
Source control measures	
Chemical substitution	Substitution of NPE by alcohol ethoxylates (paint, plastic industry, textile, leather industry, metal working, industrial and institutional cleaning).
Market surveillance	Perform market surveillance for NP(E) in domestic cleaners (and in textiles in the future, if such a ban will be introduced).
Regulatory measures	
Review of "Requirements for use of sewage sludge for soil improvement and recultivation", Order of	Ban the use of NP(E) containing sludge as soil improver

Ban the import of NP(E) containing textiles.	Support a ban of placing on the market of NP(E) containing textiles. Sweden has issued a notice to ECHA saying that he would compile a report on NPE. Swedish Chemicals Agency listed a rationale for a restriction on the placing of the market of textile and leather articles containing NP or NPEO. Notification of intention: September 2, 2011 Expected date of submission: August 3, 2012
End of pipe measures	
Municipal wastewater treatment	Optimization of WWTP (Active carbon treatment, NF/RO, oxidative treatment).
Industrial wastewater treatment	Control / treatment of industrial wastewaters (advanced water treatment and reuse, oxidative, NF/RO treatment).
Other measures	
Import control	Imported products (e.g. cleaning agents) from non-EU countries should be tested (checked)
Consumer awareness raising	Raising awareness of industrial community to substitute NPEs in paint industry applications.

Octylphenols and their ethoxylates (OP, OPE)

Table 29. The proposed measures for the reduction of emissions of octylphenols and their ethoxylates

Measure	**Description of possible measure**
Source control measures	
Chemical substitution	Substitution of OP/OPE in pharmaceuticals, household and industrial cleaning chemicals, pulp and paper production, paint production, metal processing, printing houses, textile, leather, plastic, rubber industry.
End of pipe measures	
Industrial wastewater treatment	Sorption: activated carbon and other sorbents
Municipal wastewater treatment	Optimization of WWTP (Mechanical/biological treatment (adsorption to sludge); Sorption: activated carbon and other sorbents; Advanced sludge treatment: Controlled incineration).
	Optimization of WWTP (Aerobic activated sludge treatment).

Phthalates (DEHP)

Table 30. The proposed measures for the reduction of emissions of phthalates

Measure	**Description of possible measure**
Source control measures	
Chemical substitution	Substitution of DEHP as plasticizer in PVC and other polymer materials used for producing a range of products including: flooring, roofing, cables, profiles and medical products, synthetic leather and etc.
Encourage purchasing of DEHP-free medical products for state hospitals	Suitable alternatives to replace DEHP for medical products do exist. Encourage inclusion of DEHP-free medical devices as a criterion during procurement procedures by State medical institutions.
Chemical substitution	Substitution of DEHP in large number of various preparations

	including adhesives, sealants, rubber, lacquers, paints, printing inks and etc.
Regulatory measures	
Review of "Requirements for use of sewage sludge for soil improvement and recultivation", Order of Lithuanian MoE, 2006	Ban the use of DEHP containing sludge as soil improver. Rather, sewage sludge can be used as a secondary fuel.
Support a ban of DEHP and other phthalates (DBP, BBP, and DIBP) in products	ECHA published a proposal made by Denmark that would amend the REACH Regulation. The proposal would restrict DEHP, DBP, BBP and DIBP in articles intended for indoor use and articles that may come into direct contact with the skin or mucous membranes. Interested parties are invited to provide comments during the public consultation period. Proposal published: September 19, 2011 Consultation period: September 16, 2012
End of pipe measures	
Municipal wastewater treatment	Optimization of WWTP (Aerobic activated sludge treatment).
Industrial wastewater	Control / treatment of industrial wastewaters (advanced water treatment and reuse).
Other measures	
"DEHP free" labels	Awareness rising for users of products.

Brominated diphenylethers (PBDE)

Table 31. The proposed measures for the reduction of emissions of brominated diphenylethers

Measures	Description of possible measures
Source control measures	
Improved use of DecaBDE in production processes (plastics, textiles)	*By companies*: Improve raw material handling, compounding and conversion/ backcoating in order to reduce losses to the environment. Follow good practises established by VECAP – a Responsible Care voluntary program (www.vecap.info). By state institutions: Inform and encourage companies, dealing with DecaBDE in production processes, to Commit to the VECAP Code of Good Practice
Chemical substitution	Alternatives for PBDEs exist for various applications. Penta and OctaBDE *must be substituted* because of their ban since 2004. Also, alternatives for DecaBDE are available and can be applied.
Market surveillance	Perform market surveillance for PBDE in articles (plastics of EEE, textiles, etc.).
Regulatory measures	
Setting requirements (standard) for flame retarded textiles to be designed more wash-	Require any new flame retarded textiles subject to washing to have undergone tests on their durability during washing.

Setting requirements (standard) for flame retarded textiles to be designed more wash-resistant	Require any new flame retarded textiles subject to washing to have undergone tests on their durability during washing.
Review of "Requirements for use of sewage sludge for soil improvement and recultivation", LAND 20-	Ban the use of PBDE contaminated sludge as soil improver. Rather, sewage sludge can be used as a secondary fuel.

Chlorinated paraffins (SCCP, MCCP)

Table 32. The proposed measures for the reduction of emissions of chlorinated paraffins

Main measures available	**Application and level of implementation of measure in the country**
Source control measures	
Chemical substitution	Alternatives for SCCP exist for various applications. When technical alternatives exist, also substitution of MCCP shall be encouraged.

Perfluorinated compounds (PFOS / PFOA)

Table 33. The proposed measures for the reduction of emissions of perfluorinated compounds

Main measures available	**Application and level of implementation of measure in the country**
Source control measures	
Chemical substitution	PFOS *must be substituted* because of their total ban by inclusion into the Stockholm convention. Substitute PFOA, where technical alternatives exist (however, at the moment substitutes for e.g. manufacturer of semi-conductors -- the probable use in Lithuania – seem not to be commercially available).
End of pipe measures	
Treatment of PFOS/PFOA contaminated waters	E.g. Active Carbon filtration as a 4th stage of waste water treatment in the big WWTPs. It affects PFOS and PFOA, but also another 11 HS of special concern to the Baltic Sea.
Other measures	
Consumer awareness raising and labelling of products	E.g. information campaign about PFOA issue in Teflon pans – look for information "without PFOA", "toxfree".

D.3. Actions map for the reduction of PS in Lithuania

Table 34. A summary of the proposed measures for emissions reduction for hazardous substances

Measure	Reduction potential/ efficiency	Possible instruments for the implementation	Costs	Approximate time-period for implementation	Relevant for substances
General					
Wider market surveillance	High	Establishment of laboratory capacities and approval of a program for more intensive checks	High costs for establishment of capacities and for maintenance	Min 3 to establish laboratory capacities	
Source analysis	Low (more oriented towards gathering information to be able to take further steps)	Update of legal acts Processing of information	Low (electronic data presentation possibilities are covered by AIVIKS)	1-2 years	All
Proper implementation of IPPC	Medium	Update of legal act	Low	1-2 years	All
No land application of sludge from WWTPs	100%	Update of legal act	High costs of alternative methods (anaerobic digestion or incineration)	Min 5 years for setting alternative ways	Heavy metals, TBT, NP, phthalates
Extend the scope of permitting	Medium	Update of legal acts	Low	1-2 years	All
Include environmental criteria („no priority substances“) in procurement procedures	Medium, but for special cases – may be high	Update of legal acts	Low to medium, for more expensive offers	2-3 years	All
Control/ treatment of landfill effluents	High	Establishment of the necessary capacities	High	Min 3 years	All
Advanced waste water treatment	High	Treatment facilities at WWTPs and, for pre-treatment, in companies	High	Min 5 years	All
Obtaining an official confirmation on the absence of substances	Low	Update of legal acts	Low	1 -2 years	All
Informing industries	Medium	Update of legal act Seminars	Low	Continuous	All
Informing society	Medium	Projects, mass-media, publications, etc.	Low to medium	Continuous	All
Substitution of chemicals	100 %	Substitution at companies	Low to medium, case specific	Fast to few years, case specific	All
Substance specific					
Proper handling of shipyards wastewaters	High	Technical and technological solutions at shipyards	Medium to high	Min 2 years	TBT
Proper dredging and disposal of sediments	High	Following HELCOM recommendation while dredging and disposing sediments. Not issuing permits to dump TBT containing sediments to the sea	Medium	Immediately	TBT, TPhT, heavy metals, PAHs, PCBs
Situation analysis in	Medium	Carefully review	Low	1 year	TBT and

shipyards		inventories of chemical substances of shipyards, receive confirmations from suppliers regarding presence of TBT. Evaluate the work practises (e.g. acceptance of ships from third countries), and technological processes used.			other organotins
Ban of NP(E) containing textiles	High	Support of ongoing REACH emmendment procedures	Low (implementation by companies – from low to medium, case specific)	2-3 years	NP(E)
Ban of phthalates in products	High	Support of ongoing REACH amendment procedures	Low (implementation by companies – from low to high, case specific)	1-2 years	DEHP, DBP, BBP, DIBP
Improved use of DecaBDE in production processes	Medium	Following good practises established by VECAP. Commitment to the VECAP Code of Good Practise	Low to high (company specific)	1 year	DecaBDE
Setting requirements for flame retarded textiles to be designed more wash-resistant	Medium	Establishment and adoption of standard	Medium (mainly for establishment of the standard and then its implementation by the companies)	Min 2 years	PBDE
Establishing of ELV for DecaBDE	Medium	Establishment of the limit value and update of legal act	Low	Min 1 year	DecaBDE

E. List of abbreviations

AA-EQS – annual average environmental quality standard;
AC – activated carbon;
BAF – bioaccumulation factor;
BBP – benzyl butyl phthalate;
BDE – brominated diphenylether;
BMF – biomagnifcation factor;
BSAP – Baltic Sea Action Plan;
CLP – Regulation on Classification, Labelling and Packaging;
DBP – dibutylphthalate;
DBT – dibutyltin;
DEHP – di-(2-ethyhexyl) phthalate;
DEP – diethylphthalate;
DIBP – diisobutylphthalate;
DOT – dioctyltin;
EEE – electric and electronic equipment;
ELV – emission limit value;
EPA – Environmental Protection Agency;
EQS – environmental quality standard;
HBCDD – hexabromocyclododedane;
HS – hazardous substance(s);
IPPC – Integrated Pollution Prevention and Control;
LOD – limit of detection;
LOQ – limit of quantification;
MAC-EQS – Maximum allowed concentration environmental quality standard;
MBT – monobutyltin;
MCCP – medium chain chlorinated paraffins;
MoE – Ministry of Environment;
MOT – monooctyltin;
NF – nanofiltration;
NILU – Norwegian Institute for Air Research;
NP – nonylphenol;
NPE – nonylphenol ethoxylate;
NP(E) – nonylphenols and their ethoxylates
NP1EO - nonylphenolmonoethoxylate;
NP2EO - nonylphenoldiethoxylate;
NP3EO - nonylphenoltriethoxylate;
OP – octylphenol;
OPE – octylphenol ethoxylate;
OP(E) – octylphenols and their ethoxylates
OP1EO – octylphenolmonoethoxylate;
OP2EO - octylphenoldiethoxylate;
OP3EO - octylphenoltriethoxylate;
PAH – polyaromatic hydrocarbons;
PBDE – polybrominated diphenylethers;
PBT – persistent, bioaccumulative and toxic;
PFOS – perfluoroctane sulfonate;
PFOA – perfluorooctanoic acid;
PS – priority substance;
PVC – polyvinylchloride;
RO – reverse osmosis;

SCCP – short chain chlorinated paraffins;
TBT – tributyltin;
TPhT – triphenyltin;
VECAP – a Responsible Care voluntary program;
WFD – Water Framework Directive;
WWTP – waste water treatment plant;

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G. Annexes

Annex 1. HS data sheet

Organotin compounds (TBT and others)

Nomenclature and substance properties

Chemical group: Organotin compounds: tributyltin (TBT);

CAS number: 688-73-3 (TBT); 36643-28-4 (TBT cation);
EINECS number: 211-704-4 (TBT);

Molecular Formula: (n-C_4H_9)3Sn-X;

Degradability, bioaccumulation, toxicity/ecotoxicity:
TBT is the most hazardous of all tin compounds with considerable biological effects such as shell malformation of oysters, imposex in marine snails, reduced resistance to infection (e.g. flounder), and effects on the human immune system.

Substance-specific regulations

Dir. 2008/105/EC:

Name of substance	CAS number	AA-EQS Inland surface waters	AA-EQS Other surface waters	MAC-EQS Inland surface waters	MAC-EQS Other surface waters
Tributyltin compounds (Tributhyltin-cation)	36643-28-4	0,0002	0,0002	0,0015	0,0015

Wastewater Regulation (Lithuanian MoE, No. D1-236, D1-261, D1-416):

Name of substance	CAS number	ELV to sewage system	ELV to the environment	AA-EQS		MAC-EQS	
				Inland surface waters	Other surface waters	Inland surface waters	Other surface waters
Tributyltin compounds (Tributhyltin-cation)	36643-28-4	0,4	0,02	0,0002	0,0002	0,0015	0,0015

Standard classification and labelling (CLP):

Classification	Labelling	Concentration limits
T; R25-48/23/25 Xn; R21 Xi; R36/38 N; R50-53	T; N R: 21-25-36/38-48/23/25-50/53 S: (1/2-)35-36/37/39-45-60-61	C ≥ 25 %: T, N; R21-25-36/38-48/23/25-50/53 2,5 % ≤ C < 25 %: T, N; R21-25-36/38-48/23/25-51/53 1 % ≤ C < 2,5 %: T; R21-25-36/38-48/23/25-52/53 0,25 % ≤ C < 1 %: Xn; R22-48/20/22-52/53

Classification		Labelling		Concentration limits
Acute Tox. 3 * STOT RE 1 Acute Tox. 4 * Eye Irrit. 2 Skin Irrit. 2 Aquatic Acute 1	H301 H372 ** H312 H319 H315	GHS06 GHS08 GHS09 Dgr	H301 H372 ** H312 H319 H315 H410	* oral STOT RE 1; H372: C ≥ 1 % STOT RE 2; H373: 0,25 % ≤ C < 1 % * dermal

Aquatic Chronic 1	H400 H410			Eye Irrit. 2; H319: C ≥ 1 % Skin Irrit. 2; H315: C ≥ 1 %

Production

(Based on information from COHIBA project)

In 2001 organotin compounds were manufactured by seven companies at eight sites in Europe (RPA, 2005). In 2007 there was one manufacturer left in the EU producing tributyltin compounds (RPA, 2007). Estimations based on information from the industry gave the following quantities of TBTs manufactured and sold in the EU in 2007: 500 tones/year as intermediate for synthesis and less than 100 tones/year of TBTO (probably around 30 tonnes/year, RPA, 2007) are exported outside the EU for production of biocide products. Although TBT itself is unstable, it forms stable compounds such as bis(tributyltin) oxide (TBTO), able to persist for years both in hull paints – which is what makes them useful – and in the environment – which makes them a problem. In general the volumes of TBT compounds have been reduced due to phasing out and prohibition of their use as biocide (RPA, 2007; ECHA, 2009).

Manufacturing of mono- and di-substituted organotin compounds have been increasing and were in 2007 around 20 000 tonnes/year (RPA, 2007). TBTO can be found as an impurity of up to 1 % in these compounds (RCOM, 2008), resulting in a total quantity of up to 200 tonnes/year (ECHA, 2009). TBT might be present as a contaminant in these organotin compounds, this means that despite of not manufacturing TBT directly we still have TBT in stock, as the contaminant of other products.

There is no production of organotins in the European catchment area of the Baltic Sea.

Use (in general)

Tributyltin (TBT) is a highly toxic biocide that has been used extensively to prevent the growth of marine organisms on the hulls of ships. It is a problem in the aquatic environment because it is extremely toxic to non-target organisms. The main emission source for TBT is leaching from ship hulls (still continuing). Related main activities that cause emissions are sea ship traffic, shipyards (during removal of old antifouling paints), contaminated harbour sediments / dumping of dredged material. Antifouling use of organic tin compounds in all vessels has been banned in 2003 in EU-15. Old paint should be removed or overcoated since 1st Jan 2008.

Organotin compounds may be used as a preservative for wood, textiles, paper, leather and electric equipment. They are also used as a stabilizer in the manufacturing of plastic products, for example, as an anti-yellowing agent in clear plastics and as a catalyst in poly(vinyl chloride) products.

Examples of probable use of TBT are the following: TBT treated timber, diapers (probably as impurity), PVC flooring & vinyl wallpapers (probably as impurity), earplugs (probably as impurity), manufacture (and use) of regular (non-antifouling) paints (fungicide), manufacture (and use) of aircraft / marking agent, silicon-sealings in buildings, chemical industry (production and wide application of chemical preparations containing TBT), rain clothes, glues and sealants used in construction industry. As biocide, TBT may be present in pillows, canvas, carpets, cuttings, pharmaceuticals, sponges and shoe insoles, textile (in back-coating of textiles used in upholstery and in treatment of feather), paper, leather and glass (OSPAR, 2000).

DBT compounds are used mainly as additives in PVC plastic as a stabilizer. They are also used to speed up (catalyse) the production of plastics, e.g. polyurethanes (foam plastics, glue/sealant) and silicones (e.g. dental products, sealants/jointing material).

Approaches for emission mitigation measures

SOCOPSE project, 2009:

Since the use of TBT in anti fouling is forbidden since 2003, the emission of TBT to water will decrease. Attention must be paid to environmental effect of the substitutes used as anti fouling. Especially to the copper-containing anti-fouling. Also attention must be paid to the TBT contaminated sediments. There are a number of advisable abatement measures for reducing the emissions of TBT to water systems. These measures are:

Source control measures:

- avoid disposal of TBT to waste water during wood preservation
- avoid disposal of TBT coatings to water during activities in ship- and dockyards
- substitution of TBT in anti fouling paint

- substitution of TBT in wood preservatives
- substitution of TBT containing stabilizers in plastics (PVC)

End-of-pipe measures:
- coagulation/flocculation + filtration + coal adsorption or adv. oxidation (shipyard waste water)
- coal adsorption or advanced oxidation (WWTP effluent)

Community level measures:
- use of environmental dredging methods
- remediation of TBT contaminated sediment
- treating of TBT containing sewage sludge or reuse of dried sludge as a secondary fuel

Measures at regulatory level:
- ban dumping of TBT containing sediment and sewage sludge to sea
- ban the use of TBT containing chemicals

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Nonylphenols and their ethoxylates

Nomenclature and substance properties

Chemical group: Nonylphenols and nonylphenol ethoxylates
It is a family of closely related organic compounds, a subset of the alkylphenols.

CAS number: 25154-52-3 (previously covered all nonylphenols but later only nonylphenol with a straight alkylchain); branched nonylphenols: 104-40-5 (4-n-nonylphenol); 84852-15-3 (4-nonylphenol);
27986-36-3, 20427-84-3 (nonylphenol ethoxylates);

EINECS number: 246-672-0 (previously - all nonylphenols, lately - with a straight alkylchain); 203-199-4 (4-n-nonylphenol); 284-325-5 (4-nonylphenol); 248-762-5 (NP1EO); 243-616-4 (NP2EO), etc.;

Molecular Formula: $C_9H_{19}C_6H_4OH$ - nonylphenols; $C_9H_{19}C_6H_4(OCH_2CH_2)_nOH$ – nonylphenol ethoxylates;
Nonylphenol has two types of the isomers, straight and branched.

Degradability, bioaccumulation, toxicity/ecotoxicity:
Nonylphenol is considered to be an endocrine disruptor due to weak ability to mimic estrogen and in turn disrupt the natural balance of hormones in affected organisms. It is toxic to many aquatic organisms.

Substance-specific regulations

Dir. 2008/105/EC:

Name of substance	CAS number	AA-EQS Inland surface waters	AA-EQS Other surface waters	MAC-EQS Inland surface waters	MAC-EQS Other surface waters
Nonylphenols (4-nonylphenol)	104-40-5	0,3	0,3	2,0	2,0

Wastewater Regulation (Lithuanian MoE, No. D1-236, D1-261, D1-416):

Name of substance	CAS number	ELV to sewage system	ELV to the environment	AA-EQS		MAC-EQS	
				Inland surface waters	Other surface waters	Inland surface waters	Other surface waters
Nonylphenol (4-n-nonylphenol)	25154-52-3 (104-40-5)	400	20	0,3	0,3	2,0	2,0

Standard classification and labeling according (CLP):

Name of substance	Classification		Labelling	
nonylphenol [EC: 246-672-0] 4-nonylphenol, branched [EC: 284-325-5]	Xn; R22 C; R34 N; R50-53		C; N R: 22-34-50/53 S: (1/2-)26-36/37/39-45-60-61	
	Classification		Labelling	
	Repr. 2 Acute Tox. 4 * Skin Corr. 1B Aquatic Acute 1 Aquatic Chronic 1	H361fd H302 H314 H400 H410	GHS08 GHS05 GHS07 GHS09 Dgr	H361fd H302 H314 H410

Production

(Based on information from COHIBA project)
The total production of NP in EU was around 78 000 tonnes in 1994 and 74 000 tonnes in 1997 (EU RAR, 2002). NPEs are produced by the ethoxylation of NP.

The production of NPEs was 109 808 tonnes in 1994 and 118 000 tonnes in 1997 in the EU (EU RAR, 2002). Due to restriction of NP in several uses (EU directive 2003/53/EC, now Annex XVII of Reach regulation) the production volumes of NP in EU can assumed to have been reduced by 50 % since 2005 (Cohiba, 2011).
The manufacture of NP and NPE is not banned in the EU and there is still production of NP and NPE in the European catchment area of the Baltic Sea. In 2006, there were three NP producers in Europe and one of them was potentially locating in Baltic catchment area (in Poland). The production volume is 8 000 tonnes/year. Additionally, NPEs are produced in Sweden in the catchment area of Kattegat and Skagerrak (amount of production is confidential information).
Globally the annual production of nonylphenol have reached 154 200 tons in the USA, 16 500 tons in Japan and 16 000 tons in China (Cohiba, 2011).

Use (in general)

Nonylphenol is used in the production of other chemicals, mainly nonylphenol ethoxylates, and also other nonylphenol-derivatives. It is a starting substance in the production of modified phenolic resins. It is used in the manufacture of phenolic oximes. Nonylphenol might be also used as stabiliser and emulsifying agent (in paints, varnishes and coatings), as adhesive or binding agent, process regulator, stabiliser and hardener for epoxy resin in manufacture of plastic products (e.g. in construction materials), as soldering agent (in insulated wired and cables).

Phenols are subjected to ethoxylation to give phenol ethoxylates, which are widely used as industrial surfactants. NPE might be used in various applications: as cleaning agent in cleaning mixtures (both industrial and household use), as stabiliser and emulsifying agent (in paints, varnishes and coatings), as stabiliser and developer agent in developing photos, as solvent for pesticide (agricultural use), as aid agent in pretreated wooden fibre mass and removal of lignin in manufacture of pulp, as degreasing agent in treatment of animal hides, as surface-active agent in manufacture of pharmaceuticals (human and veterinary), as soldering agent in manufacture of electronic components, as anti-icing agent in aircrafts, use in processing of wool, use in metal fluids in treatment and coating of metal, use in concrete in order to increase its porosity, use as laboratory agent, use in cosmetics. [HELCOM Overview 2007]

Approaches for emission mitigation measures

SOCOPSE project, 2009:

Source control options:
- substitution of nonylphenol ethoxylates by alcohol ethoxylates (mostly implemented)
- separation zone in case of using NPE containing pesticides (mostly already phased out)

End-of-pipe options:
- coal adsorption or chemical oxidation as polishing techniques for effluents of WWTPplants

Community level measures:
- use of end of pipe techniques for NP(E) containing effluent WWTP
- reuse sewage sludge options
- use of end of pipe techniques for NP(E) containing landfill leachate and groundwater

Measures at regulatory level:
- ban the use of NP(E) containing sludge as soil improver
- ban the import of NP(E) containing textiles

References

COHIBA, 2011. Guidance document No.6 [lead authors J. Mehtonen, P.Munne]. Measures for emission reduction of NP and NPE to the Baltic Sea.

EU RAR, 2002. 4-nonylphenol (branched) and nonylphenol. European Communities. 244 p.

HELCOM, 2007. "Towards a Baltic Sea Unaffected by Hazardous Substances - HELCOM Overview 2007". Background Document for HELCOM Ministerial Meeting in Krakow, Poland, 15 November 2007. 48 p. Helsinki Commission.

HELCOM, 2009 [author J. Mehtonen]. Hazardous substances of specific concern to the Baltic Sea – Final report of the HAZARDOUS project. Baltic Sea Environment Proceedings No. 119. 95 p. Helsinki Commission.

SOCOPSE, 2009. An Inventory and Assessment of Options for Reducing Emissions: Nonylphenols. 44 p.

Octylphenols and their ethoxylates

Nomenclature and substance properties

Chemical group: Octylphenols and octylphenol ethoxylates
It is a family of closely related organic compounds, a subset of the alkylphenols.

CAS number: 140-66-9 (4-tert-octylphenol); 1806-26-4 (4-n-octylphenol); 9002-93-1, 9036-19-5 (octylphenol ethoxylates);
EINECS number: 205-426-2 (4-tert-octylphenol); 266717-8 (4-n-octylphenol);

Molecular Formula: $C_8H_{17}C_6H_4OH$ - octylphenols; $C_8H_{17}C_6H_4(OCH_2CH_2)_nOH$ – octyl phenol ethoxylates;

Degradability, bioaccumulation, toxicity/ecotoxicity:
Octylphenol (OP) is very toxic to aquatic organisms, not easily degraded in the environment, and has the potential to cause significant endocrine disruption effects.

Substance-specific regulations

Dir.2008/105/EC:

Name of substance	CAS number	AA-EQS Inland surface waters	AA-EQS Other surface waters	MAC-EQS Inland surface waters	MAC-EQS Other surface waters
Octylphenol (4-tert-noctylphenol)	104-66-9	0,1	0,01	Not applicable	Not applicable

Wastewater Regulation (Lithuanian MoE, No. D1-236, D1-261, D1-416):

Name of substance	CAS number	ELV to sewage system	ELV to the environment	AA-EQS		MAC-EQS	
				Inland surface waters	Other surface waters	Inland surface waters	Other surface waters
Octylphenol (4-tert-octylphenol)	140-66-9	400	20	0,1	0,01	-	-

Standard classification and labelling according (CLP):
No standard classification.

Production

(Based on information from COHIBA project)
There are listed 12 producers and importers of octylphenol in the actual version of the European information system ESIS, but only the company ARIZONA CHEMICALS (Sweden) is located in the Baltic Sea Catchment.
In the EU, approximately 23,000 tons (2001) of 4-tert-octylphenol were produced per year, of which only a small portion was exported. Since 2001, the production decreased significantly, and a greater proportion of the production volume is exported. 4-tert-octylphenol can also arise in the production of nonylphenol as a contaminant in an amount of up to 10%, usually about 3-5% (OSPAR, 2004).

Use (in general)

4-tert-octylphenol (104-66-9) is the only commercially important octylphenol.
Octylphenol is used as adhesive during vulcanisation (in manufacture of car tyres); it is also used in paper coating, in insulation of electronic coils (in electric motors, generators and transformers). OP might be present as an impurity in nonylphenol.

Octylphenol ethoxylate is used as surface-active agent in cleaning preparations (e.g. in service of motor vehicles, compressors and other industrial cleaning), as adhesive and glue in manufacture of plastic products, as stabiliser and developer in developing photos, as emulsifier in manufacture of styrene-butadiene polymers, as emulsifier and dispersant in water based paints, printing inks and paints intended to surfaces exposed to sea water, as emulsifier and dispersant for pesticide applied in agriculture and horticulture, in water based metal working fluids in treatment and coating of metal, in treatment of textiles and leather finishing, in pharmaceuticals.

Approaches for emission mitigation measures

COHIBA project, 2009:

Substitution: Changing of product material (for OP/OPE-containing products: tyres, paints);
Redesign of the products (for OP/OPE-containing products: tyres, paints);
Urban run-off management (for OP/OPE-containing products: tyres, paints);
Sorption: activated carbon and other sorbents (for industrial and municipals waste water);
Mechanical/biological treatment (adsorption to sludge) (for municipals waste water);
Advanced sludge treatment: controlled incineration (for municipals waste water).

References

COHIBA, 2011. Guidance document No. 7 [lead author F. Marscheider-Weidemann]. Measures for emission reduction of octylphenols and octylphenol ethoxylates to the Baltic Sea.

HELCOM, 2009 [author J. Mehtonen]. Hazardous substances of specific concern to the Baltic Sea – Final report of the HAZARDOUS project. Baltic Sea Environment Proceedings No. 119. 95 p. Helsinki Commission.

OSPAR, 2004. Octylphenol. Hazardous Substances Series. OSPAR Commissions, 2003 (2004 update).

RPA, 2006. 4-tert-Octylphenol Risk Reduction Strategy and Analysis of Advantages and Drawbacks. Draft Final Report.

DEHP and other phthalates

Nomenclature and substance properties

Chemical group: phthalates.
There is a wide range of different phthalates, which each have specific properties, uses, and health effects.

CAS number: 117-81-7 (DEHP); 84-74-2 (DBP); 84-69-5 (DIBP); etc.
EINECS number: 204-211-0 (DEHP); 201-557-4 (DBP); 201-553-2 (DIBP); etc.

Molecular Formula: $C_{24}H_{38}O_4$ (DEHP); $C_{16}H_{22}O_4$ (DBP and DIBP);

Degradability, bioaccumulation, toxicity/ecotoxicity:
Hazardous properties of DEHP are related to its ability to bioaccumulate and accumulate in aquatic environments. It is classified as being reprotoxic.

Substance-specific regulations

Dir. 2008/105/EC:

Name of substance	CAS number	AA-EQS Inland surface waters	AA-EQS Other surface waters	MAC-EQS Inland surface waters	MAC-EQS Other surface waters
Di(2-ethylhexyl)-phthalate (DEHP)	117-81-7	1,3	1,3	not applicable	not applicable

Wastewater Regulation (Lithuanian MoE, No. D1-236, D1-261, D1-416):

Name of substance	CAS number	ELV to sewage system	ELV to the environment	AA-EQS		MAC-EQS	
				Inland surface waters	Other surface waters	Inland surface waters	Other surface waters
Di(2-ethylhexyl)-phthalate (DEHP)	117-81-7	40	2	1,3	1,3	-	-

Standard classification and labelling (CLP):

Name of substance	Classification		Labelling	
bis(2-ethylhexyl) phthalate; di-(2-ethylhexyl) phthalate; DEHP	Repr. Cat. 2; R60-61		T R: 60-61 S: 53-45	
	Classification		Labelling	
	Repr. 1B	H360-FD	GHS08 Dgr	H360FD

Name of substance	Classification		Labelling	
dibutyl phthalate; DBP	Repr. Cat. 2; R61 Repr. Cat. 3; R62 N; R50		T; N R: 61-50-62 S: 53-45-61	
	Classification		Labelling	
	Repr. 1B Aquatic Acute 1	H360-Df H400	GHS08 GHS09 Dgr	H360Df H400

Production

In 1997, 595 kilotons of DEHP have been produced in the EU, of which about half was produced in Germany, respectively 251 kilotons in 1994. Total European production is divided over about 20 production locations in 12 countries.

DEHP was registered by ECHA according to REACH requirements in October of 2010. The members of the DEHP consortium included Arkema (lead registrant), Oxea, Perstorp, Polynt SPA, Zak S. A., Deza a. s., Oltchim S. A. and Boryszew S. A. They claim DEHP accounts for around 17% of all plasticiser usage in Western Europe and approximately one third of plasticiser use worldwide.

Use (in general)

Phthalates are mainly used as plasticizers. They are not chemically bound to plastics, so they can be released from consumer products into the environment

Due to its suitable properties, DEHP is widely used as a plasticizer in manufacturing of articles made of PVC. It is also used as a hydraulic fluid and as a dielectric fluid in capacitors. DEHP also finds use as a solvent in glowsticks.

Examples of probable use of DEHP are the following: medical devices, plastic products such as PVC, polycarbonate, cosmetic chemical products. DEHP has been used as a plasticiser in medical devices such as intravenous tubing and bags, catheters, nasogastric tubes, dialysis bags and tubing, and blood bags and transfusion tubing, and air tubes. For this reason, the patient, especially those requiring extensive infusions, might be exposed to DEHP.

Dibutyl phthalate (DBP) is a commonly used plasticizer. It is also used as an additive to adhesives or printing inks. DBP is also used as an ectoparasiticide.

DIBP is used in nitro cellulose plastic, nail polish, explosive material, lacquer manufacturing and used with methyl methacrylate applications.

Approaches for emission mitigation measures

SOCOPSE project, 2009:

Several *source control options* to decrease production and emission of DEHP:

- substitution of both PVC and DEHP by DINP or DIDP but preferably by biodegradable alternatives;
- legislative control on production;
- legislative control on the (domestic-) use of DEHP containing products will stimulate industry to use alternative plasticizers indirectly.

Furthermore, several *end-of-pipe solutions* to reduce the emission of this substance from WWTP's:

- (Biological) Optimization of existing WWTP's to enhance biodegradation and adsorption to sludge;
- Secondary Sludge treatment should be controlled because main removal mechanism in conventional WWTP is adsorption to sludge. DEHP should be prevented to enter the environment when sludge is treated;
- Advanced waste water treatment by means of separation and oxidation to decrease the DEHP content of the effluent even further.

Based on the fact that DEHP is produced in already lower quantities, but is still being released from both old and new buildings, neither source control, nor end-of-pipe solutions will be sufficient on their own.

References

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Polybrominated diphenylethers

Nomenclature and substance properties

Chemical group: Polybrominated diphenyl ethers (PBDEs)
The group includes 209 aromatic brominated compounds.

Major classes of PBDEs: tetrabromodiphenylether, pentabromodiphenylether, hexabromodiphenylether, heptabromodiphenylether, octabromodiphenylether, nonabromodiphenylether, decabromodiphenylether.

CAS number: 40088-47-9 (tetra-); 32534-81-9 (penta-); 36483-60-0 (hexa-); 68928-80-3 (hepta); 32536-52-0 (octa-); 63936-56-1 (nona-); 1163-19-5 (deca);

EINECS number: 254-787-29 (tetra-); 251-084-2 (penta-); 253-058-6 (hexa-); 273-031-2 (hepta); 251-087-9 (octa-); 264-565-7 (nona-); 214-604-9 (deca);

Molecular Formula: $C_{12}H_{10-x}Br_xO$ (with 1≤ x ≤10). For example: $C_{12}H_5Br_5O$ (penta-), $C_{12}H_2Br_8O$ (octa-), $C_{12}H_{10}O$ (deca-).
The PBDE congeners differ by the degree of bromination (1 to 10) and the relative location of bromine atoms on the two aromatic rings. They are usually numbered from 1 to 209.

Degradability; bioaccumulation; toxicity/ecotoxicity:
PBDEs have a low acute toxicity, varying from 2000 to >7000 mg/kg in mammals, however, they are highly bioaccumulative – especially PentaBDE which was found to have BCF (bioconcentration factor) larger than 10 000 in aquatic organisms. Exposure can result in neurotoxical effects and irreversible damage to the endocrine system. Various laboratory studies on rats and fish have shown a potential to significantly damage liver and cause increased risk of carcinogenetic.

Substance-specific regulations

Dir. 2008/105/EC:

Name of substance	CAS number	AA-EQS Inland surface waters	AA-EQS Other surface waters	MAC-EQS Inland surface waters	MAC-EQS Other surface waters
Brominated diphenylether	32534-81-9	0,0005	0,0002	Not applicable	Not applicable

Wastewater Regulation (Lithuanian MoE, No. D1-236, D1-261, D1-416):

Name of substance	CAS number	ELV to sewage system	ELV to the environment	AA-EQS		MAC-EQS	
				Inland surface waters	Other surface waters	Inland surface waters	Other surface waters
Pentabromodiphenylether	32534-81-9	-	-	0,0005	0,0002	-	-

Standard classification and labelling of pentabromodiphenylether according to CLP:

Classification		Labelling	
Xn; R48/21/22 R64 N; R50-53		Xn; N R: 48/21/22-50/53-64 S: (1/2-)36/37-45-60-61	
Classification		Labelling	
STOT RE 2 * Lact. Aquatic Acute 1 Aquatic Chronic 1	H373** H362 H400 H410	GHS08 GHS09 Wng	H373 ** H362 H410

Production
(Based on information from Socopse and Cohiba) PBDEs have been marketed mainly under three technical products, referred to as PentaBDE, OctaBDE, and DecaBDE. However, each commercial product is neither a specific congener nor a pure class of isomers but a mixture of PBDEs with varying degrees of bromination. There is no more production of PBDEs in Europe. PentaBDE, OctaBDE, and DecaBDE production ceased in 1997, 1998, and 1999, respectively (European Chemicals Bureau, 2001, 2002, 2003). Four manufacturers are outside the EU: two in the USA (Albermarle Corporation and Chemtura), one in Japan (Tosoh Corporation), and one in Israel (ICL Industrial Products) (Socopse, 2009). In 2001 the world-wide demand for DecaBDE was reported to be 56,100 tonnes, of which of 7,600 tonnes found its way to the European market. In addition, it is assumed that a further 1,300 tonnes/year of DecaBDE were imported into the EU in finished (or partly finished) articles. This estimate consisted of 500 tonnes/ year from DecaBDE present in non-television (TV) consumer electronics produced in Asia, 400 tonnes/year of DecaBDE present in TVs produced in Asia, and 400 tonnes/ year of DecaBDE in flame retarded polystyrene produced outside the EU.
Use (in general)
PBDEs might be used as flame retardant in plastic (in electrical equipment such as computers) – the main use; also as flame retardant in different textiles (for special work wear and special carpets), as flame retardant in different products made of flexible polyurethane foam (in furniture, mattresses, parts of cars and packing material). PBDEs are not chemically combined with but physically added to the material (Lassen et al, 1999), so that during the product lifetime, there is a possibility that PBDEs may escape and be released (WHO IPCS, 1994; European Chemicals Bureau, 2001). The use of PentaBDE and OctaBDE is banned in EU; DecaBDE is banned in electric and electronic equipment, but inflow to the market is occurring via importing finished articles.
Approaches for emission mitigation measures
SOCOPSE (2009): Most current PBDE emissions to water come from waste (disposal and sludge spreading), but some industrial point sources (DecaBDE) as well as fires via extinguishing water might cause local pollution. However the PBDE concentrations in the environment are mainly due to historical pollution and accumulation. For the last decade the production of PBDEs has disappeared in EU member states and the uses of PentaBDE and OctaBDE have been phased out: only DecaBDE may be used. Beyond the ban of PentaBDE and OctaBDE which is in effect since 2004, there are a number of other possible PBDE abatement measures, which can be combined and whose implementation has been often already started. These options for reducing emissions are about: source control options (limiting the effects of DecaBDE and DecaBDE alternatives including chemical substitution, changing product materials, and redesigning products); and end-of-pipe options (recycling and disposal). Since PBDEs are very stable and widespread in the environment, even if all measures for reducing PBDE emissions are taken, they will still remain in the environment for some years. But as the implementation of the chosen options for controlling release progresses, the pollution by PBDEs will decrease, though with a delay.
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report, Ispra: European Commission, 274 p.

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C. Lassen, S. Løkke, L. I. Andersen, 1999. Brominated flame retardants: Substance flow analysis and assessment of alternatives, Report 494, Copenhagen: Danish Environmental Protection Agency, 225 p.

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Short-chain (SCCP, C_{10-13}) and medium-chain (MCCP, C_{14-17}) chlorinated paraffins

Nomenclature and substance properties

Chemical group: Short-chain (SCCP, C10-13) and medium-chain (MCCP, C14-17) chlorinated paraffins;
They are chlorinated derivatives of n-alkanes, having carbon chain of different length (e.g. between 10 and 13 for SCCP), and different degree of chlorination (e.g. chlorine content ranges from 30 to 70% in weight for SCCP).
CAS number: 85535-84-8 (SCCP), 85535-85-9 (represents the commercial MCCP used in Europe);
Arround 40 CAS numbers have been used to describe the whole chlorinated paraffin family at one time or another;
EINECS number: 287-476-5 (SCCP), 287-477-0 (MCCP);

Molecular Formula: SCCP: $C_xH_{2x+2-y}Cl_y$, where x=10 – 13, and y=1 – 13;

Degradability; bioaccumulation; toxicity/ecotoxicity:
Chlorinated paraffins are not readily biodegradable. Short carbon chain length chlorinated paraffins with a chlorine content of less than 50% appear to be degradable under aerobic conditions with acclimated microorganisms, whereas the degradation appears inhibited at a chlorine content above 58%. Intermediate and long chain length chlorinated paraffins are degraded more slowly.
Chlorinated paraffins are bioaccumulated in aquatic organisms, and the reported bioconcentration factors (BCFs) are in the range of 7 to 7155 for fish and 223 to 138 000 for mussels. In fish, chlorinated paraffins of short chain length are accumulated to a higher degree than intermediate and long chain length chlorinated paraffins.
They are toxic to aquatic organisms at low concentrations.

Substance-specific regulations

Dir. 2008/105/EC:

Name of substance	CAS number	AA-EQS Inland surface waters	AA-EQS Other surface waters	MAC-EQS Inland surface waters	MAC-EQS Other surface waters
Short-chain (SCCP, C10-13)	85535-84-8	0,4	0,4	1,4	1,4

Wastewater Regulation (Lithuanian MoE, No. D1-236, D1-261, D1-416):

Name of substance	CAS number	ELV to sewage system	ELV to the environment	AA-EQS		MAC-EQS	
				Inland surface waters	Other surface waters	Inland surface waters	Other surface waters
Short-chain (SCCP, C10-13)	85535-84-8	40	0,2	0,4	0,4	1,4	1,4

Standard classification and labelling (CLP):

Classification		Labelling	
Carc. Cat. 3; R40 N; R50-53		Xn; N R: 40-50/53 S: (2-)24-36/37-60-61	
Classification		Labelling	
Carc. 2 Aquatic Acute 1 Aquatic Chronic 1	H351 H400 H410	GHS08 GHS09 Wng	H351 H410

Production

The worldwide production of polychlorinated paraffins (short, medium and long chain) has been estimated to be 3000,000 tonnes in 1993 (Oehme et al, 2005). Later the production of MCCP in the EU-15 has been

estimated to be 45,000-160,000 tonnes per year (EU RAR, 2005).
Use (in general)
SCCP is used in manufacture of textiles in order to achieve clothes (e.g. for sailing, for industrial work) of high flame resistant, water-proof and anti-fungal properties. It is also used as greasing agent in leather finishing, as lubricants in compressed air tools in garages and in different industrial sectors, as plasticiser and flame retardant in paints (used e.g. in road marking and as primer for surfaces exposed to sea water), varnishes and coatings, also as plasticiser and flame retardant in rubber products (for construction sector and car industry), in metal working fluids. MCCP is used as greasing agent in leather finishing, as plasticiser and flame retardant in paints, varnishes and coatings, as plasticiser and flame retardant in rubber products (for construction sector and car industry), as plasticiser and flame retardant in PVC plastic, used in some carbon copy paper types, used in metal working fluids. Currently MCCP are alternatives to SCCP for many applications.
Approaches for emission mitigation measures
COHIBA project, 2009: The updated EU risk assessment report on "alkanes, C10-13, chloro" (EU RAR 2008) sees "a need for limiting the risks; risk reduction measures which are already being applied shall be taken into account" due to the recognition of SCCP as a PBT substance. Due to secondary poisoning via the aquatic food chain and the marine secondary poisoning this conclusion also applies to the areas of: 1) formulation of backcoatings and application of backcoatings to textiles; 2) conversion and compounding of rubber, formulation and processing of textiles backcoatings, and from the industrial use of paints and coatings. The EU risk assessment report on "alkanes, C14-17, chloro (MCCP)" (EU RAR 2005) sees "a need for limiting the risks; risk reduction measures which are already being applied shall be taken into account" for surface waters from: 1) the use of MCCP in the production of PVC in some processes; 2) the formulation of metal cutting fluids; 3) the use in leather fat liquors. For sediment a risk is identified additionally from: 1) use of MCCP in plastics/rubber; 2) use in carbonless copy paper (sites carrying out paper recycling). For the terrestrial compartment, a risk is further identified from waste remaining in the environment. The recommendations of EU RAR (2005) and EU RAR (2008) for limiting the risks are objecting regulatory measures for restricting production and use of SCCP and MCCP.
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Perfluorooctane sulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA)

Nomenclature and substance properties

Chemical group: Perfluorinated compounds;

CAS number: 1763-23-1 (PFOS), 335-67-1 (PFOA);
EINECS number: 217-179-8 (PFOS), 251-543-7 (PFOA);

Molecular Formula:
$C_8HF_{15}O_3S$
$C_8HF_{15}O_2$

Degradability; bioaccumulation; toxicity/ecotoxicity (of PFOS):
PFOS is persistent, bioaccumulative and toxic to mammalian species. There are species differences in the elimination half-life of PFOS: the half-life is 100 days in rats, 200 days in monkeys, and years in humans. The toxicity profile of PFOS is similar among rats and monkeys. Repeated exposure results in hepatotoxicity and mortality; the dose-response curve is very steep for mortality. A 2-year bioassay in rats has shown that exposure to PFOS results in hepatocellular adenomas and thyroid follicular cell adenomas; the hepatocellular adenomas do not appear to be related to peroxisome proliferation. Further work to elucidate the species differences in toxicokinetics and in the mode of action of PFOS will increase our ability to predict risk to humans. Epidemiologic studies have shown an association of PFOS exposure and the incidence of bladder cancer; further work is needed to understand this association.
PFOS is persistent in the environment and has been shown to bioconcentrate in fish. It has been detected in a number of species of wildlife, including marine mammals. It appears to be of low to moderate toxicity to aquatic organisms but there is evidence of high acute toxicity to honey bees. No information is available on effects on soil- and sediment-dwelling organisms and the equilibrium partitioning method may not be suitable for predicting PNECs for these compartments.

Substance-specific regulations

Dir. 2008/105/EC: AA-EQS and MAC-EQS not defined;
Wastewater Regulation (Lithuanian MoE, No. D1-236, D1-261, D1-416): ELV, AA-EQS, MAC-EQS not defined;
Classification and labelling: No standard classification.

Production

(Based on information from COHIBA project)
Manufacture of PFOS and PFOS-related compounds is banned in the EU and the US, but China started large-scale production of POSF based chemicals in 2003. There is no production of PFOS in the European catchment area of the Baltic Sea.

Manufacture of PFOA/APFO is still allowed in the EU, but there is a voluntary agreement to eliminate emission of PFOA and PFOA content of products until 2015. There is no production of PFOA in the European catchment area of the Baltic Sea-

Use (in general)

The main uses of PFOS are as surface-active agent in waxes and floor polishes, as dirt rejecter, friction control agent, surfactant and antistatic agent in photographic industry, as surface-active agent in metal surface treatment (e.g. chromium plating; important applications are e.g. aircraft and vehicles), as surfactant in industrial and household cleaning products, as flame retardant, corrosion inhibitor and surface-active agent in hydraulic fluids of both civil and military airplanes, as water and oil repellent in surface treatment of textiles and leather, as water and grease repellent in surface treatment of paper and cardboard, use in semiconductor industry, in fire-fighting foams.

PFOA is used as fluxing agent in plumbing with leaded soldering tin, as processing aid in manufacture of fluoropolymers such as PTFE (polytetrafluoroethylene; applied in many sorts of products). Then PFOA is not

intentionally part of the final products (unlike PFOS), but remains as impurity (e. g. In fluorpolymer).
Approaches for emission mitigation measures
COHIBA project, 2009: Apply substitution of PFOS. The BREF document, which defines current BAT in metal surface treatment dates from 2006. As the document was written before the EU ban (Directive 2006/122/EC), it contains only few references to PFOS. More general measures for PFOS emission reduction are advised, such as closing water cycles, minimizing drag out, economic use of PFOS by measuring surface tension in the baths. Especially, the BREF document contains no definite reference to which waste water treatment technologies are effective for PFOS. For example, AC treatment is mentioned as an option, but so is sand filtration, which is not effective for PFOS. Therefore, even with full implementation of BAT, metal plating facilities can have very high emission factors for PFOS. Additionally, metal plating facilities with bath volumes <30 m^3 are not IPPC regulated. Also consumer awareness in the field of hazardous substances is in general rather low, which can be due to the complexity of the issue. But it can be expected, that people desire to live in a “toxfree cities”. So awareness raising can have several effects: consumer buys products, which are labelled “toxfree” (e.g. teflon pans without PFOA); consumer buys less of certain products (“chromium” water taps or car parts) as they are aware, that this is a specialized product (whose production requires hazardous substances), and that the functionality of the product is not required in the foreseen application (e.g. impregnated jackets for everyday use). Activated Carbon Filters (AC) for removal of pollutants from wastewater are a proven technology. AC has a high surface area and is an effective sorbant for many substances. Different technical systems are commercially available (e.g. powder (PAC) and granular activated carbon (GAC).
References
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