IMPLEMENTATION PLAN OF THE STOCKHOLM CONVENTION ON PERSISTENT POLLUTANTS. AMENDMENT UNDER CONFERENCE DECISIONS IV, V AND VI

1. INTRODUCTION

The supplement to the implementation program of the Stockholm Convention on Persistent Organic Pollutants includes adopted at the IV, V and VI Conferences of the Parties to the Convention, respectively in 2009, 2011 and 2013 with decisions SC-4/10, 4/11, 4/12, 4,/13, 4/14, 4/15, 4/16, 4/17, 4/18, 5/3 and 6/13 Convention new persistent organic pollutants (hereinafter *POS)* listed in the appendices and products containing them.

The implementation plan provides an overview of new POS, their possible sources, use and from being found and in the analyzes of surface and ground water, landfill leachate and food. In order to find out how many products contain these substances, an inventory was made, which as a result, the main areas of activity and product groups where these substances can be found were marked and organized survey of companies.

Scientific literature was used to compile an overview of new chemicals and their possible sources and materials of several international organizations.

Previous studies of new POS in Estonian waters have been added to the list described in the implementation plan analysis of the results of national monitoring, hazardous substance studies and COHIBA and BaltActHaz projects on the basis of, in addition, samples collected from the Pääsküla and Aardla landfills were examined for landfill leachate based on
Table 1 lists the subjects discussed in the implementation program update.

Table 1. Subjects discussed in the implementation program update

chemical	**CAS no**	**of the decision to add to the Convention no**	**possible uses**
chlordecone	143-50-9	SC-4/12	pesticide for control of ants, cockroaches, tobacco bugs and banana root pests
endosulfan	115-29-7	SC-5/3	pesticide
alpha-hexachloro-cyclohexane, (ÿ-HCH)	319-84-6	SC-4/10	pesticide, also used to make lindane
beta-hexachloro-cyclohexane (ß-HCH)	319-85-7	SC-4/11	pesticide, also used to make lindane
pentachlorobenzene (PeCB)	608-93-5	SC-4/16	contained in products containing PCBs, also used as a fungicide, flame retardant, in paint powder, occurs as an intermediate product of the chemical industry

lindane (ÿ-HCH)	58-89-9	SC-4/15	used as a medicine, in the treatment of seeds and wood
hexabromobiphenyl, (HBB)	36355-01-8	SC-4/13	In ABS plastics, varnishes and coating materials, polyurethane foam, as a flame retardant
pentabromodiphenyl ether (BDE)	40088-47-9; 32534-81-9	SC-4/18	in polyurethane foam, electronic devices, textile materials
octabromodiphenyl ether (BDE)	68631-49-2; 207122-15-4; 446255-22-7; 207122-16-5	SC-4/19	In ABS plastics, synthetic textile materials, thermoplastic elastomers, polyolefins
perfluorooctane sulfonic acid (PFOS) its salts, perfluorooctanesulfonyl -fluoride (PFOS-F)	1763-23-1; 307-35-7	SC-4/17	coating of metals and semiconductors, fire extinguishing foams, electrical and electronic equipment, photographic displays, hydraulic fluids, LCD screens, textile materials, paper and cardboard impregnation and coating
1,2,5,6,9,10-hexabromocyclododecane (HBCDD)	3194-55-6	SC-6/13	as a flame retardant

2. OVERVIEW OF PERMANENTS HANDLED IN THE IMPLEMENTATION PLAN OF ORGANIC POLLUTANTS

2.1 Chlordecone

Chlordecone is no longer produced or used in the world. Based on the risk profile of chlordecone, there is it has been used in various parts of the world to kill and control various pests for storage.

The management of chlordecone waste and residues is regulated at the level of the European Union By Parliament and Council Regulation No. 850/2004, according to which all waste containing more than 50 mg/kg POSs, including chlordecone, handle so that the content of POSs is destroyed.

2.2 Endosulfan

Endosulfan is a pesticide against insects and mites belonging to the group of organochlorine compounds for destruction mainly in the cultivation of tea, coffee, cotton, fruits rice and vegetables. Endosulfan is a highly toxic chemical to most organisms.

Endosulfan is defined as a priority hazardous substance. European Union member states have the use of endosulfan as a plant protection agent has been prohibited since June 2007 by the Council by Directive 91/414/EEC for not including it in Annex I and containing the active ingredient in question on the cancellation of permits for plant protection products. By 2012, the use of the chemical has been banned for 80 years in the country.

Endosulfan is also stipulated as a persistent toxic substance in the convention on long-range transboundary air pollution *(Convention of Long-range Transboundary Air Pollution (LRTAP))* and the United Nations United Nations Environment Program *(Pesticide Action Network (PAN) International, 30 June 2008))* in the lists.

In October 2009, the Stockholm Convention on Persistent Organic Pollutants was adopted Against *the Persistent Organic Pollutants Review Committee (POPRC) .* a draft risk profile for endosulfan, according to which global action is being taken to ban the chemical justified because endosulfan is highly volatile in the environment and harmful to humans and the environment dangerous chemical.

2.3 Alpha-hexachloro-cyclohexane (ÿ-HCH)

Alpha-HCH is produced as an intermediate or by-product in the production of technical HCH and is not handled separately as a chemical. Technical HCH is used as an insecticide or lindane (gamma-HCH, i.e. enriched HCH) in production. There is no official information on the production of technical HCH, although the production of lindane is still happening in certain countries.

Alpha-HCH is one of the five stable isomers of the technical HCH used in agriculture as an organochlorine pesticide.

Alpha-HCH is a by-product in the production of lindane and enters the environment when using technical HCH and in the case of improper disposal of residues from lindane purification.

Technical HCH is synthesized from benzene and contains 65-70% alpha-HCH, 7-10% beta-HCH, 14-15% gamma-HCH (lindane), ~7% delta-HCH , ~1-2% epsilon-HCH and ~1-2% other components.

2.4 Beta-hexachloro-cyclohexane (ß-HCH)

Beta-HCH is one of five stable isomers of the technical organochlorine pesticide HCH.

After nearly 40 years of worldwide use of technical HCH, it was phased out replace with lindane. After 2000, there is no information on the significant use of technical HCH, although it still enters the environment during the production of lindane and from hazardous waste storage sites and landfills and from contaminated areas.

2.5 Pentachlorobenzene (PeCB)

PeCB has been used to reduce the viscosity of polychlorinated biphenyl (PCB) products, in the composition of dyes, as a fungicide, in flame retardants, as an intermediate chemical in the production of quintocene (soil fungicide), in the importation and distribution of quintocene. Any use of it outside the production process has been prohibited in Estonia since 1999.

PeCB is also produced as a by-product in industrial and combustion processes and also occurs as an additive in solvents and pesticides.

The importance of the use of PeCBs is decreasing due to restrictions on their use and content in products.

The most important sources of PeCBs are thermal processes where PeCBs are generated unintentionally, e.g in the metallurgical industry, electricity production, waste incineration plant and waste burning in households, as well as in sewage sludge. PeCB was one of the components of a mixture of chlorobenzenes, which was used to reduce the viscosity of PCBs in heat transfer equipment. There are also PeCBs used by combining with PCBs in dielectric fluids in various electrical devices such as capacitors, transformers, etc. Since the 1980s, PCBs have been used in electrical equipment significantly reduced, therefore the emission of PeCBs also decreases. As of 2013, there are In Estonia, all equipment containing PCBs has been dismantled.

Estimates of PeCB emissions are calculated based on, for example, energy of the amount of fuels used for production.

Even short-term exposure to PeCBs can affect the central nervous system, long-term exposure can damage several tissues. The results of animal studies show that PeCB can have reproductive toxic effects on humans.

In summary, PeCB can be emitted into the environment:

- burning of household waste **–** PeCB is produced by burning all chlorine-containing materials;
- burning of hazardous waste **–** PeCBs are produced in larger quantities during burning in uncontrolled conditions, but in smaller quantities when special furnaces are used;
- in wood processing **–** PeCBs are found as an additive in pentachlorophenols used in wood processing, PeCBs have also been used in the processing of railway sleepers, building materials, piles and posts. PeCB is emitted into air, water and soil during wood processing, as well as processed wood when using or burning wood. By 2010, the use of PeCB as a wood processing tool was prohibited in the countries of the European Union, but since the service life of the treated wood is approx. 15 years, then the emission of PeCBs may still occur in EU countries, but it will decrease over the years;
- in metal production **–** chlorobenzenes are most likely to occur in various forms during metal production, e.g. aluminum degassing, magnesium oxide carbon-chlorination, iron recycling, etc.;
- when using solvents **–** PeCBs have been found in perchlorethylene used in dry cleaning of selenium and carbon tetrachloride;
- from pulp and paper production, iron and steel industry and oil refining effluents;
- from activated sludge generated during wastewater treatment.

2.6 Lindane (gamma-hexachlorocyclohexane, ÿ-HCH)

Lindane is an odorless white crystalline powder that was used as a fruit and vegetable pesticide, for processing seeds in forestry and also in medicine for the treatment of lice and scabies. For medical for use, lindane is produced purposefully even today, since 2007 it has been producing lindane only India and probably Russia.

Lindane (and also HCH) is included in the list of POS, the use of which has been restricted by the United Nations

Environmental Committee *(United Nations Economic Commission)* with the Persistent Organic Pollutants Protocol of the Long-Range Convention on Transboundary Air Pollution.

Lindane has a half-life of **2.3-13** days in air, 30-300 days in water, 50 days in sediment, and 2 days in soil. Lindane is stable to air, high temperature and acids, but hydrolyzes at high pH. Lindane degrades very slowly through microbiological processes and is more water soluble and more volatile than other chlorinated organic chemicals. These properties are also the reason why lindane has been found everywhere in the environment - in water, snow, air, soil and sediment, and in areas where it has not been used, such as the Arctic. An estimated 13 tons of lindane are deposited in the Arctic annually.

Lindane is dangerous for both human health and the natural environment, is toxic to aquatic animals (bioaccumulates in fish) and is long-range due to its high volatility.

The use of lindane in Estonia has been prohibited since October 21, 1967, although there is information about its use from a later time as well. In Estonia, lindane has only been used in the treatment of seeds, but products containing at least 99% gamma isomers could be used in the treatment of soil, wood, etc., in addition to the treatment of seeds. There are no known reserves of lindane. In addition, ÿ-HCH has been used in Estonia under the name gammahexane until 1999 (the amount of the active substance used in 1975–1986 was 4.3 tons).

In the publication "Hazardous substances in the Estonian environment" you can find information about the use of lindane as a plant protection agent, in the years **1960-1988 ,** 8.6 tons of the preparation containing lindane was used (this is the amount of the preparation, not the active substance).

Lindane has been found in surface and waste water as well as in sediments.

Shampoos and creams for eliminating lice and scabies containing lindane are not sold in the European Union, including Estonia.

2.7 Hexabromobiphenyl (HBB)

HBB belongs to the group of polybrominated biphenyls (PBB). Production and use of HBB has been discontinued in most countries.

PBB's *FireMaster* product was used as a fire/flame retardant in acrylonitrile butadiene styrene (ABS) used to make equipment parts such as engine housings, radio and television parts, varnishes and coatings, and automotive interior polyurethane foam.

HBB is less volatile compared to other POS.

Commercial production of PBB began in 1970 and lasted until 1979.

Since PBB is not chemically bound to the plastic in the products, but is mixed into it, PBB easily enters the environment.

In the European Union, the use of PBBs in textile products that come into contact with the skin (clothing, underwear, bedding, etc.) was banned in 1984. The production and distribution of HBB was completely banned in the European Union in 2004 by Regulation 850/2004. Internationally, the handling of the substance is controlled by the Stockholm Convention, to which it was added in 2009. Production and use of HBB is prohibited in most countries.

From the PBB group, three mixtures, hexa-, octa- and decabromobiphenyl, were industrially produced. In both the US and Canada, HBB was the most widely used. It was the main component in the mixtures called *Firemaster BP-6* and *Firemaster FF-1.* The HBB content in these products was up to 68%, and the difference was that *Firemaster FF-1* was in ground form and 2% calcium polysilicate was added as an anti-caking agent. Besides HBB, the mixtures also contained 7-27% heptabromobiphenyl.

The effect of HBB on health depends on many factors, especially the nature, duration and of the amount of HBB. They mainly occur in the skin, nervous system, liver, kidneys, thyroid gland and serious damage to the immune system. PBB has caused cancer in rats, but their carcinogenicity to humans has not been fully proven.

Products where HBB was used have generally been withdrawn from circulation, but emissions may still occur from landfills to the environment.

2.8 Pentabromodiphenyl ether (penta-BDE)

Penta-BDE was used as a flame retardant in flexible polyurethane foam for furniture, upholstery and in the production of electronic devices. In North America and Western Europe, penta-BDE is predominant the source was polyurethane foam containing penta-BDE used in the production of furniture.

Penta-BDE is also released, for example, during the processing of old electronic equipment and cars and buildings during dismantling. Burning products containing penta-BDE can release toxic substances such as for example, brominated dibenzo-p-dioxins and furans. Penta-BDEs are also emitted into the air by products during use.

Penta-BDE is very persistent in marine sediments, where it can persist for over 30 years.

In general, penta-BDE binds to other substances in the environment and only a small amount is transferred either in the gaseous state or dissolved in water to remote areas where penta-BDEs ever not used, e.g. to the Arctic.

Modeling and environmental studies have shown that the transfer of penta-BDE to distant areas, there is multiple precipitation and volatilization, dissolved in water and also through animals.

Approximately 100,000 tons of Penta-BDE have been used worldwide since 1970. Its use is decreased over the years: 8,500 tons in 1999, 7,500 tons in 2001, etc.

Penta-BDE is used or has been used in the following areas:

- in electronic equipment: in office equipment, in computers, in consumer electronics, in household appliances and other places where laminate printed circuit boards, plastic casings and plastic parts (e.g. rigid polyurethane or elastomer bodies);
- traffic and transport means: in textile parts of cars, trains, planes and ships, in plastic interior design and plastic electronic parts;
- in construction materials: foam fillers, insulation boards, foam insulation, pipes, wall and ceiling panels, sheet plastics, resins (epoxy resins, phenolic resins), etc.;
- in furniture: in soft furniture, furniture covers, mattresses, furniture parts that contain foam filler;
- in textiles: in curtains, carpets, tents, blankets, work clothes and protective clothing;
- in packages: in packages containing polyurethane foam;
- in rubber products: conveyor belts, cover and floor panels;
- in oil drilling fluids.

Polyurethane foam can contain 10-18% penta-BDE, in recent years penta-BDE is preferred highly brominated deca-BDEs.

In the early 1990s, penta-BDE was used in printed circuit boards in Asia, mostly in FR2 laminate (in phenolic resins) used (used) in household electronics (TVs, radios), in household appliances (dishwashers and other kitchen appliances), ~60% of textiles were used in Europe penta-BDE in processing, but now the use of penta-BDE in textile processing is prohibited.

In the UNECE region, penta-BDE is present in textiles and as a flame retardant determined in the composition by cross-border material flow analysis.

In a 2003 material flow analysis in Norway, manufacturers have claimed that furniture textiles contain 0.45% penta-BDEs.

The use of Penta-BDE as part of hydraulic fluid in oil drilling and extraction was discontinued in 10– 20 years ago.

Penta-BDE is emitted from the products into the environment during the manufacturing process, during the use of the products and also after disposal in waste treatment processes.

About 3.9% of BDE in products is emitted into the air due to its volatile properties, the product 10- during its annual lifetime, BDE emissions in the EU are between 585 and 1053 tonnes each year.

BDE is a volatile chemical and can enter the environment through volatilization from products during the useful life or if the products are handled as waste. The release of BDE from products also depends about the weather and whether the product is worn (e.g. textile), handling in case of waste handling of the way.

During the life cycle of the products, 75% of BDEs are released into the soil from products containing polyurethane, 0.1% to the atmosphere and 24.9% to surface water *(Technical Review of the Implications ... 2007).*

When cutting polyurethane foam, particles of flame retardant fly into the atmosphere, foam left over from cutting scraps are used as carpet underlays, especially in the USA, the European Union exports to the USA approx 40,000 tons of foam waste.

Foam residues are also used as filling in several products, such as car seats. Obsolete foam residues are either deposited in landfills or even incinerated.

Penta-BDE is released into the environment during the processing of raw materials during the production of products, their in use and from waste after the end of their useful life. In addition to reducing penta-BDE emission into the air during the processing of raw materials, it is important to reduce it also during the use of products and after decommissioning.

Penta-BDE enters the environment the most in filtration waste and scrap material landfills during disposal, wastewater containing penta-BDE can also escape into the environment.

During production, the main sources of penta-BDE release are filtered waste and scrap materials, but these quantities are very small. In general, wastes from production are landfilled, although wastes containing more than 0.25% penta-BDE are hazardous wastes.

The European Union has stipulated since 2004 the requirement that products with more than 0.1% of penta-BDEs, sale and use on the market is prohibited. Since 2006, penta-BDE gradually limited in electrical and electronic equipment. Products that contain excess waste 0.25% penta-BDE, is classified as hazardous waste.

Studies have shown that the main sources of human exposure to penta-BDE are dust and food **–** fish and agricultural products in adults, mother's milk in children. Long-term exposure to penta-BDE can cause health damage because penta-BDE accumulates in the human body, but the effects of its degradation on humans are not exactly known.

2.9 Octabromodiphenyl ether, octa-BDE

Commercial octa-BDE is a mixture of several polybrominated diphenyl ethers and additives. Them synthetic brominated compounds have been used mainly in flame retardants.

Okta-BDE is used in ABS polymers - polybutylene terephthalates, polyamide polymers, but also in nylon, low-density polyethylene, polycarbonates, phenol-formaldehyde resins, in unsaturated polyesters.

Approximately 95% of the octa-BDE supplied in the European Union was used in ABS polymers (globally ~70%). Okta-BDE was added to the product at 10-18% depending on the weight of the product. ABS was mainly used in the production of housings for electronic devices.

In the course of research, it has been found that octa-BDE is contained in plastic parts of computers and consumer goods, in CRT monitors and televisions, as well as octa-BDE electronic equipment in the surrounding dust.

Okta-BDE has found wide use as an additive or chemical reagent in polymers and textile, in curtains and car interiors, octa-BDE has also been detected between 15 and 10,000 ng/g in certain toys made in China.

Okta-BDE has also been detected in topsoil and combustion residues

2. 10 Perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOS-F)

PFOS is a widely used synthetic chemical found in a variety of products such as in parts of electrical and electronic products, fire extinguishing foams, photo detectors, hydraulic fluids and in textiles, industrial and household cleaners, and pesticides and insecticides. PFOS produced in several countries to this day.

Perfluorinated substances with long carbon chains, including PFOS, are grease and water repellent, so substances similar to PFOS are used as surfactants. The extreme persistence of these substances making them suitable for use in high temperature and acid/alkaline environments. Their extreme stability is caused by a very strong carbon-fluorine bond.

Substances similar to PFOS have been used to make paper and cardboard resistant to grease, oil and water as well as water to protect other packaging materials, such as food packaging, marble and concrete as well as water-based products such as alkaline cleaning agents, to improve wetting of floor polishes, shampoos.

PFOS is used in photoacid (PAGi) chemical enhancer components that increase sensitivity of light resistance and allow to etch images smaller than the wavelength of light.

Hydraulic fluids were also previously used in aircraft brake fluids.

The main use of PFOS-like substances in metal coating is chroming of metals and anodizing and acid etching, it was also used in pesticides, mining and as oil surfactants in flame retardants and adhesives.

2.11 Hexabromocyclododecane (HBCDD)

HBCDD is a brominated flame retardant. The compound exists in 16 different stereoisomeric forms, of which six pairs are enantiomers. The technical mixture of HBCDD mainly consists of three diastereomers, ÿ, ÿ and ÿ. Chemical formula: $C_{12}H_{18}Br_6$. The CAS numbers of the isomers are:

HBCDD (mixture of three diastereomers) - 25637-99-4, 25495-98-1;

1,2,5,6,9,10-HBCDD - 3194-55-6;

ÿ-HBCDD – 134237-50-6;
ÿ-HBCDD – 134237-51-7;
ÿ-HBCDD – 134237-52-8.

The composition of technical HBCDD is: ÿ-HBCDD content 70-90% and ÿ-HBCDD and ÿ-HBCDD total content 10-30%.

The names of products containing HBCDD are: Bromkal 73-6CD, Nikkafainon CG 1, Pyroguard F 800, Pyroguard SR 103, Pyroguard SR 103A, Pyrovatex 3887, Great Lakes CD-75P™, Great Lakes CD-75, Great Lakes CD75XF, Great Lakes CD75PC *(compacted),* Dead Sea Bromine Group Ground FR 1206 I-LM, Dead Sea Bromine Group Standard FR 1206 I-LM, Dead Sea Bromine Group Compacted FR 1206 I-CM.

3. LIMIT STANDARDS OF NEW PERSISTENT POLLUTANTS IN THE ENVIRONMENT

Limit values for the content of hazardous substances in the environment are stipulated by the following legislation:

1) Regulation No. 49 of the Minister of the Environment of September 9, 2010 "Restriction of hazardous substances in surface water, including of priority substances and priority hazardous substances and certain other pollutants of the environment quality limit values, priority substances in surface water and priority hazardous substances in the environment methods of applying quality limit values';

Table 2. Environmental quality limit values for persistent organic pollutants in surface water are as follows:

Name of the substance	CAS number	Annual average limit value in terrestrial surface water, µg/l	Annual average limit value other in surface water, µg/l	The highest permissible limit value in terrestrial surface water, µg/l	Maximum permissible limit value other in surface water, µg/l
bromodiphenyl ether	32534-81-9	0.0005	0.0002	not applicable	not applicable
endosulfan	115-29-7	0.005	0.0005	0.01	0.004
hexachlorocyclohexane	608-73-1	0.02	0.002	0.04	0.02
pentachlorobenzene	608-93-5	0.007	0.0007	not applicable	not applicable

2) Regulation No. 32 of the Minister of the Environment of July 21, 2010 "On substances and groups of substances hazardous to the aquatic environment lists 1 and 2 and lists of priority substances, priority dangerous substances and groups of these substances";

3) Regulation No. 75 of the Minister of the Environment of October 16, 2003 "Establishment of requirements for hazardous substances discharged into public sewers";

Table 3. The limit values of persistent organic pollutants in waste water managed by public sewers are as follows:

Name of the hazardous substance	CAS no	Unit of measurement	Limit value
hexachlorocyclohexane	608-73-1	µg/l	1.0
lindane	58-89-9	mg/l	2.0

4) Limit values for the content of persistent organic pollutants in soil, stipulated by the regulation of the Minister of the Environment of August 11, 2010 "Limit values for the content of hazardous substances in soil"

Table 4. Limit values for the content of persistent organic pollutants in soil:

Name of the substance	CAS number	Target number, mg/kg	Limit number in the country of residence, mg/kg	Limit number in industrial land, mg/kg
hexachlorocyclohexanes (each isomer)		0.05	0.2	2
plant protection products (sum of active ingredients)		0.5	5	20

5) by Regulation No. 76 of the Minister of the Environment of December 13, 2006 "Related to outdoor air pollution the procedure and form of reporting on activities" provided in the report, the data is included in the VOCs on the total emissions of the POSs and separately on the following pollutants in kilograms:
Chlordecone, CAS No. 143-50-0;
1,2,3,4,5,6-Hexachlorocyclohexane *(HCH),* CAS No. 608-73-1;
lindane, CAS No. 58-89-9;
Hexabromobiphenyl, CAS No. 36355-01-8;
Hexabromodiphenyl ether, CAS No. 68631-49-2; CAS No. 207122-15-4;
Heptabromodiphenyl ether, CAS No. 446255-22-7; CAS No. 207122-16-5; alpha-hexachlorocyclohexane, CAS No. 319-84-6; beta-hexachlorocyclohexane, CAS No. 319-85-7;
Tetrabromodiphenyl ether, CAS No. 400088-47-9;
pentabromodiphenyl ether, CAS No. 32534-81-9.

4. STUDIES ON THE PRESENCE OF NEW PERMANENT POLLUTANTS IN THE ENVIRONMENT

In Estonia, the content of POS has been determined during several studies of dangerous substances such as COHIBA and BaltActHaz projects, in studies of dangerous substances in 2011 and 2012, within the framework of the national monitoring program, in the monitoring of dangerous substances in rivers, groundwater and coastal seas.

In the COHIBA project, from September 2009 to August 2010, 11 priority substances were investigated in Baltic Sea water in 6 thresholds (two settlement waste water outlets, two industrial waste water outlets, landfill leachate, rainwater). The content of endosulfan, BDEs and PFOS has been analyzed from the list of POS.

In the BaltActHaz study, two samples were taken in 2011 and analyzed with a very wide list of dangerous substances, including compounds from the new list of POS. Analyzes were taken from the effluent (PFOS) of 3 industrial enterprises, from 7 sluices of a small river flowing on agricultural land (endosulfan and HCH), from two monitoring points of Lake Peipsi (HBB, PBEs, PFOS, PeCB), from the coastal sea at the Sillamäe waste storage monitoring point and from 4 monitoring sluices of BLRT (HBB, PBEs, PFOS, PeCB), from 12 river basins (HBB, PBEs, PFOS, PeCB) and from 8 effluents (HBB, PBEs, PFOS, PeCB, ÿ-HCH).

In 2011 and 2012, studies of dangerous substances were carried out to determine priority substances in water, aquatic organisms and bottom sediments in order to meet the requirements of Council of Europe Directive 2008/105/EC.

In the 2011 studies, the content of POSs in fish in 8 bays and 3 estuaries of Lake Peipus was analyzed (HCHs and endosulfan in the liver and muscle of perch, PDEs in the liver), BDE, HCH and endosulfan content in water and sediments 17 in the river monitoring basin (3 of them in the wastewater basin), in the 6th sea basin (of which 4 in the wastewater basin), in the 3rd Lake Peipsi monitoring basin.

In the 2012 studies, water and sediment samples were taken in 9 waste water inlet thresholds, the content of PFOS and BDEs was analyzed from the POS.

In the national monitoring program, the new list of POS has been monitored since 2006 (HCHs in herring and perch). In 2011, the content of endosulfan and PeCB in herring was also determined.

In 2010, the river monitoring plan analyzed the content of the pesticides endosulfan and HCH in two agricultural floodplains. There were no new POSs in the list of analyzed pesticides in the monitoring studies carried out in the groundwater and in the thresholds of the nitrate-sensitive area. Also, no POSs have been found within the ambient air monitoring program.

4.1 Chlordecone

Chlordecone is a pesticide that is not specified in Estonia.

4.2 Endosulfan

Endosulfan is the pesticide identified in all of the above studies. Endosulfan has been found as endosulfan sulfate at 38.4 ng/l in the leachate of the Väätsa landfill in June 2010, and in the 2011 hazardous substances survey, both ÿ- and ÿ-endosulfan, with a maximum value of 0.90 ÿg/l, were found in the liver and muscle of perch in Muuga Bay (corresponding no EQS for biota).

In 2011, endosulfan was not found in surface water and sediment samples.

4.3 Alpha-hexachloro-cyclohexane (ÿ-HCH), beta-hexachloro-cyclohexane (ß-HCH), lindane (ÿ-HCH)

Lindane is no longer used as a pesticide, but its residues can be found in both sediments and organisms. The most toxic HCH isomer is ÿ-HCH.

HCHs have been studied as the sum of ÿ-, ÿ- and ÿ-isomers in fish as part of the monitoring of hazardous substances in the coastal sea since 1997. The HELCOM COMBINE program has developed a target number of HCH in Baltic Sea fish tissues – 16.7 ÿg/kg.

In the muscles of perch, the content of HCH compounds was on an increasing trend between 2006 and 2010, the average content of ÿ-HCH has increased four times and the content of ÿ-HCH has increased 2.5 times. The highest total values were in the fish of Haapsalu Bay and Väikse Väina in 2010, lindane was also found in fish of Väinamere and Kunda Bay.

The content of lindane in fish was decreasing until 2007, but an increase in content has been observed in recent years, the source of lindane is unclear. As part of the monitoring of dangerous substances in the coastal sea in 2011, the content of HCHs was analyzed in both perch and herring. The content of ÿ-HCH was higher in herring (16.9 ± 3.6 ÿg/kg lipids) than in perch (10.8 ± 1.8 ÿg/kg lipids). Among the HCH compounds, ÿ-HCH dominated in herring (62%), and ÿ-HCH (56%) in perch. The ÿ-HCH content was 24% in herring and 35% in ÿ-HCH perch. ÿ-HCH accounted for 14% and 9% in herring and perch, respectively (Monitoring of dangerous substances in the coastal sea 2011 report).

In the 2011 hazardous substances studies (EKUK report), the content of HCHs in perch is lower than in coastal sea monitoring analyses, the content of HCHs in liver (up to 2.55 ÿg/kg lipids) is higher than in muscle (0.27 ÿg/kg lipids) , the greater share is in the ÿ-HCH content, 30–58%.

The HCH values in surface water and bottom sediments analyzed during the 2011 hazardous substances survey are all below the determination limit.

4.4 Pentachlorobenzene

PeCB was determined in 2011 during a survey of hazardous substances in surface water and bottom sediments. The content of PeCB was below the detection limit, in the perch it was higher in the liver reaching 1.87 ÿg/kg, in the muscle it was up to 0.15 ÿg/kg. The content of PeCB is high in the perch of Lake Peipsi and in the liver of fish from Muuga and Lohusalu bays.

In the BaltActHaz study, the content of PeCB was determined in the effluents of sewage treatment plants, the results were below the determination limit.

4.5 Hexabromobiphenyl

During BaltActHaz studies, HBB was determined in the discharges of wastewater treatment plants, rivers and Lake Peipsi, the results of all analyzes were below the determination limit.

4.6 Pentabromodiphenyl ether, penta-BDE, octabromodiphenyl ether, octa-BDE

BDEs have been determined in COHIBA, BaltActHaz and 2011 and 2012 studies on dangerous substances.

In the results of the COHIBA studies, the value of penta-BDE exceeded the surface water EQS in Narva, Keila, Loksa in the waste water coming out of the sewage treatment plant, but also in the leachate of the Väätsa landfill and in the rainwater of Tallinn, penta-BDE has also been found in the waste water of the Kohtla-Järve sewage treatment plant.

In the 2011 hazardous substances survey, BDEs in fish were below the detection limit. Surface water exceeded EQS limit value penta-BDE in the Kuressaare Bay in the area of the deep-sea outlet of the city sewage treatment plant, Emajões below the outlet of the Tartu wastewater treatment plant, in Lake Peipsi in the Rannapungerja area. Penta-BDE has also been found in Tallinn Bay in the area of the deep-sea outlet of the city's wastewater treatment plant.
Penta-BDE has mainly been found in northern sediments from the Keila River and the Emajõgi below the Tartu sewage treatment plant exit.

In the 2012 hazardous substances survey, the concentrations of BDEs in sediments and water were below the determination limit.

During the BaltActHaz work, the content of BDEs in the effluent of rivers, lakes, sewage treatment plants was below the determination limit.

4.7 Perfluorooctanesulfonic acid (PFOS), its salts

PFOS has been determined in the COHIBA, BaltActHaz and 2012 studies on hazardous substances.

In the 2012 hazardous substances survey, the content of PFOS in sediments and water is below the detection limit.

In the BaltActHaz studies, the content of PFOS in waste water from sewage treatment plants and industrial plants and rivers in water below the determination limit.

In the analyzes of the COHIBA project, PFOS was found in the waste water of Kohtla-Järve, Narva, Loksa and Keila and In the rainwater of Tallinn, but the values were below the EQS value, but in the leachate of the Väätsa landfill, they were high PFOS contents exceeding both AA-EQS and MAC-EQS values.

4.8 Hexabromocyclododecane (HBCDD)

The first indirect data on the possible presence of HBCDD in the Estonian environment was obtained in 2008 In a HELCOM study, which showed that HBCDD levels were very low in the eastern Baltic Sea, remaining below the determination limit. It can be assumed that in the eastern part of the Baltic Sea, HBCDD was not used to such an extent as In Sweden.

The HBCDD content of the fish (herring, perch and flounder) studied in the coastal sea of Estonia was present in all samples below the determination limit.

In the environment, HBCDD was first determined in 2009 within the COHIBA and BaltActHaz projects.

Within COHIBA, HBCDD ÿ-, ÿ-, and ÿ-HBCD isomers were determined. Up to 3.5 HBCDD was found in the effluent ng/l. The level of HBCDD in rainwater was 6.48 ng/l. During the COHIBA project, waste water samples were taken 8 times from May 2009 to August 2010. Landfill and sewage sludge were sampled twice (in winter and summer), rainwater samples were taken after snow melt and during the first heavy rain period in summer.

Table 5. HBCDD analysis results in samples of landfill, rainwater, waste water and sewage sludge in Estonia in 2009–2010

Landfill Rainwater WWTP1				WWTP2 WWTP3			WWTP4a WWTP4b	
ng/l ng/l		water, ng/l Mud,	l µg/kg too	water, ng/l water, ng/l mud,		µg/kg also	water, ng/	water, ng/l
1.07 3.94–6.48 0.44–3.06 12.8 <LOQ – 3.5 0.20–2.39 93.4 <LOQ – 1.24 2.44 and 2.76								

WWTP discharge

LOQ - limit of determination

HBCDD content in Narva, Kohtla, Kunda, Mustjõgi, Jägala, Keila, Vääna, Vasalemma and Pärnu rivers was below the determination limit of 200 ng/l of the used analysis methodology.

HBCDD content from North-Eastern Estonia's industrial (three chemical and one wood industry) and from domestic sewage, semi-coke and ash waste water at Kohtla-Järve sewage treatment plant and Järve bio-treatment plant OÜ's effluent was below the determination limit of the analysis methodology used (200 ng/l). Järve Biopuhasti OÜ in all three parallel samples of sewage sludge, the contents of HBCDD were below those used the determination limit of the analytical methodology of 200 µg/kg was also made within the COHIBA project analysis and found its possible sources in Estonia, which are shown in Figure 1.

Figure 1. Hexabromocyclododecane substance flow analysis in Estonia 2010. (COHIBA WP4)

Table 6. Summary of POS content studies

Chemical	Water	Sediment	Biota
chlordecone	not analyzed not analyzed not analyzed		
endosulfan	found in landfill leachate	found	found
alpha-hexachloro-cyclohexane, (ÿ-HCH)	found, below the determination limit	found, below the determination limit	found, trending up
beta-hexachloro-cyclohexane, (ß-HCH)	found, below the determination limit	found, below the determination limit	found, trending up
pentachlorobenzene (PeCB)	found, below the determination limit	found, below the determination limit	found. The highest among fish in Lake Peipus
lindane, (ÿ-HCH)	found, below the determination limit	found, below the determination limit	found, trending up
hexabromobiphenyl (HBB)	found, below the determination limit	not analyzed not analyzed	
pentabromodiphenyl ether (BDE)	found, found in effluent, determination	below limit of determination limit	found, below the determination limit
octabromodiphenyl ether (BDE)	found, found in effluent, determination	below limit of determination limit	found, below the determination limit
perfluorooctane sulfonic acid (PFOS) its salts, perfluorooctane sulfonyl fluoride (PFOS-F)	found, below the determination limit, In the leachate of the Väätsa landfill, it exceeds the determination limit	found, below the determination limit	not analyzed
Hexabromocyclododecane (HBCDD)	found	found, below the determination limit	found, below the determination limit

5. USE OF PESTICIDES AND PESTICIDES IN FOOD RESIDUAL STATEMENT STUDIES

Among the new POS added to the list of substances of the Stockholm Convention, there are 6 mainly a chemical used as a plant protection agent, which has been used in Estonia as follows:
– mixture of HCH isomers 404.6 t in the period 1957–1969 (import into Estonia banned from 21.10.1967);

– gamma-HCH (lindane) 6.1 t between 1975 and 1986 (banned from 26.01.1999); – endosulfan 0.91 t between 1978 and 1992.

Since 1995, plant protection products containing the mentioned active ingredients have not been registered in Estonia the list of plant protection products allowed for use and it is assumed that they have not been used either. Chlordecone and pentachlorobenzene have never been used as plant protection agents in Estonia. Although In Estonia, the use of these substances is prohibited, these pesticides may enter the environment and into ecosystems with foods that have been used to grow them.

The Veterinary and Food Board has investigated the residual content of pesticides in foodstuffs, pentachlorobenzene and the content of chlordecone has not been studied. The following table contains the regulation of the European Parliament and the Council No. 396/2005 Article 26 and Commission Implementing Regulation (Multiannual Community Control Programme about) the results of studies carried out for fulfillment.

Table 7. Research on the residual content of pesticides in foodstuffs 2008-2010.

	2008		2009				2010			
	non-animal food		animal food		non-animal food		animal food		non-animal food	
residue name	Prof vide number	ÿ LOQ	Prof vide number	ÿ LOQ	Prof vide count ÿ	LOQ	Prof the door de number	ÿ LOQ	Sample idea number	ÿ LOQ
endosulfan (sum of ÿ and ÿ isomers and endosulfan sulfate)	307 0		0	0	0	0	0	0	0	0
ÿ-endosulfan	0	0	25	0 372		0	30	0	256	0
ÿ-endosulfan	0	0	25	0 372		0	30	0	256	0
endosulfan sulfate	0	0	25	0 372		0	30	0	256	0
hexachlorobenzene	65	0	25	2 372		0	30	0	256	0
hexachloro-cyclohexane, (HCH), sum of isomers excl. ÿ isomer	307 0		0	0	0	0	0	0	0	0
hexachloro-cyclohexane (ÿ-HCH), ÿ-isomer	307 0		25	0 372		0	30	0	256	0
hexachloro-cyclohexane (ÿ-HCH), ÿ-isomer	307 0		25	0 372		0	30	0	256	0

lindane (ÿ-isomer of hexachlorocyclohexane (ÿ-HCH))	307 0		25	0 372		0	30	0	256	0

In 2009, HCB was found in butter from two producers, in both cases the sample result was equal to the LOQ value i.e. 0.001 mg/kg, in one case it was a product from Lithuania and in the other from Estonia.
In summary, pesticides added to the list of POS are not used in Estonia, their residues are not in food have been found to a significant extent.

6. LANDFILL RESEARCH

On September 1, 2012, POS samples were taken from untreated sewage from the Pääsküla and Aardla landfills for analysis. A large part of hazardous substances ends up in landfills with products and foodstuffs. In previous studies the content of dangerous substances in landfill leachate has only been analyzed within the framework of the COHIBA project and found high levels of penta-BDE and PFOS.

All POSs belonging to the Stockholm Convention, both old and new substances, were analyzed. OÜ Estonia Pesticides, PCD and HCB were analyzed in the laboratory of the Center for Environmental Research and *Gesellschaft für* PFOS, BDEs, chlordecone and PBB were carried out in the laboratory of *Bioanalytik Hamburg GmbH (GBA)* analyses.

The analysis results were generally below the limit of determination, so the investigated landfills have their POSs release into the environment is unlikely. Only the contents of PFOS and its salts were exceeded determination limit, their level was high in the studies of the Väätsa landfill. Both Pääsküla and Aardla landfill the determined content of PFOS in leachate was also higher than the environmental quality established for surface water from the standard.

7. POSS IN PRODUCTS AND HANDLING OF PFOS IN COMPANIES

The main new POSs that are widely used in products are PBDEs, which are organobromine compounds, which are mainly used as flame retardants, and PFOS, which repel grease, dirt and water from textiles and other materials.

BDE is used in the production of building materials (insulating foams), electrical and electronic equipment in the production of plastic parts and in the textile industry, mainly in the processing of furniture textiles.
Before the handling of PFOS was banned, they were used in many products such as carpets, in leather/clothing, textile/upholstery, paper, packaging, coatings and coating additives, industrial and in household cleaning products.

The following figures and tables present the flow analysis of these substances in Estonia and based on 2010 data the estimated handling amount of BDE is found to be **35.5** kg per year. The main source of penta-BDE is electronic devices (TVs, computers) and PUR products (Figure 2).

Table 8. Estimated substance flows of penta-BDE in Estonia

Area of activity:	Source	Environment	Quantity kg/year
waste treatment,	landfill leachate surface water wastewater from		0.01
waste water treatment,	water treatment plants surface water long-range		0.009 to 0.03
remote monitoring	airborne surface water		0.015

to surface water total			**0.034 to 0.055**
product use	emissions indoor incineration in	outside air	0.007 to 0.073
product use	households incineration of	outside air	0.028
waste management	electronic waste god	outside air	1.53
total outside air			**1.56 to 1.63**
product use	In PUR products,	indoor air	17
product use	electronic parts of TVs,	indoor air	3.75
product use	electronic parts of computers	indoor air	12,28
indoor air total			**33.03**
waste	landfill leachate long-	soil soil	0.013
management	range airborne sewage	soil	0.167
remote monitoring waste water treatment	sludge		0.63
into the soil			**0.81**

Figure 2. Penta-BDE substance flow in Estonia.

The main amount of penta-BDE enters indoor spaces when using electronics, based on the flow analysis is it is 33.03 kg per year (Table 8) and 1.6 kg per year is released into the outdoor air.

The use of PFOS (Fig. 3, Table 9) is much more widespread, but the main amount of PFOS ends up from carpets and other textile products impregnated into the environment through products. So it's important monitor waste water from cleaning products, carpets, office supplies, textiles, etc. reaching the environment and its sediment. The estimated flow of PFOS in 2010 was **159** kg.

The largest is the emission of PFOS into the soil through long-range diffusion, which according to the Swedish Environmental Institute from the coefficients of the model calculations, it is estimated to be 126 kg per year.

Figure 3. PFOS substance flow in Estonia.

Table 9. Estimated substance flow of PFOS in Estonia

Activity	Source	Environment	Quantity, kg/year
wastewater treatment	waste water	surface water	0.04-0.06
waste management	landfill leachate long-	surface water	0.01-0.11
remote monitoring	distance distribution	surface water	8.02
total to surface water			**8.1-8.2**
air transport	aircraft hydraulic fluids waste water		0.013
product life cycle emissions	treatment of carpets with chemicals waste water		25
product life cycle emissions	impregnation of textiles	waste water	0.088
into waste water			**25.1**
waste water treatment	sewage	soil soil	0.07
waste management	landfill leachate	soil	0.01-0.11
waste management	landfill leachate		0.01-0.11
air transport remote	aircraft hydraulic fluids soil long range soil		0.031
monitoring			125.7

into the soil	**125.8-126**

In order to evaluate the handling of products containing BDEs and PFOS in Estonia, companies were interviewed by letter. None of the companies that responded to the questionnaire could find their products in safety data sheets and certificates Stockholm Convention chemicals.

8. SUMMARY

The overview highlights the main industries and product groups where new POS can be found, and is a summary of the survey conducted in companies. The amount of PFOS substance flow in Estonia can be estimated 159 kg and a penta-BDE material flow of 35.5 kg per year. Because there are no POS included in this list in Estonia are not produced or used in production according to environmental permits, then they end up in our environment with products that end their life cycle in landfills.

The new substances include several substances that were used as pesticides, which have been in Estonia since 1995 prohibited. These substances have not been analyzed in a time series in surface waters, effluents, biota or sediments. HCHs and PeCBs have been found in fish from the Baltic Sea and Lake Peipsi, indicating pollutants movement in the Estonian environment. The sources of these substances may be further away (remote transmission), but These substances pose a threat to Estonian water ecosystems.

9. MEASURES TO IMPLEMENT THE REQUIREMENTS OF THE CONVENTION

9.1 Importance of substances in our environment to plan environmental protection activities

Chemical	Finding in the Estonian environment	The significance of the effect of the chemical	Action
Chlordecone	Not found	Insignificant	No need to plan
Endosulfan	Residues in circulation	Insignificant	No need to plan
Alpha-hexachloro-cyclohexane, ÿ-HCH	Residues in circulation	Insignificant	No need to plan
Beta-hexachloro-cyclohexane, ß-HCH	Residues in circulation	Insignificant	No need to plan
Pentachlorobenzene PeCB	May be found in landfills	Insignificant	No need to plan
Lindane, ÿ-HCH	Residues in circulation	Insignificant	No need to plan
Hexabromobiphenyl HBB	Waste in circulation (landfills)	Important	The effect needs to be clarified. Waste management needs clarification. Regulation of circulation of products containing HBB ABS plastics, lacquers, polyurethane foam and materials containing HBB as a flame retardant
Pentabromodiphenyl ether BDE	Residues in circulation (landfills) and in products	Important	The effect needs to be clarified. Waste management needs clarification. Regulation of circulation of polyurethane foam, electronics and textiles.

Octabromodiphenyl ether BDE	Residues in circulation (landfills) and products	Important	The effect needs to be clarified. Waste management needs clarification. Regulation of circulation of ABS plastics, textile materials, thermoplastics.
Perfluorooctane sulfonic acid acid (PFOS) its salts, perfluorooctanesulfonyl -fluoride (PFOS-F)	Residues in circulation (landfills) and products	Important	The effect needs to be clarified. Waste management needs clarification. Regulation of circulation of PFOS-coated metals and semiconductors, fire-fighting foams containing them, electrical and electronic equipment, hydraulic fluids, LCD screens, textiles, paper and cardboard.
Hexabromocyclododecane (HBCD), 1,2,5,6,9,10-hexabromocyclododecane	HBCD is included in marketed products. Residues in circulation (landfills).	Important	The effect needs to be clarified. Waste management needs clarification. Regulation of the circulation of products in which it has been used as a flame retardant.

9.2 Measures to implement the requirements of the Convention

Objectives, measures and activities		**Immediate result**	**Relationship with other strategic documents**	**The main person in charge**	**Co-responsible persons**
Purpose	**Fulfilling the obligations of the Stockholm Convention**				
Measure 1	**Estimation and forecasting of POS emissions**				
Direction of action 1.1	***Emission assessment and emission data disclosure***	POS databases are regularly updated			
Activity 1.1.1	Monitoring of POS in different environments	Effective monitoring, the results of which are publicly available	Estonian Environmental Strategy until 2030 Development plan of the Ministry of Social Affairs 2013–2016 Development plan of the Ministry of Agriculture's governance area 2014-2017	KeM	SoM, Mon

Activity 1.1.2. Com	pilation and disclosure of POS emissions inventory	An annual inventory of POS emissions into the air has been carried out. The data is public.	Estonian Environmental Strategy until 2030 KeM		
Activity 1.1.3 Speci	fying the methodologies for calculating emissions	Calculations done	Estonian Environmental Strategy until 2030 Development plan of the Ministry of Agriculture's governance area 2014-2017	KeM	PM
Activity 1.1.4 Asses	sment of the impact of POS on human health based on regional monitoring data and health data	Continuous studies of the effects to find out. 2020 The data is public.	Population health development plan 2009–	KeM	SoM
Direction of action	***Forecasting emissions 1.2***	Forecasts prepared			
Activity 1.2.1 Estim	ation of POS emissions and refining forecasts into different environments	Forecasts prepared and specified	Estonian Environmental Strategy until 2030 KeM		PM
Action 1.2.2 Long-r	ange system of transboundary air pollution transboundary pollution assessment and monit	Development of oring forecasts prepared	Estonian Environmental Strategy until 2030 KeM		
Direction of action 1.3	***Reducing contamination with POS and its evaluation in different environments***	Monitoring that works			
Action 1.3.1 Asses	sment of possibilities to reduce POS emissions and preparation of an action plan to improve the situation.	Possibilities for reduction assessed based on monitoring data	Estonian Environmental Strategy until 2030 Development plan of the Ministry of Agriculture's governance area 2014-2017 Development plan of the Ministry of the Interior's administrative area 2011-2014	KeM	PõM, SiM
Activity 1.3.2 Redu	ction of residual pollution Development of proposals for the creation of a legislative framework, including clearly defined responsibilities to prevent the emergence of new residual pollution hotspots. Remediation and follow-up monitoring of residual pollution hotspots	The legislation stipulates the conditions for the prevention of residual pollution, the liquidation of created pollution and follow-up monitoring, as well as restrictions on activities in areas with residual pollution	Estonian Environmental Strategy until 2030 KeM		

Action 1.3.3 Ensuring the safe handling of waste in accordance with the requirements of the Waste Act		enforcement	Estonian Environmental Strategy until 2030 KeM		Local governments
Measure 2 Reduction of POS emissions					
Direction of action	***Reducing emissions in small 2.1 in solid fuel combustion devices (up to 0.3 MW)***	Emissions per reduced source of pollution			
Action 2.1.1 For incinerators brought to the market	stipulating the requirements to be submitted	Requirements set out	Estonian Environmental Strategy until 2030 SiM		KeM, professional and professional associations, operators
Activity 2.1.2 Implementation of the standard EVS-EN	15544:2009 for small combustion devices (pottery stoves)	The principles of the standard are applied	Estonian Environmental Strategy until 2030 SiM		KeM, professional and professional associations, operators
Action 2.1.3 Development and implementation of good	practice in the use of small incinerators	Requirements for implementation	Estonian Environmental Strategy until 2030 KeM		SiM, professional and trade unions, operators
Direction of action	***POSs related to transport 2.2 reducing emissions***	Emissions per reduced source of pollution			
Action 2.2.1 Effective reduction of transport-related POS emissions by	implementing Estonia / EU legislation and programs in the field of transport and fuel.	Claims applied	Estonian Environmental Strategy until 2030 Transport development plan 2014-2020 Fuel and energy economy long-term national development plan until 2015	KeM, MKM PõM	
Direction of action 2.3	***Reduction of industrial emissions***				
Action 2.3.1 In the fuel and energy economy, ensure	compliance with the state-established environmental requirements	Regular monitoring Fuel and energy management long-term	national development plan until 2015	KeM	PõM, MKM
Activity 2.3.2 Regulation of POS emissions with environmental	permits	Environmental permits take POS emissions into account	Estonian Environmental Strategy until 2030 KeM		
Direction of action 2.4	***Inventory of products containing POS***	Inventory carried out			

Activity 2.4.1 Products containing POS to the market of products containing POS transfer, import and export and their Agriculture's waste handling requirements doing implementation		will be handled in accordance with the requirements of the Ministry of	Estonian Environmental Strategy until 2030 administrative area development plan 2014–2017 Fuel and energy economy long-term national development plan until 2015	KeM	MKM, SoM, RM, PõM, specialty and trade unions, operators
Measure 3	**Raising awareness**				
Direction of action 3.1	***Electronic use of information exchange systems, publication of information materials and training***	information materials prepared and distributed. a functioning training system			
Activity 3.1.1	Use of electronic information exchange systems	Ability to use electronic communication systems	Estonian Environmental Strategy until 2030 Development plan of the Ministry of Social Affairs 2013-2016	KeM	SoM, PõM, specialty and trade unions, operators
Activity 3.1.2	Target groups (operators, making process operators, experts in various fields, prepared and issued, specialists, population) awareness raising through the preparation and publication of sectoral information materials	Sectoral decision- information materials notification system works	Estonian Environmental Strategy until 2030 Development plan of the Ministry of Social Affairs 2013–2016	KeM	MKM, SoM, PõM, specialty and trade unions, operators
Activity 3.1.3	Organizing the legal space regarding the prevention of possible emergencies, emergency preparedness planning and resolution	The terms are specified and the responsibilities of the institutions are clearly defined. General principles regarding public information and early warning have been specified	The Ministry of the Interior's governance area development plan 2011-2014 Estonian Environmental Strategy until 2030 Development plan of the Ministry of Social Affairs 2013–2016 Population health development plan 2009–2020	SiM	KMK, KeM
Measure 4	**Linking strategic documents and legislation of various fields to Stockholm**				

	with the requirements of the Convention				
Direction of action 4.1	***Related to POS emissions management drafting and supplementing strategic documents and legislation***	Strategic documents and legislation take into account the requirements of the Stockholm Convention			
Activity 4.1.1 Taking	into account the requirements of the Stockholm Convention when drafting legislation and strategic documents concerning industry, transport, energy, the environment and public health	Strategic documents and legislation account the development with the requirements of the Convention	Estonian Environmental Strategy until 2030 The Ministry of Agriculture takes into plan of the Stockholm administrative area 2014-2017 Development plan of the Ministry of Social Affairs 2013-2016 Fuel and energy economy long-term national development plan until 2015 Population health development plan 2009–2020	KeM	SoM, PõM, RM, JuM
Measure 5 Monitoring					
Direction of action	***POS emissions and POS 5.1 control of containing products***	A functioning monitoring system	Estonian Environmental Strategy until 2030		
Action 5.1.1 Effective	cooperation of different supervisory authorities in controlling POS emissions and POS-containing products	A functioning supervision system and effective cooperation in various supervision	Estonian Environmental Action Plan for the years 2007-2013 Development plan of the Ministry of Agriculture's governance area 2009-2012		SoM, PõM, RM, MKM

EXTRAS

add 1

Emissions of persistent organic pollutants into the outdoor air in the period 1990-2011

	Dioxins/ furans	***Benzo(a) pyrene***	***Benzo(b) fluoranthene***	***Benzo(s) fluoranthene***	***Indeno (1,2,3-cd) pyrene***	***PAHs, together***	***HCB***	***PCB***
	g I-Teq	**t**					**kg**	
1990	5.666	3,641	4,289	2,217	2.052	12.201	0.060	10.154
1991	5.413	3,531	4,208	2,145	1.992	11.876	0.060	10.190
1992	4.296	2,552	2,911	1,538	1.475	8.476	0.050	7.266
1993	3.554	2,142	2,411	1,309	1.266	7.128	0.040	10.569
1994	3.832	2,572	2,840	1,570	1.578	8.559	0.070	7.995
1995	4.528	4,359	4,756	2,640	2.727	14.481	0.120	9.190
1996	4.928	5,040	5,558	3,080	3.178	16.856	0.140	10.454
1997	4.832	5,005	5,506	3,048	3.165	16.725	0.140	10.325
1998	3.813	3,998	4,445	2,430	2.506	13.379	0.130	9.026
1999	3.454	3,861	4,298	2,346	2.423	12.929	0.120	8.154
2000	3.399	3,757	4,164	2,269	2.366	12.557	0.130	7.070
2001	3.539	3,727	4,186	2,261	2.338	12.511	0.140	9.613
2002	3.758	3,810	4,259	2,312	2.398	12.778	0.130	9.409
2003	4.125	3,953	4,422	2,371	2.483	13.230	0.146	10.256
2004	3.811	4,150	4,668	2,482	2.568	13.867	0.184	9.219
2005	3.373	3,771	4,278	2,232	2.308	12.589	0.150	8.883
2006	2.879	3,762	3,870	2,063	2.029	11.724	0.120	8.068
2007	4.909	3,943	4,351	2,413	2.519	13.226	0.130	7.957
2008	5.183	4,209	4,620	2,536	2.679	14.045	0.147	9.119
2009	4. 867	4,517	4,981	2,712	2.862	15.072	0.173	9.666
2010	5.528	4 ,900	5 ,462	2 ,913	3.072	16.346	0.206	10.916
2011	5.429	4,265	4,765	2,540	2.672	14.241	0.177	9.801
trend 1990-2011, %	**-4.2**	**17.2**	**11.1**	**14.6**	**30.2**	**16.7**	**195.2**	**-3.5**

Between 1990 and 2011, dioxin and PCB emissions decreased by 4.2% and 3.5%, respectively, while emissions from other POSs increased. The main source of PCB emissions is oil shale burning, dioxins the main source is energy production, including the burning of waste fuel, wood and wood waste incineration in households and industry, as well as the use of waste fuel in the cement industry and incineration of industrial and hospital waste.

Emissions of PAHs and HCBs have increased due to the increased use of biomass for energy production in households. Household emissions come first, followed by energy production.

Appendix 2

Emissions of persistent organic pollutants from energy production to ambient air in the period 1990–2011

A year	*Dioxins HCB*		*PCB*
	g I-Teq	kg	
1991	5.20	0.06	10,15
1992	4.94	0.06	10,19
1993	3.84	0.05	7.27
1994	3.10	0.04	10.57
1995	3.39	0.07	7.99
1996	4.10	0.12	9.19
1996	4.50	0.14	10.45
1998	4.21	0.14	10.32
1998	3.25	0.13	9.03
1999	3.16	0.12	8.15
1999	3.00	0.13	7.07
2000	3.18	0.14	9.61
2001	3.14	0.13	9.41
2002	3.64	0.15	10.25
2002	3.15	0.18	9.22
2003	2 .73	0.15	8.88
2004	2.72	0, 12	8.07
2006	4.61	0.13	7.96
2006	4.72	0.15	9,12
2006	4.28	0.17	9.67
2008	5.21	0.21	10.92
2008	5.07	0.18	9.80
2009 2010 2011 1990-2011, %	**-2.5**	**195.2**	**-3.5**

Appendix 3

Emissions of persistent organic pollutants from transport to ambient air in the period 1990–2011

	PCDD /F	**B(a)p B(b)f B(k)f**			**I(1,2,3 -cd)p**	**Sum- March no BAD**	**HCB HCH PCB**		
	g I-Teq	**t**					**g**	**kg**	
1990	0.226	0.022	0.040	0.017	0.012	0.091	0.074	NA	0.020
1991	0.223	0.022	0.039	0.015	0.012	0.088	0.089	NA	0.024
1992	0.096	0.012	0.022	0.008	0.005	0.047	0.030	NA	0.008
1993	0.104	0.013	0.023	0.009	0.006	0.051	0.033	NA	0.009
1994	0.142	0.012	0.021	0.010	0.008	0.050	0.034	NA	0.009
1995	0.128	0.009	0.017	0.010	0.007	0.042	0.024	NA	0.007
1996	0.148	0.010	0.019	0.010	0.008	0.047	0.037	NA	0.010
1997	0.152	0.009	0.018	0.010	0.007	0.045	0.023	NA	0.006
1998	0.111	0.008	0.016	0.010	0.006	0.040	0.009	NA	0.002
1999	0.132	0.007	0.014	0.009	0.006	0.037	0.002	NA	0.001

2000	0.137	0.007	0.014	0.009	0.006	0.037	0.004	NA	0.001
2001	0.167	0.008	0.017	0.011	0.008	0.043	0.005	NA	0.001
2002	0.156	0.011	0.020	0.012	0.008	0.050	0.001	NA	0.000
2003	0.151	0.010	0.019	0.011	0.007	0.048	0.535	NA	0.003
2004	0.149	0.011	0.019	0.012	0.008	0.049	0.377	NA	0.002
2005	0.152	0.011	0.019	0.012	0.008	0.050	0.336	NA	0.002
2006	0.161	0.012	0.021	0.013	0.009	0.055	0.170	NA	0.001
2007	0.168	0.013	0.022	0.013	0.009	0.057	0.168	NA	0.001
2008	0.169	0.012	0.021	0.013	0.009	0.055	0.348	NA	0.002
2009	0.153	0.011	0.019	0.012	0.008	0.050	0.453	NA	0.002
2010	0.148	0.013	0.021	0.013	0.009	0.056	0.274	NA	0.001
2011	0.143	0.012	0.021	0.014	0.009	0.056	0.143	NA	0.001
trend 1990-2011, %	**-36.6**	**-43.1**	**-48.3**	**-18.3**	**-23.6**	**-38.2**	**93.2**	**NA**	**-96.6**

Appendix 4

Emissions of persistent organic pollutants from the production of building materials into the outdoor air in the period 1990–2011

A year	Cement			Lime			Bricks and building blocks	
	production, tons	EF, ÿg I-TEQ/t	discharge, g	production, tons	EF, ÿg I-TEQ/t	discharge, g	production, tons	EF, ÿg I-TEQ/t
1990	938,000	0.060 0.563 0.060		185,000	0.07 0.0130 0.07		541 401	0.2
1991	905,000	0.543 0.060 0.290		207,000	0.0140	0.07	592 206	0.2
1992	483,000	0.060 0.212 0.060		92,000	0.0060	0.07	350,444	0.2
1993	354,000	0.242 0.060 0.251		21,000	0.0010	0.07	139,217	0.2
1994	402,500	0.060 0.233 0.070		18,000	0.0010	0.07	128,283	0.2
1995	417,600	0.030 0.070 0.022		16,800	0.0010	0.07	81 343	0.2
1996	387,700	0.070 0.025 0 .070		17,400	0.0010	0.07	68,009	0.2
1997	422,500	0.023 0.070 0.028		19,500	0.0010	0, 07	62,674	0.2
1998	321,300	0.070 0.033 0.070		32,100	0.0020	0.07	54,674	0.2
1999	357,700	0.035 0.070 0.035		23,300	0.0020	0.07	46 139	0.2
2000	329,100			21,200	0.0010	0.07	45,072	0.2
2001	404,600			20,000	0.0010	0.07	54 140	0.2
2002	465,900			21,200	0.0010	0.07	61,608	0.2
2003	506,300			32,000	0.0020	0.07	63,741	0.2
2004	506,300			32,000	0.0020	0.07	63,741	0.2
2005 NA		0.070 NE 0.099		37,200	0.0020	0.07 0		0.2
2006	848,900	0.059 0.070 0.065		39,700	.0030 0.07 0.0030		82,667	0.2
2007	936,200	0.003 0.056 0.003		43,500	0.07 0.0040 0.07		143,485	0.2
2008	806,100	0.023 0.004 0.037		59,400	0.0040	0.07	113,081	0.2
2009	326,000	0.004 0.037		30,200	0.0019	0.07 0.0019	38,938	0.2
2010	536,700			27,200			56,500	0.2
2011	719 002			36,100			84,544	0.2

Dioxin emissions from the construction materials industry (cement, lime and brick production) are calculated according to the UNEP guideline *"Standardized Toolkit for Identification of Dioxin and Furan Releases"* on the basis of Whereas Nordic is obliged to measure dioxin emissions twice a year, which is important to prove that the actual emissions are considerably lower than those presented in the guideline compared to special emissions.

Appendix 5

Persistent organic pollutant emissions from waste management and incineration into ambient air in the period 1990–2011

A year	Waste handling	Incineration of waste		
	PCDD/F		PCDD/F	PAHs
		g I-Teq	kg	
1990	NA	0.470	NA	NA
1991	NA	0.470	NA	NA
1992	NA	0.460	NA	NA
1993	NA	0.450	NA	NA
1994	NA	0.440	NA	NA
1995	NA	0.430	NA	NA
1996	NA	0.430	NA	NA
1997	NA	0.620	NA	NA
1998	0.002	0.560	NA	NA
1999	0.002	0.290	NA	NA
2000	0.002	0.400	NA	NA
2001	0.002	0.360	NA	NA
2002	0.002	0.620	NA	NA
2003	0.002	0.483	NA	0.001
2004	0.002	0.660	NA	NA
2005	0.002	0.640	NA	NA
2006	0.002	0.050	NA	NA
2007	0.002	0.300	NA	NA
2008	0.001	0.455	NA	NA
2009	0.001	0. 582	NA	NA
2010	0.001	0.321	NA	NA
2011	0.001	0.361	0.085	NA

Appendix 6

Main PCB emission sources based on 2011 data

Field	*2011, kg*	*Total cumulative*
Residential heating, stationary sources	6.2800	64.1%
Electricity and heat production	2.4463	89.0%
Incineration in manufacturing: other processes	0.8346	97.5%
Incineration in the commercial sector: stationary sources	0.1833	99.4%
Burning in the agriculture, forestry, fishing sector: stationary sources	0.0307	99.7%
Production of solid fuels (conversion)	0.0257	100.0%

National Fisheries	0.0007	100.0%

Appendix 7

Main sources of PCDD/PCDF emissions based on 2011 data

Field	*2011, g I-Teq*	*Total cumulative*
Electricity and heat production, stationary sources	3.1060	57.2%
Domestic burning, stationary sources	1.5700	86.1%
Incineration of industrial waste	0.2954	91.6%
1 A 2 fi Incineration in the processing industry: other processes	0.2216	95.6%
1 A 3 bi Road transport: passenger cars	0.1265	98.0%
6 C a Incineration of hospital waste	0.0661	99.2%
1 A 1 c Production of solid fuels (conversion)	0.0144	99.5%
1 A 3 b iii Road transport: trucks and buses	0.0114	99.7%
1 A 4 ai Incineration in the commercial sector: stationary sources	0.0100	99.9%
1 A 3 b ii Road transport: small vehicles	0.0046	99.9%
1 A 4 ci Burning in the agriculture, forestry, fishing sector: stationary sources	0.0014	100.0%
6 D Other waste	0.0009	100.0%
1 A 3 b iv Road transport: mopeds and motorbikes	0.0008	100.0%
1A 4 c iii National fisheries (mobile pollution sources)	0.0002	100.0%
3 D 3 Use of other products	0.0000	100.0%
1 A 1 b Oil processing	0.0000	100.0%
1 B 2 c Ignition in oil and gas production	0.0000	100.0%

Appendix 8 Main sources of HCB emissions in 2011. based on the data

Field	*2011, kg*	*Total cumulative*
1 A 4 bi Burning in households, stationary sources	0.1000	56.4%
1 A 1 a Electricity and heat production, stationary sources	0.0556	87.8%
1 A 2 fi Incineration in the processing industry: other processes	0.0192	98.6%
1 A 4 ai Incineration in the commercial sector: stationary sources	0.0018	99.6%
1 A 1 c Production of solid fuels (conversion)	0.0005	99.8%
1A 4 c iii National Fisheries	0.0001	99.9%
1 A 4 ci Burning in the agriculture, forestry, fishing sector: stationary sources	0.0001	100.0%
1 A 1 b Oil processing	0.0000	100.0%