REPORT
HAZARDOUS SUBSTANCES SCREENING RESULTS IN THE AQUATIC ENVIRONMENT OF ESTONIA

Completed within the project LIFE07 ENV/EE/000122
“Baltic Actions for Reduction of Pollution of the Baltic Sea from Priority Hazardous Substances”

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Sisukord

1. Introduction

According to § 53 of The Constitution of the Republic of Estonia, everyone has a duty to preserve the human and natural environment and to compensate for damage caused to the environment. Environmental protection in Estonia derives from historically developed objectives: to ensure a healthy environment that satisfies people and the necessary resources for the development of the economy without significantly damaging the environment, preserving the diversity of the landscape and biota, and taking into consideration the level of development of the economy.

This report on the screening results of the hazardous substances in the aquatic environment of Estonia was prepared based on results obtained during the course of activities of the project "Baltic Actions for Reduction of Pollution of the Baltic Sea from Priority Hazardous Substances, BaltActHaz" The project with a duration of three years began in 2009. BaltActHaz project (LIFE07 ENV/EE/000122) was financed by the European Union's LIFE+ Programme, with co-financing from the Estonian Environmental Investment Centre, Latvian and Lithuanian Ministries of the Environment and the Estonian Ministry of Social Affairs. A total of 19 partners from the three Baltic States participated in the project. The lead partner was Baltic Environmental Forum Estonia. Estonian Environmental Research Centre as research institution was participating in the project from Estonia.

The goal of the BaltActHaz project is to reduce the amount of hazardous substances in the Baltic Sea, along with the required implementation of legislation in Estonia, Latvia and Lithuania. Directive 2000/60/EC of the European Parliament established a framework for the protection of inland bodies of surface water, coastal water and groundwater, and a common method of approach in assessing water quality in all Member States, but lacks control actions regarding the measures to be used. Member States select the best method based on local conditions and existing internal approaches. Data collected within the framework of the monitoring of hazardous substances is the basis for the design, implementation and, when necessary, adjustment of environmental measures. Specific deadlines are foreseen for Member States in order to protect the aquatic ecosystems.

One of the objectives of the project was to obtain an overview of hazardous substances present in and contaminating Estonia's aquatic environment. Which is why priority substances and priority hazardous substances and their groups of substances named in the Water Framework Directive, substances harmful to the aquatic environment belonging to the list of substances in group 1 and 2, Helsinki Commission (HELCOM) priority hazardous substances, and the content of other pollutants in surface water and sediment, were identified during the course of the project's activities.

Samples were collected from inland surface waters and from surface water along coastal areas, from the bottom sediment, and from effluents and sewage sludge of waste water treatment plants. The contents of hazardous substances were identified at a total of 33 sampling locations, of which 8 were waste water treatment plants, 11 rivers, Lake Peipus, 2 coastal regions and regions engaged in intensive agriculture.

The following hazardous substances and their groups of substances were identified: heavy metals, phenols, alkylphenols and their etoxylates, polyaromatic hydrocarbons, volatile organic compounds, organotin compounds, phthalates, polybrominated biphenyls, diphenylethers and polybrominated organic compounds, sodium tripolyphosphate, short- and medium-chain chlorinated paraffins, perfluoro-compounds, cyanides and pesticides. Since it was not possible to identify all of the listed substances in Estonia, then corresponding analyses were ordered from a foreign laboratory.

This report contains an overview of previous hazardous substances monitoring and the relevant surveys conducted in Estonia, and results of hazardous substances screening in Estonia's aquatic environment conducted in the project BaltActHaz. The results presented in the report are primarily intended for use by state authorities tasked with developing a policy and strategy for substances hazardous to aquatic environment as well controlling the corresponding substances.

Information on hazardous substances contained in this report allows the further development of state monitoring programmes, improvement of the emission related control of hazardous substances and is of help to Estonia's reporting on hazardous substances to the European Commission as well as to HELCOM.

The end result of activities associated with hazardous substances should be the removal of priority hazardous substances from surface water and the bringing of substances with natural origins to concentrations near the natural background level in aquatic environment. In accordance with the Water Act, the good chemical status of surface water and good ecological potential should be achieved by 2015.

2. Legal background

With the Water Framework Directive (WFD; Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000) a framework for Community action in the field of water policy has been established, along with legal bases for the protection and rehabilitation of all clean water in Europe, in order to ensure long-term and sustainable use.

The first instructions covering the protection of the community's aquatic environment from pollution caused by the discharge of hazardous substances was established with directive 76/464/EEC. The goal of this hazardous substances directive was to end the pollution of inland surface water, coastal water and ground water with List I substances and to reduce the level of pollution of water by List II hazardous substances. Hazardous substances were selected primarily based on their level of toxicity, as well as long-term stability in nature and capacity to accumulate in living organisms (bioaccumulation). During the course of the restructuring and development of the community's water policy the above mentioned directive along with its sub-directives were incorporated into the water framework directive.

With Desicion 2455/2001/EC of the European Parliament and of the Council of 20 November 2001, a list of priority substances was established for the field of water policy. The list includes 33 substances or groups of substances, which were recognised as requiring regulation with community level measures. Certain substances among the number of priority substances were identified as priority hazardous substances. The WFD has been amended further with directives 2006/11/EC and 2008/105/EC, which establish limits on pollution caused by the release of hazardous substances into the aquatic environment and environmental quality standards for priority substances.

The WFD designates priority substances, priority hazardous substances and pollutants or groups of pollutants, which are of great danger to the aquatic environment or to people and nature via the aquatic environment. These substances have been identified through strict risk assessments, in which the scientific evidence regarding the hazardous properties of substances are studied, to what degree they pollute European bodies of water and other factors, such as volumes used. Among 33 priority chemicals were 13 that were designated as priority hazardous substances due to their persistence, bioaccumulation and toxicity. The European Commission reviews the list every four years, in order to allow for the addition of new problematic substances. With the aid of the Water Framework Directive the progressive reduction of pollution resulting from priority substances and the cessation or phasing-out of discharges, emissions and losses of priority hazardous substances is sought. Priority hazardous substances should be phased out gradually during the next 20 years.

Two types of environmental quality standards are established for priority substances: annual average concentration and the maximum allowable concentration. The first of these protects against long-term continuous pollution and the other against short-term acute pollution. Member States are responsible for the monitoring of concentrations of priority substances in surface water, which is a part of their state's monitoring programmes.

WFD article 8 prescribes that Member States establish water status monitoring programmes in order to achieve a uniform and comprehensive overview of water status in each catchment region.

Monitoring is the most important tool of Member States for classifying each body of water (which are designated sections of rivers or other surface water). As required by the directive, surface water status is rated using a five point scale – very good, good, average, unsatisfactory and poor. In accordance with the WFD requirements, Member States must achieve the good ecological status of surface water and good water quality by 2015.

When Member States have established the status of bodies of water, they will be able to use monitoring to help keep track of how efficient the measures implemented within the operational programme to achieve good water quality have been and make adjustments, if necessary.

Three types of monitoring are provided with the directive: Long-term surveillance monitoring, which provides an overview of the status of water bodies and helps to keep track of long-term changes, above all, due to climate change. The operational monitoring focuses on the water bodies which condition is not good. The main imminent hazards to these – pollution, if this is a main problem, or changes in flow due to water extraction – are monitored. During the course of operational surveillance, the efficiency of investments and other measures used in order to improve the status of water bodies are assessed. Member States organise investigative monitoring if they require additional information about surface waters, which the operational surveillance does not enable.

The majority of WFD's requirements involving hazardous substances are integrated into Estonian legislation.

Regulation No. 32 of 21 July 2010 of the Minister of the Environment "Lists 1 and 2 of substances and groups of substances hazardous to the aquatic environment and lists of priority substances, priority hazardous substances and their substance groups" is established pursuant to §265 (7) of the Water Act, and the lists of substances hazardous to the aquatic environment are established with this (Annex 1).

Regulation No. 49 of 9 September 2010 of the Minister of the Environment “The environmental quality standards for hazardous substances in surface water, including priority substances and priority hazardous substances and certain other pollutants, methods of application of environmental quality standards for priority substances and priority hazardous substances in surface water” are established pursuant to §265 (10) of the Water Act, and this establishes environmental quality standards for priority as well as other hazardous substances and certain pollutants (Annex 2).

Also adopted is Regulation No. 269 of 31 July 2001 of the Government of the Republic “Requirements for Waste Water Discharged into Water Bodies or into Soil”, which establishes requirements for wastewater treatment and waste water discharge into bodies of water or the soil and measures for assessing the fulfilment of requirements. When fulfilling the requirements for discharging waste water into water bodies or the soil, it must be ensured that the condition of the water, as well as aquatic and terrestrial ecosystems and wetlands, does not worsen. With regulation No. 75 of 16 October 2003 of the Minister of the Environment, “Establishing requirements for the discharging of hazardous substances into a public sewerage system”, limit values are established for the hazardous substances contained in waste water directed into a public sewerage system.

The Water Framework Directive is supported by other EU environmental legislation. With the REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) regulation (Regulation (EC) No 1907/2006 Of The European Parliament And Of The Council, which covers the registration, assessment, authorisation and restriction of chemicals), chemicals in articles are controlled in order to reduce the pollution of water bodies.

With the Plant Protection Products Directive (91/414/EEC) pollution with agricultural chemicals is controlled, and with the Biocidal Products Directive (98/8/EC) pest control and antimicrobial substances used in other sectors are regulated. With the Nitrates directive (91/676/EEC), pollution with nitrogenous compounds resulting from the application of fertilizer and manure is restricted. With the Integrated Pollution Prevention and Control Directive (2008/1/EC), pollution originating from factories and other plants is regulated.

In Estonia there are 6 laws serving as the basis for the control of chemicals, including hazardous chemicals: The Chemicals Act, Waste Act, Plant Protection Act, Water Act, Food Act and Integrated Pollution Prevention and Control Act and the Ambient Air Protection Act.

3. Overview of previous hazardous substances monitoring in Estonia

The objective behind the surveying of Estonia's aquatic environment was to obtain a better overview of the hazardous substances present in and contaminating the aquatic environment. Corresponding monitoring programmes in Estonia have been carried out by the Ministry of the Environment. Monitoring reports, as of 1994, are available on the Internet via the homepages of the Ministry and the divisions within its area of government: Ministry of the Environment (environmental monitoring programme) – (http://eelis.ic.envir.ee:88/seireveeb/).

Development of Estonia's state environmental monitoring programme first began in the Ministry of the Environment in 1993 [3.1] and was implemented in 1994, when the programme was first financed from the state budget.

The overview of monitoring until 2004 in this chapter reflects the monitoring of hazardous substances in the aquatic environment prior to Estonia's accession to the European Union. Information on heavy metals (As, Zn, Sn, Cu, Cr, Cd, Pb, Hg, Ni) and organic compounds (petroleum products, polychlorinated biphenyls, mono- and dibasic phenols, benzene, fluoranthene, hexachlorobenzene, hexachlorocyclohexane, naftalene, polyaromatic hydrocarbons, chloroform, DDT, dieldrin, endrin, isodrine, etc.) is presented up to 2004.

Since 2005, the monitoring of hazardous substances has become more detailed; even so, it has not been possible to support all research on substances harmful to the aquatic environment. Therefore, the screening of hazardous substances carried out during the BaltActHaz project was also quite relevant, since for the first time such hazardous substances were investigated for which data regarding concentrations in the aquatic environment had been missing – the majority of alkylphenols and their etoxylates, phthalates, polybrominated biphenyls, diphyenylethers and polybrominated organic compounds, organotin compounds, short- and medium-chain chlorinated paraffins, perfluoro-compounds, sodium tripolyphosphate and certain pesticides.

3.1. Overview of monitoring up to 2004

When the monitoring of substances hazardous to the aquatic environment first began, attention was initially focused on those priority hazardous substances which have, as of now, been entered in the EU Water Policy Framework Directive and which it was possible to analyse in Estonia.

The objective of the mapping of hazardous substances carried out by the Estonian Environmental Research Centre in 1999-2001, was to obtain an overview of hazardous substances discharged into Estonia's aquatic environment. With the given work, approximately 90% of Estonia's so-called water polluters [3.2-3.4] were caught. Coordinates for sampling points were specified with GPS equipment and the results entered on a map.

During the first screening carried out in the City of Tallinn and Harju County in 1999, effluent samples were collected from 28 points. During the second screening, carried out in Lääne and Ida Viru counties in 2000, effluent samples were collected from 34 points. During the third screening carried out in 12 counties in 2001, 42 effluent samples were collected from waste water plant's outlets or sewerage connection points. Samples were collected by the Estonian Environmental Research Centre, where a majority of the chemical analyses were also performed. Some of the samples were sent for analysis to the Netherlands (Analytico Laboratories, Breda).

Based on the obtained results total emissions into surface and ground water were calculated (more than 300kg/year) [3.5], and were as follows:

Petroleum products	15 771 kg
Barium	7 531 kg
Nickel	4 980 kg
Zinc	2 566 kg
Monobasic phenols	866 kg
Chromium	451 kg
Copper	398 kg
Carbon-tetrachloride	304 kg

Alachlor, pentabromodiphenyl ethers, chloroalkanes, chlorfenvinphos, methylene chloride, diuron, isoproturon, nonyl- and octylphenols were not analysed during these screenings. Alachlor, chlorfenvinphos, diuron and isoproturon were not analysed, since, on the basis of existing data, there was reason to believe that they are not used in Estonia. The other above mentioned substances, such as pentabromodiphenyl ethers, chloroalkanes, methylene chloride, nonyl- and octylphenols, were not analysed due to a lack of corresponding competence by laboratories.

The inventory and mapping of given hazardous substances provided a clear direction for further work. The obtained results allowed for the focus to be placed specifically on those substances which were deemed significant based on the obtained results, and the discharges of which originated from different branches of business. Even though approximately 90% of Estonia's "water polluters" were covered by the mapping of hazardous substances, the collection and analysis of a single random sample did not allow for significant conclusions to be drawn regarding the condition of surface water.

Within the framework of the national hydrochemical survey of rivers and the HELCOM PLC-4 programme (Baltic Sea Pollution Load Compilation) water samples [3.6] were collected in 2000 from the rivers Keila, Kasari, Jägala, Pirita, Vääna, Pudisoo, Valgejõe, Loobu, Kunda, Narva, Purtse, Pühajõe, Selja, Pärnu, Suur-Emajõe and Võhandu, and were analysed for heavy metal content. A total of 95 samples were collected and 493 analyses performed. Cu, Cd, Pb, Zn and Hg content in water samples was analysed. In addition to the above mentioned heavy metals, water samples collected from nine rivers in February were analysed for Cr and Ni content. The number of samples collected from one river fluctuated from one to eleven samples. The obtained results are presented in Table 3.1.1.

During the 2003 hydrochemical survey of rivers, heavy metal (copper, lead, cadmium, zinc, mercury) content was determined in 16 of Estonia's rivers, with one sample having been collected from the majority of rivers. Heavy metal content in Estonia's rivers was low, in many instances below or close to the limit of quantification for metals. Heavy metals were also detected in rivers containing valuable fish (Table 3.1.2.).

A three year hazardous substances rotating monitoring programme for inland water bodies began in 2002. The implementation of the programme began in North-East Estonia, which is the most polluted industrial area in Estonia. The goal of the monitoring programme was to identify and monitor the content of hazardous substances in inland water bodies to assess the pollution level of receiving water bodies and to specify problematic areas. Sampling points in water bodies were selected by the Ministry of the Environment, University of Tartu and the Estonian Environmental Research Centre. Substances hazardous to the aquatic environment were analysed in the samples – lindane, DDT, aldrin, endrin, isodrine, hexachlorobenzen, Hg, Cd, 1,2-dichlorethane, trichloromethane (chloroform), trichloroethylene, tetrachloroethylene and carbon tetrachloride. In addition to the above mentioned substances polychlorinated biphenyls (PCB), polyaromatic hydrocarbons (PAH) and heavy metals (Cu, Cd, Pb, Zn, Hg, Ni, Ba, Co, Mo) were analysed.

Tables 3.1.3 and 3.1.4 show the contents of hazardous substances in samples collected during the monitoring programme.

Data on content of hazardous substances in bottom sediment is presented in Table 3.1.5.

Prior to Estonia's accession to the European Union, the Estonian Environmental Research Centre did prepare, on the basis of directive 92/446/EEC of 2005, a report on the monitoring of hazardous substances in Estonia during the period 2002-2004 [3.9]. In the report, data was presented on the average, minimum and maximum content of hazardous substances and regarding the number of analyses performed during the year in surface water, bottom sediment as well as biota.

Table 3.1.1. Content of heavy metals (µg/l) in Estonia's rivers [3.6], obtained from the 2000 hydrochemical survey of rivers

No.	Name of river	Cu	Cd	Pb	Zn	Hf	Ni	Cr
		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1.	Keila River	0,4–1,3	<0,02–0,02	<0,2	<2,0–6,0	<0,1	<1,0	0,2
2.	Kasari River	0,5–2,0	<0,02–0,02	<0,2	<2,0–7,0	<0,1	<1,0	0,4
3.	Jägala River	0,4–10,0	<0,02	<0,2–0,3	<2,0–17,0	<0,1	–	–
4.	Pirita River	0,3–9,0	<0,02–0,02	<0,2–0,6	<2,0–2,0	<0,1	–	–
5.	Vääna River	1,6	<0,02	<0,2	3,0	<0,1	–	–
6.	Pudisoo River	0,9	<0,02	<0,2	4,0	<0,1	–	–
7.	Valge River	0,5	<0,02	<0,2	3,0	<0,1	–	–
8.	Loobu River	0,5	<0,02	<0,2	2,0	<0,1	–	–
9.	Kunda River	0,7–2,0	<0,02–0,13	<0,2–0,3	<2,0–11,0	<0,1	<1,0	<0,2
10.	Narva River	1,0–2,1	<0,02–0,2	<0,2–0,4	<2,0–4,0	<0,1	<1,0	<0,2
11.	Purtse River	1,0–4,0	<0,02–0,1	<0,2–0,3	<2,0–6,0	<0,1–0,1	2,0	0,3
12.	Püha River	2,0	0,04	<0,2	4,0	<0,1	–	–
13.	Selja River	0,8–2,0	0,02	<0,2	<2,0–4,0	<0,1	<1,0	<0,2
14.	Pärnu River	0,4–3,0	<0,02–0,02	<0,2	<2,0–3,0	<0,1	<1,0	0,3
15.	Suur-Emajõgi River (Kavastu)	1,0	0,02	<0,2	<2,0	<0,1	<1,0	<0,2
16.	Võhandu River (below Räpina)	1,0	0,02	<0,2	<2,0	<0,1	<1,0	<0,2

Table 3.1.2. Heavy metal content (µg/l) in Estonia's fishing rivers in 2003 [3.7]

Threshold	Species of fish	Hg	Cd	Cu	Pb	Zn
Kasari River	Cyprinidae	0,1	0,03	1,5	0,2	4,0
Mouth of the Keila River	Salmonidae	<0,1	0,05–0,54	8,0–19,0	<0,2–0,8	3,0–22,0
Pirita River	Salmonidae	<0,1	0,29	2,6	0,2	19,0
Pärnu River	Salmonidae	<0,05	<0,1	3,0	<1,0	<10
Mouth of the Selja River	Salmonidae	0,15	0,06	2,0	1,0	10,0
Mouth of the Kunda River	Salmonidae	0,1–0,65	0,06–0,08	10,0–33,0	1,0–4,0	<10–21,0
Narva River	Salmonidae	0,13	0,09	36,0	<1,0	<10
Emajõgi River	Cyprinidae	<0,1	<0,1	<1,0–2,5	0,4–1,0	3,0–9,0

Table 3.1.3. Content of hazardous substances in surface water in 2002 [3.8]

No.	Substance name	Unit	River Kohtla after VKG outlet[1]	River Kohtla Lüganuse	River Purtse below Kohila	Mouth of the river Purtse	AS Narva Vesi outlet[2]	Mouth of the River Pljussa
1.	Aldrin	ng/l	<10	<10	<10	<5	<10	<10
2.	Dieldrin	ng/l	<10	<10	<10	<5	<10	<10
3.	Endrin	ng/l	<10	<10	<10	<5	<10	<10
4.	DDT	ng/l	<10	<10	<10	<5	<10	<10
5.	Lindane	ng/l	1	<10	<10	<5	<10	<10
6.	HCB	ng/l	<10	<10	<10	<5	<10	<10
7.	1,2-dichlorethane	µg/l	<1	<1	<1	<1	<1	<1
8.	Trichloromethane	µg/l	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
9.	Trichloroethylene	µg/l	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
10.	Tetrachloroethylene	µg/l	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
11.	Tetrachloromethane (carbon tetrachloride)	µg/l	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
12.	Hg	µg/l	0,05	<0,05	<0,05	<0,05	<0,05	<0,05
13.	Cd	µg/l	0,1	<0,1	<0,1	<0,1	0,1	<0,02
14.	PAH	µg/l						0,011
15.	Petroleum products	µg/l					87,6	
16.	Sulphides	mg/l					<0,02	
17.	Sn	µg/l					<0,005	
18.	Ni	mg/l					<0,001	
19.	Cu	mg/l					0,018	
20.	Pb	µg/l					0,002	
21.	Zn	µg/l					<0,01	
22.	Cr	mg/l					<0,001	

VKG – Viru Keemia Grupp AS
[1] – Sampling point – River Kohtla after VKG's outlet;
[2] – Sampling point – On the River Narva, after AS Narva Vesi's outlet

Table 3.1.4. Content of hazardous substances in surface water during the period 2002–2004 [3.8]

No.	Hazardous substance	Results (number of samples in parentheses)		
		2002[1]	2003[2]	2004[3]
1.	Mercury	<0,05–0,05 µg/l (5)*	<0,05 µg/l (10)	<0,05 µg/l (10)
2.	Cadmium	0,28 µg/l <0,1–1,0 µg/l (5)	0,15 µg/l 0,02–0,46µg/l (10)	0,27 µg/l <0,1–0,4 µg/l (10)
3.	Hexachlorocyclohexane (HCH)	<10 ng/l (5)	<10 ng/l (2)	–
4.	Carbon tetrachloride	<0,1µg/l (5)	<0,1 µg/l (4)	–
5.	DDT	<10 ng/l (5)	<10 ng/l (2)	–
6.	1,2-dichlorethane (EDC)	<1,0µg/l (5)	<1,0 µg/l (2)	–
7.	Aldrin	<5 ng/l (5)	<10 ng/l (2)	–
8.	Dieldrin	<5 ng/l (5)	<10 ng/l (2)	– –
9.	Endrin	<5 ng/l (5)	<10 ng/l (2)	–
10.	Isodrin	–	–	–
11.	Hexachlorobenzene (HCB)	<10 ng/l (5)	<10 ng/l (2)	–
12.	richloroethylene (TRI)	<0,1µg/l (5)	<0,1 µg/l (2)	–
13.	Trichloromethane (Chloroform)	<0,1µg/l (5)	<0,1 µg/l (4)	–

[1] – Sampling point region – Ida-Viru County and sampling point location: VKG (Rivers Kohtla and Purtse) and AS Narva Vesi (River Narva, below Narva);
[2] – Sampling region: Harju County and sampling point: Kroodi Brook, Lasnamäe collector, Vana-Narva Highway, Mustaoja (Paldiski Hwy.) and Keila waste water treatment plant effluent;
[3] – Sampling point region – Harju County and Põlva County and sampling point: Vana-Narva Highway region and AS Räpina Paber;
– not designated

Table 3.1.5. Content of hazardous substances in bottom sediment in 2002 [3.8]

Substance	Unit	Sampling point					
		River Kohtla after VKG outlet[1]	River Purtse, Estonian thermoelectric power station	River Mustajõgi below the Estonian ther-moelectric power station cooling water channel	AS Narva Vesi outlet[2]	Baltic Thermal electric power station, cooling water outflow channel	Mouth of the River Pljussa
Aldrin	µg/kg	< 5	< 5	< 5	< 5	< 1	< 1
Dieldrin	µg/kg	< 5	< 5	< 5	< 5	< 1	< 1
Endrin	µg/kg	< 5	< 5	< 5	< 5	< 1	< 1
DDT	µg/kg	< 5	< 5	< 5	< 5	< 1	< 1
Lindane	µg/kg	< 5	< 5	< 5	< 5	< 1	< 1
HCB	µg/kg	< 5	< 5	< 5	< 5	< 1	< 1
Hg	mg/kg	0,03–0,04	0,05–0,43	0,02–0,04	< 0,02	0,045–0,047	0,131–0,132
Cd	mg/kg	0,196–0,331	< 0,25–0,484	< 0,25	< 0,25	0,119–0,123	0,329–0,331
PAH	mg/kg						0,15
Petroleum products	mg/kg				36,9		
Sn	mg/kg	0,283–0,724	0,255–1,026		< 0,25		
Ni	mg/kg	3,54–3,84	5,14–15,5		1,44		
Cu	mg/kg	6,11–11,7	5,1–17,5		2,8		
Pb	mg/kg	< 2,5–4,01	10,0–15,8		< 2,5		
Zn	mg/kg	14,1–25,2	19,0–61,4		9,06		
Cr	mg/kg	10,3–11,6	5,56–6,96		< 1,25		
Monobasic phenols	mg/kg					0,14	
Dibasic phenols	mg/kg					2,0	
PCB	µg/kg						< 5

[1] – Sampling point – River Kohtla after Viru Keemia Grupp AS outlet;
[2] – Sampling point – On the River Narva, after AS Narva Vesi's outlet

3.2. Overview of monitoring as of 2005

During the period 2005–2010, several proposals were made by the Estonian Environmental Research Centre, AS Maves, as well as the Estonian Marine Institute, for renewing the water monitoring programme for hazardous substances.

In the 2005 report "Specifying priority hazardous substances and preparing a monitoring network for Estonia's surface water bodies" [3.10] and the "Updating of the hazardous substances monitoring programme" [3.11] prepared by the Estonian Environmental Research Centre, recommendations were given for carrying out a monitoring programme for hazardous substances during the period 2006–2008, in regards to substances, monitoring points as well as monitoring frequency.

Since the number of repetitions in monitoring points and sampling was relatively high, it was decided to divide the monitoring programme by regions into three years. First year Tallinn and Harju County, second year Ida and Lääne Viru County and the remainder of Estonia in the third year.

During the course of hazardous substances monitoring in the aquatic environments of Tallinn and Harju County, samples were collected from seven monitoring stations: River Pääsküla, below the landfill for Tallinn (Cd, Cu, Hg, Pb, Zn, PAH, petroleum products), the storm water collector for the Lasnamäe district of Tallinn (Cd, Cu, Hg, Pb, Zn, Ba, carbon tetrachloride), Kroodi Brook (City of Maardu), below the sources of pollution (Cd, Cu, Hg, Pb, Zn, petroleum products, monophenols and diphenols, tri- and tetracloroethylene) and Vana-Narva Hwy. (Tallinn) region's storm water collector (Cd, Cu, Hg, Pb, Zn, Ba, Co, Mo, PAH, petroleum products, phenols, tri- and tetracloroethylene), Kurblu Brook in Kuusalu Rural Municipality (Cd, Cu, Hg, Pb, Zn, As, PAH, petroleum products, monobasic phenols and dibasic phenols), River Jägala below Kehra pulp mill (Cd, Cu, Hg, Pb, Zn, As, PAH, petroleum products, monobasic phenols and dibasic phenols), and the River Keila, below the City of Keila (Cu, Hg, Pb, Zn, petroleum products).

A total of 15 substances were specified, a summary of the results is presented in Table 3.2.1.

Environmental quality standards for hazardous substances in inland surface waters (Regulation No. 49 of the Minister of the Environment of 09 September 2010) were exceeded by the content of heavy metals zinc and copper and monobasic phenols, partially also petroleum products and barium contents.

The annual average environmental quality standards for priority substances and priority hazardous substances and certain other pollutants for inland surface waters (Regulation No. 49 of the Minister of the Environment of 09 September 2010) were partially exceeded by the content of heavy metals nickel and lead.

Highest heavy metal content (Table 3.2.2.) found in water samples: copper – 35.3 µg/l and nickel – 4.7 µg/l Kohtla – Järve waste water treatment plant outlet effluent, lead – 3.4 µg/l River Kohtla below the VKG outlet and River Purtse, below River Kohtla. Mercury, cadmium and zinc content remained below the limit of quantification of the method of analysis used.

From the organic compounds hexachlorobenzene (limit of quantification in water 10 ng/l), hexachlorobutadiene (0.1 µg/l), tetrachloroethylene (0.1 µg/l), carbon tetrachloride (0.1 µg/l), trichloromethane (0.1 µg/l) and diphenols (10 µg/l), contents remained below established environmental quality standards and the limits of of quantification of the method of analysis used.

Petroleum compounds exceeding the limit of quantification (20 µg/l) were found only in one sample, in Kohtla-Järve waste water treatment plant effluent. The petroleum compounds content of this water sample was 80 µg/l. In regards to polyaromatic hydrocarbons, in the majority of samples the content of compounds fell below the limit of quantification (0.1 µg/l). The higher levels of polyaromatic hydrocarbons were found only in two water samples from the River Kohtla, below the VKG outlet and in one water sample from the River Narva, below the City of Narva, respectively 1.0 – 1.6 µg/l and 0.28 µg/l. Monobasic phenols content was highest in the water samples from the River Kohtla collected below the VKG outlet, respectively 6.5 and 7.0 µg/l. Monobasic phenols content in the samples collected from Balti SEJ cooling water outlet was below the limit of quantification of the method used (2.0 µg/l).

In 2008, within the framework of the international project "EU Wide Monitoring Survey of Polar Persistent Pollutants in European River Waters", 122 water samples from 27 European Union Member States were studied [3.12]. The level of contamination of a total of 100 European Rivers and other similar flowing bodies of water were tested for 35 selected polar persistent organic compounds. Three rivers from Estonia were included in the project: River Narva, River Purtse and the River Emajõgi. 10% of studied European rivers and flowing bodies of water were classified as "very clean". The cleanest water samples were collected from Estonian, Lithuanian and Swedish water bodies. Some examples of hazardous substances belonging to the WFD list, which were analysed from the river water of 27 countries, are listed in Table 3.2.3.

On the basis of the survey results of the monitoring programme carried out in 2008, the average content of petroleum hydrocarbons in the rivers of North-East Estonia did not exceed the limit of quantification in the majority of cases. In all rivers, phenolic compounds with a content exceeding 5 µg/l were found. The highest content of phenolic compounds was in River Mustajõgi. Cadmium, zinc, mercury and chromium content did not exceed the limit of quantification in any river. The highest concentration of copper was in River Pühajõgi, manganese and nickel in Roostoja.

Concentrations of heavy metals, volatile organic compounds and petroleum hydrocarbons were low in the water of River Pärnu, Oore area [3.13].

In the survey ordered by the Ministry of the Environment in 2010: “The inventory of priority substances and the analysis of performance of monitoring programmes regarding the fulfilling the requirements of directive 2008/105/EC of the European Parliament and of the Council of 6 December 2008”, 19 water monitoring stations were studied (of which 18 were surface water bodies) for the presence of a total of 52 hazardous substances. In addition to the list of priority hazardous substances, the content of three plant protection products (AMPA, glyphosate, mecoprop) included in the list of possible priority substances in Annex III to the WFD were also analysed, as well as the surface water content of herbicide MCPA used in intensive agricultural regions in Estonia. Samples were collected from 15 sampling points in May and September of 2010. Analyses were performed in Germany, at the accredited laboratory GBA Gesellschaft für Bioanalytic Hamburg mbH.

Concentrations of hazardous substances in inland surface waters remained below the limit of quantification. In single sampling locations, cadmium, nickel and tin were discovered to be over the limit of quantification. Nickel content exceeded the limit of quantification in Kroodi Brook and in the coastal waters of the Gulf of Narva and Kunda. The annual average quality standard for cadmium was exceeded in the River Kuusiku. Isononylphenol content exceeded the annual average quality standard in the waters of Kroodi Brook, River Emajõgi, Gulf of Pärnu, and Lake Peipus. In some other water bodies this substance was found over the limit of quantification. 4-tert-octylphenol content exceeded the quality standard in Kroodi Brook. Alkylphenols were discovered in many bodies of water, but the analysed contents did not exceeded the quality standards. Trichloromethane or chloroform, pyrene and PAH concentrations; and AMPA in the fall and glyphosate concentrations in the spring were found over the limit of quantifications [3.14].

Table 3.2.1. Content of hazardous substances in water samples in 2006

No.	Substance	Unit	Pääsküla River	Lasnamäe Collector	Kroodi Brook	Vana-Narva Hwy.	Kurbla Brook (Kuusalu)	Jägala River	Keila River
1.	Cd	µg/l	0,1-0,2	0,1-0,2	<0,1	<0,1	<0,1	<0,1	
2.	Cu	µg/l	4,0-6,4	12,1-15,4	20,1-20,7	37,8-318	6,6-8,7	4,9-8,3	5,4-5,6
3.	Hg	µg/l	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
4.	Pb	µg/l	<1,0	1,0-1,8	7,7-8,4	8,0-48,6	<1-7,1	<1-1,3	<1-1,1
5.	Zn	µg/l	11-12	19-25	157-158	95-2080	35	<10	<10
6.	As	µg/l					<1	<1	<1
7.	Ba	µg/l		77-78		34-49			
8.	Ni	µg/l				15,5-742			
9.	PAH	µg/l	<1			<1	<1	<1	
10.	Monobasic phenols	µg/l		10,1	6,9	3,9	4,0-5,6	5,2-6,8	
11.	Dibasic phenols	µg/l		<10	<10	<10	<10	<10	
12.	Tetrachloroethylene	µg/l		<0,1	<0,1	<0,1			
13.	Trichloroethylene	µg/l		0,34	0,21	0,18-0,22			
14.	Petroleum products	µg/l	<50	410	<50	<20	<50	<20	<50
15.	pH		7,26	7,92	7,56	6,85	8,02	7,77	7,89

Table 3.2.2. Heavy metal content of water samples (minimum and maximum content) in 2006

Location of monitoring point	Cd (µg/l)	Cu (µg/l)	Hg (µg/l)	Pb (µg/l)	Zn (µg/l)
Kohtla River	< 0,1	2,1 – 4,2	< 0,05	2,4 – 3,4	< 10
Purtse River	< 0,1	7,9 –20,3	< 0,05	3,3 – 3,4	< 10
AS Narva Vesi from the River Narva, below Narva	< 0,1	4,8 – 9,8	< 0,05	< 1,0	< 10
Kohtla-Järve waste water treatment plant outlet	< 0,1	5,9 – 35,3	< 0,05	1,5 – 2,9	< 10
Balti SEJ cooling water outlet channel	< 0,1	5,9 – 6,3	< 0,05	< 1,0	< 10

Table 3.2.3. Content of priority substances and certain other pollutants in Estonia's rivers and comparison with other European Union (EU) rivers (maximum content and average content) [3.12]

Substance	Unit	Emajõgi River	Purtse River	Narva River	Maximum content in EU rivers	Average content in EU rivers	LOD*
Diuron	ng/l	2	0	2	864	41	1
Simazine	ng/l	0	0	0	169	10	1
Isoproturon	ng/l	0	0	0	1959	52	1
Atrazine	ng/l	0	0	0	46	3	1
Nonylphenol	ng/l	0	0	0	4489	134	50
4-tert-Octylphenol	ng/l	0	0	0	557	13	10
Perfluorooctanoic acid	ng/l	1	1	0	174	12	1
Perfluorooctane sulfonate	ng/l	1	0	1	1374	39	1

* LOD- Limit of detection

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4. Selection of hazardous substances, sampling points and sampling matrices

4.1. Selection of hazardous substances

Upon selecting the hazardous substances, above all it was kept in mind that the Minister of the Environment has established the lists of substances hazardous to aquatic environment with the 21 July 2010 Regulation No. 32 "Lists 1 and 2 of substances and groups of substances hazardous to the aquatic environment and lists of priority substances, priority hazardous substances and their substance groups" (see Annex 1). These lists include 33 priority substances of the Water Framework Directive and also other hazardous substances and groups of hazardous substances.

Directive 2008/105/EC, which establishes the environmental quality standards of priority substances and certain other pollutants, the content of which in the surface water must be monitored, was also taken into account. This directive has been transposed by the 9 September 2010 Regulation No. 49 (see Annex 2).

The substances identified as priority substances by HELCOM in order to protect the Baltic Sea, e.g. dioxins, furans and dioxin-like polychlorinated biphenyls; tributyltin and triphenyltin, pentabromodiphenyl ethers, octabromodiphenyl ethers and decabromodiphenyl ethers; perfluorooctane acid and perfluorooctane sulfonate; hexabromocyclododecane, nonylphenols, nonylphenol ethoxylates, octylphenols and octylphenol ethoxylates; short- and medium-chain chlorinated paraffins, mercury and cadmium, were also considered. Dioxins, furans and dioxin-like polychlorinated biphenyls were knowingly excluded from the screening as these substances were investigated in the project COHIBA (the "Control of Hazardous Substances in the Baltic Sea Region") by the Finnish Environment Institute.

It was also important to focus on the hazardous substances found in the Estonian aquatic environment, the content of which should be constantly monitored and which are indicated in inventories [4.1] and monitoring programmes [4.2] of substances hazardous for the aquatic environment carried out by the Estonian Environmental Research Centre.

The following hazardous substances or their groups were chosen for screening in the project:

- heavy metals;
- phenols, alkylphenols and their ethoxylates;
- polyaromatic hydrocarbons;
- volatile organic compounds;
- organotin compounds;
- phthalates;
- polybrominated biphenyls, diphenyl ethers and polybrominated organic compounds;
- sodium tripolyphosphate;
- short- and medium-chain chlorinated paraffins;
- perfluoro-compounds;
- pentachlorophenol;
- cyanide;
- pesticides.

Since all these hazardous substances cannot be analysed in Estonia due to the lack of capacity of laboratories, a certain part of the analyses were ordered from a laboratory outside of Estonia. As a foreign laboratory, GALAB Laboratories GmbH (Max-Planck-Strasse 1, Geesthacht, Germany) identified the substances. The substances were analysed in two sampling rounds.

In the first round all chosen substances were analysed, and in the second round only these substances were chosen which had very high results in the first round or the results were questionable for another reason. Table 4.1.1 indicates all substances or groups of substances analysed in the process of the screening and the laboratory that analysed them. For more information on which substances from which sampling points and matrixes were analysed see the result tables in Annexes 3 and 4.

Table 4.1.1. Substances and groups of substances analysed in the project.

No.	Substance/Group of Substances	CAS number	Laboratories that carried out the analyses
Heavy metals			
1	Lead and its compounds	7439-92-1	EERC
2	Nickel and its compounds	7440-02-0	EERC
3	Mercury and its compounds	7439-97-6	EERC
4	Cadmium and its compounds	7440-43-9	EERC
5	Zinc and its compounds	7440-66-6	EERC
6	Chromium	7440-47-3	EERC
7	Copper and its compounds	7440-50-8	EERC
8	Arsenic and its compounds	7440-38-2	EERC
Phenols, alkylphenols and their ethoxylates			
9	4-nonylphenol	104-40-5	GALAB
10	Isononylphenol	25154-52-3	GALAB
11	Isononylphenol-monoethoxylate	27986-36-3	GALAB
12	Isononylphenol-diethoxylate	20427-84-3	GALAB
13	Isononylphenol-triethoxylate	-	GALAB
14	Isononylphenol-tetraethoxylate	-	GALAB
15	Isononylphenol-pentaethoxylate	-	GALAB
16	Isononylphenol-hexaethoxylate	-	GALAB
17	4-octylphenol	1806-26-4	GALAB
18	4-tert-octylphenol	140-66-9	GALAB
19	4-t-octylphenol-monoethoxylate	9036-19-5	GALAB
20	4-t-octylphenol-diethoxylate	-	GALAB
21	4-t-octylphenol-triethoxylate	-	GALAB
22	4-t-octylphenol-tetraethoxylate	-	GALAB
23	4-t-octylphenol-pentaethoxylate	-	GALAB
24	4-t-octylphenol-hexaethoxylate	-	GALAB
25	4-tert-butylphenol	98-54-4	GALAB
26	4-tert-pentylphenol	80-46-6	GALAB
27	Pentachlorophenol	87-86-5	EERC
28	p- and m-cresol	106-44-5, 108-39-4	EERC
29	o-cresol	95-48-7	EERC
30	Resorcin	108-46-3	EERC
31	2,5-dimethylresorcin	95-87-4	EERC
32	5-methylresorcin	504-15-4	EERC
33	Phenol	108-95-2	EERC
35	2,3-dimethylphenol	526-75-0	EERC
36	2,6-dimethylphenol	576-26-1	EERC
37	3,4-dimethylphenol	95-65-8	EERC
38	3,5-dimethylphenol	108-68-9	EERC
Polyaromatic hydrocarbons			
39	Anthracene	120-12-7	GALAB
40	Benzo(a)pyrene	50-32-8	GALAB
41	Benzo(b)fluoranthene	205-99-2	GALAB
42	Benzo[g,h,i]perylene	191-24-2	GALAB
43	Benzo(k)fluoranthene	207-08-9	GALAB
44	Indeno[1,2,3-cd]pyrene	193-39-5	GALAB
45	Naphtalene	91-20-3	GALAB
46	Fluoranthene	206-44-0	GALAB

No.	Substance/Group of Substances	CAS number	Laboratories that carried out the analyses
Volatile organic compounds			
47	Benzene	71-43-2	EERC
48	1,2-dichloroethane	107-06-2	EERC
49	Dichloromethane	75-09-2	EERC
50	Tetrachloromethane	56-23-5	EERC
51	Tetrachloroethylene	127-18-4	EERC
54	Chloroform (trichloromethane)	67-66-3	EERC
55	Trichloroethylene	79-01-6	EERC
56	Dichlorobromomethane	75-27-4	EERC
57	Bromoform	75-25-2	EERC
Chlorobenzenes			
58	Hexachlorobenzene	118-74-1	EERC
59	Pentachlorobenzene	608-93-5	EERC
Organotin compounds			
60	Tributyltin	3664-73-3	GALAB
61	Monobutyltin	78763-54-9	GALAB
62	Dibutyltin	1002-53-5	GALAB
63	Tetrabutyltin	1461-25-2	GALAB
64	Monooctyltin	-	GALAB
65	Dioctyltin	94410-05-6	GALAB
66	Tricyclohexyltin	6056-50-4	GALAB
67	Monophenyltin	2406-68-0	GALAB
68	Diphenyltin	6381-06-2	GALAB
69	Triphenyltin	668-34-8	GALAB
Phthalates			
70	Di(2-ethylhexyl)phthalate	117-81-7	GALAB
71	Dibutylphthalate	84-74-2	GALAB
72	Dimethylphthalate	113-11-3	GALAB
73	Diethylphthalate	84-66-2	GALAB
74	Benzylbenzonate	120-51-4	GALAB
75	Diisobutylphthalate	84-69-5	GALAB
76	Dimetoxyethylphthalate	117-82-8	GALAB
77	Diisohexylphthalate	-	GALAB
78	Di-2-ethoxyethylphthalate	605-54-9	GALAB
79	Dipentylphthalate	131-18-0	GALAB
80	Benzylbutylphthalate	85-68-7	GALAB
81	Hexyl-2-etylhexylphthalate	-	GALAB
82	Dibutoxyethylphthalate	117-83-9	GALAB
83	Dicyclohexylphthalate	84-61-7	GALAB
84	Diisononylphthalate	28553-12-0	GALAB
85	Di-n-octylphthalate	117-84-0	GALAB
86	Diisodecylphthalate	26761-40-0	GALAB
87	Di-n-hexylphthalate	-	GALAB
Polybrominated biphenyls, diphenylethers and polybrominated organic compounds			
88	Pentabromodiphenylether, PBDE-99	60348-60-9	GALAB
89	Pentabromodiphenylether, PBDE-100	189084-66-0	GALAB
90	Octabromodiphenylether, PBDE-203	32536-52-0	GALAB
91	3,3',5,5'-tetrabromobisphenol A, TBBPA	79-94-7	GALAB

No.	Substance/Group of Substances	CAS number	Laboratories that carried out the analyses
92	Tetrabromobiphenyl, PBB-52	59080-37-4	GALAB
93	Pentabromobiphenyl, PBB-101	67888-96-4	GALAB
94	Hexabromobiphenyl, PBB-153	59080-40-9	GALAB
95	Tribromodiphenylether, PBDE-28	-	GALAB
96	Tetrabromodiphenylether, PBDE-47	5436-43-1	GALAB
97	Hexabromodiphenylether, PBDE-138	182677-30-1	GALAB
98	Hexabromodiphenylether, PBDE-153	68631-49-2	GALAB
99	Hexabromodiphenylether, PBDE-154	207122-15-4	GALAB
101	Heptabromodiphenylether, PBDE-183	207122-16-5	GALAB
102	Heptabromodiphenylether, PBDE-190	189084-68-2	GALAB
103	Decabromodiphenylether, PBDE-209	1163-19-5	GALAB
104	The sum of pentabromodiphenylethers	-	GALAB
105	The sum of octabromodiphenylethers		GALAB
106	Hexabromobenzene	87-82-1	GALAB
107	Hexabromocyclodecane	25637-99-4	GALAB
108	Bromocyclene	1715-40-8	GALAB
Short- and medium-chain chlorinated paraffins			
109	C_{10-13} chloroalkanes (SCCP)	85535-84-8	GALAB
110	C_{14-17} chloroalkanes (MCCP)	85535-85-9	GALAB
Perfluoro-compounds			
111	Perfluorooctanoic acid (PFOA)	335-67-1	GALAB
112	Perfluorooctane sulfonate (PFOS)	1763-23-1	GALAB
Pesticides			
113	Aldrin	309-00-2	EERC
114	Dieldrin	60-57-1	EERC
115	Endrin	72-20-8	EERC
116	Isodrin	465-73-6	EERC
117	Endosulfan	115-29-7	EERC
118	Hexachlorobutadiene	87-68-3	EERC
119	alpha-hexachlorocyclohexane	319-84-6	EERC
120	beta-hexachlorocyclohexane	319-85-7	EERC
121	gamma-hexachlorocyclohexane	58-89-9	EERC
122	alpha-endosulfan	959-98-8	EERC
123	Chlorfenvinphos	470-90-6	GALAB
124	Alachlor	15972-60-8	GALAB
125	Atrazine	1912-24-9	GALAB
126	Isoproturon	34123-59-6	GALAB
127	Chlorpyriphos	2921-88-2	GALAB
128	Trifluralin	1582-09-8	GALAB
129	Simazine	122-34-9	GALAB
130	Glyphosate	1071-83-6	GALAB
131	AMPA	1066-51-9	GALAB
132	Mecoprop (MCPP)	7085-19-0	GALAB
Other substances			
133	Cyanide	57-12-5	EERC
134	Sodiumtripolyphosphate	9010-08-6	GALAB

EERC - Estonian Environment Research Centre laboratory
GALAB - GALAB Laboratories GmbH, Max-Planck-Strasse 1, Geesthacht, Germany

4.2. Selection of sampling points

Waste water treatment plants (WWTP)

- Focus on waste water treatment plants of larger cities. When choosing them it was taken into account that hazardous substances were released from outlets to the Baltic Sea.
- Waste water treatment plants of larger cities were chosen for the project, as such a thorough inventory of their outlets had not been performed before.
- The goal was to obtain an overview of hazardous substances which have not been identified in the outlets of waste water treatment plants before.

Internal water bodies (rivers and Lake Peipus)

- Upon choosing the mouths of rivers, the fact that hazardous substances are carried to the Baltic Sea from the whole catchment area was taken into account.
- Special attention was paid to rivers where valuable fish live. Out of these, the mouth of the River Narva [border river, fish river (salmon), spawning river for valuable fish]; the mouth of the River Pärnu [fish river (salmon)]; the mouth of the River Kasari [fish river (clams); the mouth of the River Emajõgi [fish river (clams), below Tartu]; the mouth of the River Keila [fish river, (salmon)]; the mouth of the River Pirita [fish river (salmon)] the mouth of the River Selja [fish river (salmon)] and the mouth of the River Kunda [fish river (salmon)] were chosen. The River Vasalemma (salmon and trout), which had not been a part of the national environmental monitoring programme, was added.
- The choosing of sampling spots in rivers and Lake Peipus was based on the 2002 Regulation of the Minister of the Environment No. 50 "The Establishment of State Environmental Monitoring Stations and Sites" as it states the exact coordinates of the monitoring stations chosen as sampling stations.

Coastal waters

- Coastal water regions were chosen for the project, since a thorough inventory of hazardous substances had not been conducted there before.
- When choosing the costal water regions, it was taken into account that hazardous substances are being released into the Baltic Sea.
- The goal was to obtain an overview of hazardous substances which have not been identified in these regions of Estonian coastal waters before (e.g. organotin compounds, etc.)

Agricultural regions

- The choosing of sampling points from regions with intensive agricultural activities was based on the recommendations on choosing sampling points indicated in the report "The Correction of Monitoring Plans of a Nitrate-Sensitive Area" [4.3] as they took into account the load on the environment arising from agricultural activities.
- The goal was to obtain an overview of hazardous substances which have not been identified in internal water bodies of regions with intensive agricultural activities before.

In general, the sampling points in the internal water bodies were chosen based on the 30 July Regulation No. 50 "The Establishment of State Environmental Monitoring Stations and Sites" as it states the names, numbers and exact coordinates of the monitoring stations chosen as sampling stations.

Pursuant to the 9 September 2010 Regulation of the Government of the Republic No. 132 "The Establishment of River Basins and Sub-Basins", Estonia is divided into three river basins: the West Estonian, East Estonian and Koiva river basins. The river basins, in turn, are divided into eight sub-basins: the Viru, Peipus, Võrtsjärv, Harju, Matsalu, Pärnu and Western Islands sub-basins and the Pandivere ground water sub-basin. Upon choosing monitoring stations as sampling spots the principle of covering the main river basins was taken into account. The borders of river basins and sub-basins are presented in Figure 4.2.1.

There were 33 sampling points for determining the content of hazardous substances in the project, including:

- **8 waste water treatment plants**
- **11 rivers flowing into the Baltic Sea**
- **5 points along coastal waters**
- **2 monitoring stations on Lake Peipsi**
- **7 monitoring stations in agricultural regions**

The complete list of sampling points and monitoring stations used as sampling points is contained in Table 4.2.1. On Figures 4.2.2 and 4.2.3 sampling points and their numbers pursuant to Table 4.2.1 have been presented.

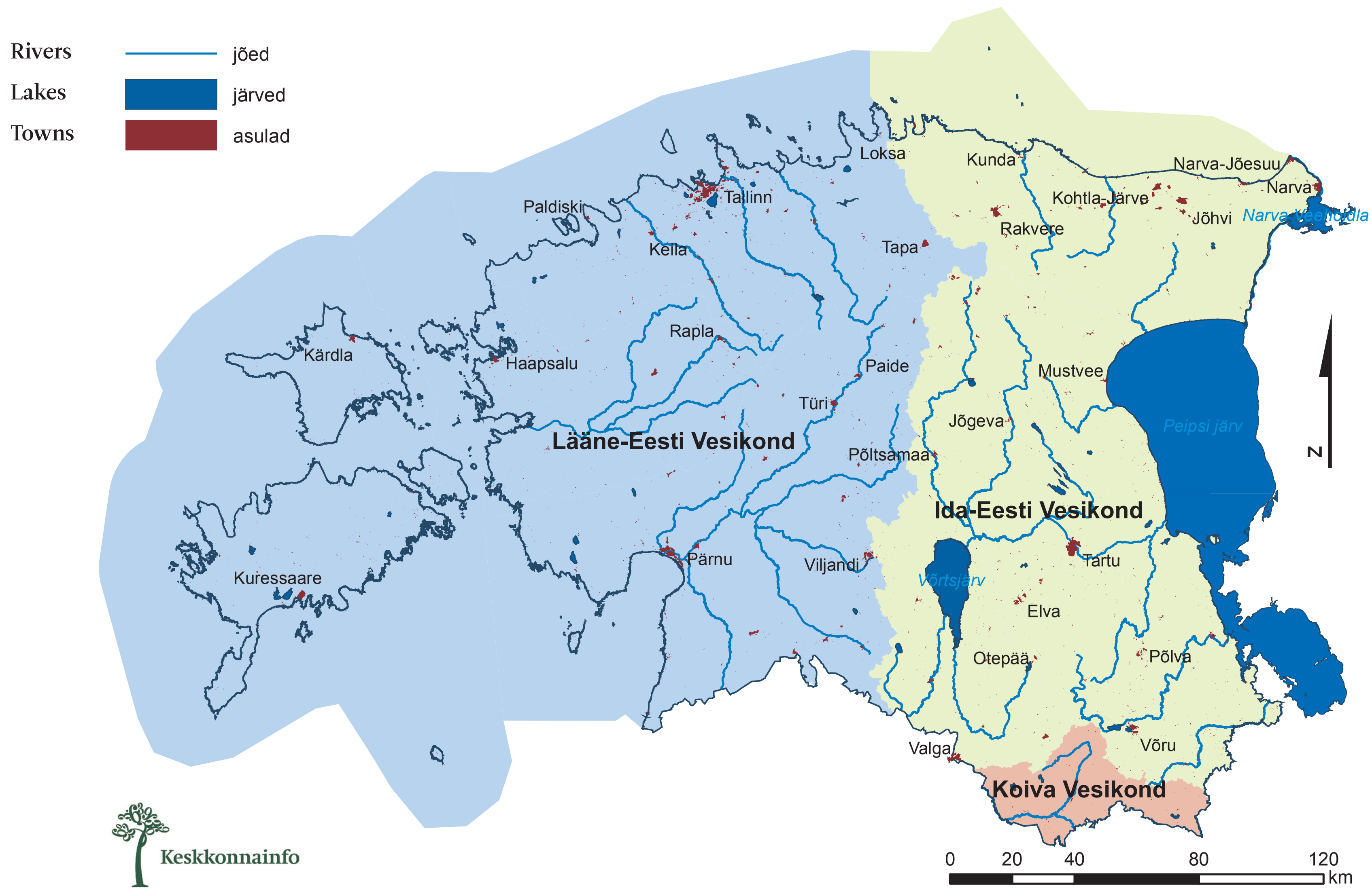

Figure 4.2.1. The map of Estonian river basins

Table 4.2.1. Sampling points / monitoring stations (Figure 4.2.2)

No. of sampling point	Sampling point	Description of sampling point /monitoring station
Waste water treatment plants (WWTP)		
1.	Tallinn WWTP	Outlet of Tallinn WWTP
2.	Kohtla-Järve WWTP	Outlet of Kohtla-Järve WWTP
3.	Narva WWTP	Outlet of Narva WWTP
4.	Pärnu WWTP	Outlet of Pärnu WWTP
5.	Kuressaare WWTP	Outlet of Kuressaare WWTP
6.	Haapsalu WWTP	Outlet of Haapsalu WWTP
7.	Keila WWTP	Outlet of Keila WWTP
8.	Tartu WWTP	Outlet of Tartu WWTP
Rivers		
9.	Narva	state monitoring station No. 32*
10.	Kohtla	flowing into the River Purtse
11.	Pühajõgi	state monitoring station No. 33* (the mouth of the river)
12.	Kunda	state monitoring station No. 36* (the mouth of the river)
13.	Mustajõgi	state monitoring station No. 60*
14.	Jägala	state monitoring station No. 42* (the mouth of the river, Linnamäe)
15.	Keila	state monitoring station No. 47*
16.	Vääna	state monitoring station No. 45* (the mouth of the river)
17.	Vasalemma	the mouth of the river
18.	Kasari	state monitoring station No. 49*
19.	Pärnu	state monitoring station No. 52*
Coastal Waters		
20.	Coast of Sillamäe	Sillamäe Bay
21.	BLRT Grupp AS (Baltic Ship Repair Company), Tallinn, Kopli Peninsula	Effluents flow into Tallinn Bay
22.	BLRT Grupp AS (Baltic Ship Repair Company), Tallinn, Kopli Peninsula	Company Baltic Premator dock No. 2 effluents flow into Tallinn Bay
23.	BLRT Grupp AS (Baltic Ship Repair Company), Tallinn, Kopli Peninsula	Company Baltic Premator dock No. 34 effluents flow into Tallinn Bay
24.	BLRT Grupp AS (Baltic Ship Repair Company), Tallinn, Kopli Peninsula	Company Baltic Premator dock No. 3 effluents flow into Tallinn Bay
Lakes		
25.	Lake Peipus	State monitoring point of Peipus No. 17**
26.	Lake Peipus	State monitoring point of Peipus No. 38 **
Agricultutal regions		
27.	Alastvere	Main ditch of Alastvere (Võhma-Nõmme Village)
28.	Tõrve	Outlet to the River Pedja
29.	Võisiku	State monitoring station No. 61* (the main ditch of Võisiku)
30.	Pedja jõgi	State monitoring station No. 14* (Jõgeva Plant Breeding Station)
31.	Jänijõgi	State monitoring station No. 64*
32.	Rannu	The main ditch of Konguta before flowing into Lake Liivaku (Tartu County)
33.	Rõhu	Rõhu stream before the collection lake (Tartu County)

* Estonian State Monitoring Programme – monitoring station numbers of the hydrochemical monitoring programme of rivers
**Estonian State Monitoring Programme – monitoring station numbers of monitoring programme of internal water bodies (Lake Peipus)

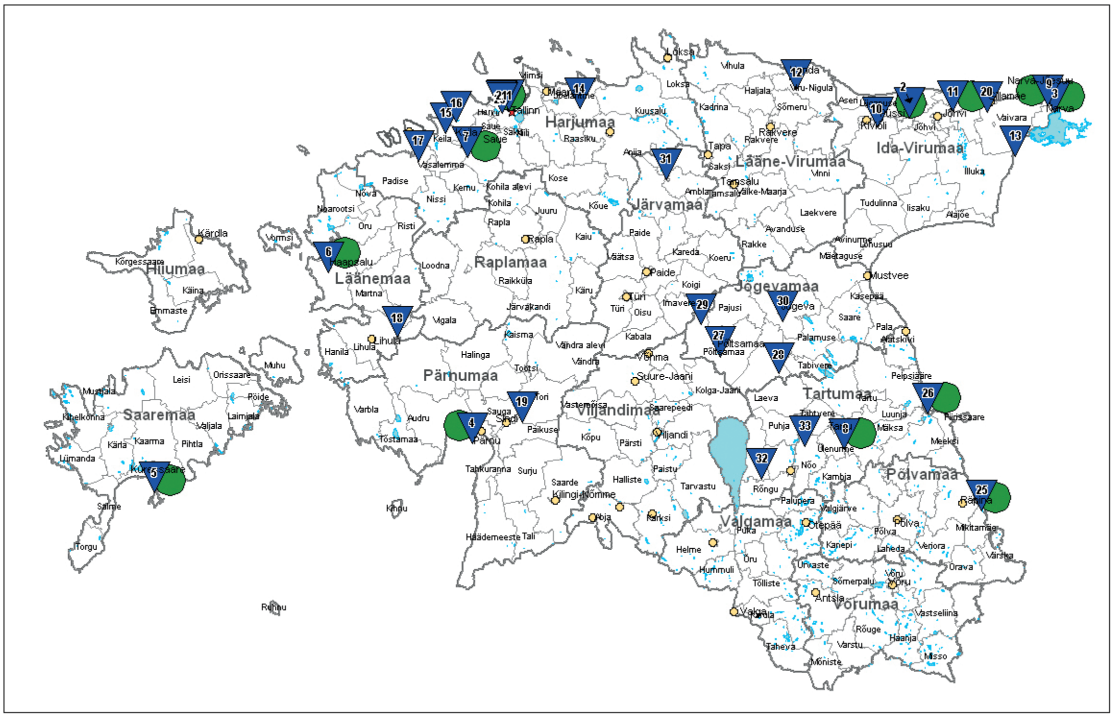

Figure 4.2.2. Sampling points all over Estonia (blue triangle – surface water or effluent, green circle – bottom sediment or sewage sludge)

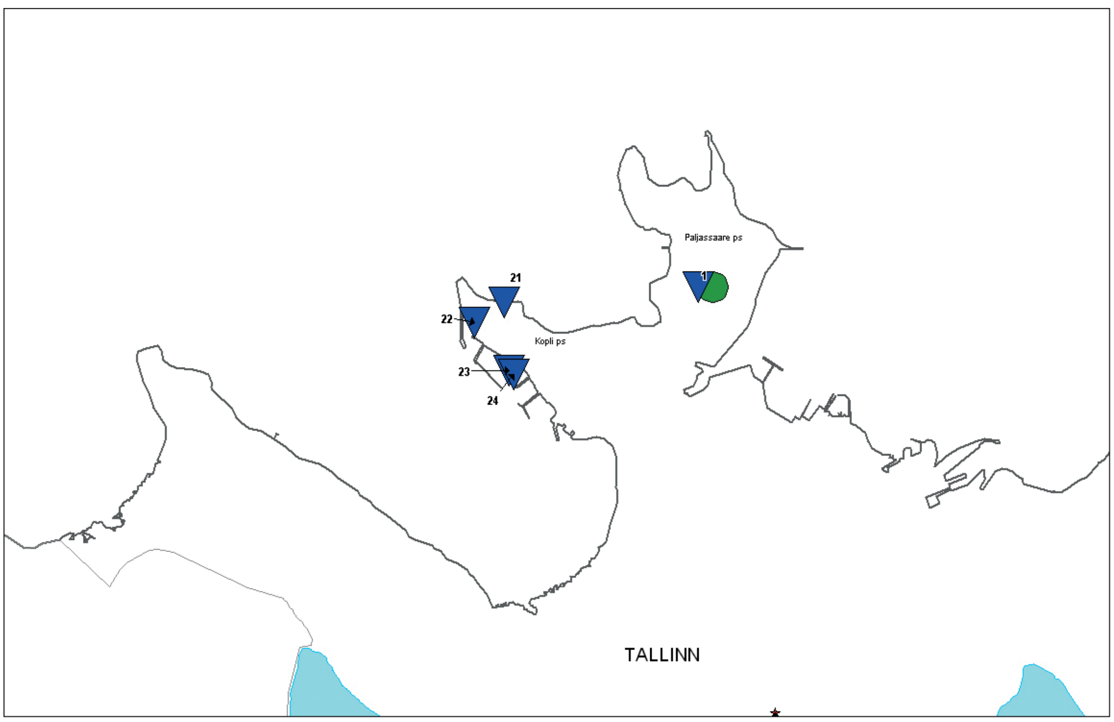

Figure 4.2.3. Sampling points in the area of Tallinn (blue triangle – surface water or effluent, green circle – bottom sediment or sewage sludge)

4.3. Selection of sampling matrices

Upon selecting of sampling matrixes, three main criteria were taken into account:

1. **Solubility of substances in water** (hydrophilic and hydrophobic chemicals), which is described by the partition coefficient K_{ow} (shows the partition of chemical in octanol and water). Chemicals with a low K_{ow} value are considered hydrophilic. They are generally characterised by good solubility in water, low absorption in soil and sediments and low value of bioconcentration factor. Chemicals with a high K_{ow} value are considered hydrophobic. They are characterised by low solubility in water, high absorption in soil and sediments and high value of bioconcentration factor. Therefore, hydrophobic substances cannot be found in water in considerable concentrations and for practical reasons there is no point in identifying them in there.

2. **The bioconcentration factor** BCF of substances which characterises the ability of a substance to bioaccumulate. It is expressed as the concentration in an organism / concentration in the environment ratio. It describes a chemical's ability to transfer from the aquatic environment to the fat tissue of a living organism. A substance is classified as bioaccumulative if its BCF value exceeds 2000. The ability of substance to bioaccumulate is considered low if it is log $K_{ow} \leq 3$.

3. **The persistence of a chemical in the environment.** For example, a persistent organic pollutant is characterised by more than a 2-month half-life in water and more than a 6 month half-life in sediments/soil. Also, their BCF> 5000 and/or log $K_{ow} > 5$.

Based on the aforementioned criteria and considering the potential occurrence of various substances in certain parts of the environments, the analyses of hazardous substances were carried out in the following matrixes:

- surface water
- effluent (treated waste water)
- bottom sediment of surface waters
- sewage sludge

Table 4.3.1 states the sampling points and the respective matrixes where, in the 1st and 2nd round, samples were taken.

Table 4.3.1 Sampling points and the respective matrixes where samples were taken.

No.	Sampling point	Description of sampling point	Matrix			
			Surface water/ effluent		Bottom sediment/ Sewage sludge	
			1 Round	2 Round	1 Round	2 Round
Waste Water treatment plants (WWTP)						
1.	Tallinn WWTP	Outlet of Tallinn WWTP	E	E	WS	WS
2.	Kohtla-Järve WWTP	Outlet of Kohtla-Järve WWTP	E	E	WS	WS
3.	Narva WWTP	Outlet of Narva WWTP	E	E	WS	WS
4.	Pärnu WWTP	Outlet of Pärnu WWTP	E	E	WS	WS
5.	Kuressaare WWTP	Outlet of Kuressaare WWTP	E	E	WS	WS
6.	Haapsalu WWTP	Outlet of Haapsalu WWTP	E	E	WS	WS
7.	Keila WWTP	Outlet of Keila WWTP	E	E	WS	WS
8.	Tartu WWTP	Outlet of Tartu WWTP	E	E	WS	WS
Rivers						
9.	Narva	state monitoring station No. 32*	SW	SW	BS	BS
10.	Kohtla	flowing into the River Purtse	SW	SW	BS	
11.	Pühajõgi	state monitoring station No. 33* (the mouth of the river)	SW	SW	BS	BS
12.	Kunda	state monitoring station No. 36* (the mouth of the river)	SW		BS	
13.	Mustajõgi	state monitoring station No. 60*	SW		BS	
14.	Jägala	state monitoring station No. 42* (the mouth of the river, Linnamäe)	SW		BS	
15.	Keila	state monitoring station No. 47*	SW	SW	BS	BS
16.	Vääna	state monitoring station No. 45* (the mouth of the river)	SW		BS	

No.	Sampling point	Description of sampling point	Matrix			
			Surface water/ effluent		Bottom sediment/ Sewage sludge	
			1 Round	2 Round	1 Round	2 Round
17.	Vasalemma	the mouth of the river	SW	SW	BS	
18.	Kasari	state monitoring station No. 49*	SW	SW	BS	
19.	Pärnu	state monitoring station No. 52*	SW		BS	
Coastal waters						
20.	Coast of Sillamäe	Sillamäe bay	SW	SW	BS	
21.	BLRT Grupp AS, Tallinn	Effluents flow into Tallinn Bay	E			
22.	BLRT Grupp AS	Company Baltic Premator dock No. 2 effluents flow into Tallinn Bay	E			WS*
23.	BLRT Grupp AS	Company Baltic Premator dock No. 34 effluents flow into Tallinn Bay	E			
24.	BLRT Grupp AS	Company Baltic Premator dock No. 3 effluents flow into Tallinn Bay	**			
Lake						
25.	Lake Peipus	State monitoring point of Peipus No. 17**	SW	SW	BS	BS
26.	Lake Peipus	State monitoring point of Peipus No. 38 **	SW		BS	
Agricultural regions						
27.	Alastvere	Main ditch of Alastvere (Võhma-Nõmme Village)	SW			
28.	Tõrve	Outlet to the River Pedja	SW			
29.	Võisiku	State monitoring station No. 61* (the main ditch of Võisiku)	SW			
30.	River Pedja	State monitoring station No. 14* (Jõgeva Plant Breeding Station)	SW			
31.	River Jänijõgi	State monitoring station No. 64*	SW			
32.	Rannu	The main ditch of Konguta before flowing into Lake Liivaku (Tartu County)	SW			
33.	Rõhu	Rõhu stream before the collection lake (Tartu County)	SW			

SW – Surface water
E – Effluent (treated waste water)
BS – Bottom sediment (surface water)
WS – Sewage Sludge (waste water sludge)
* – Sample taken from waste water sludge and from coastal sediment 50 metres away from the dock
** – Since Company Baltic Premator dock No. 3 was not operating during the time of the planned sampling, it was not possible to take effluent samples from there.

References

4.1 Prioriteetsete ainete allikate ja sealt emiteerivate ainete inventuur, EKUK, 2008.

4.2 Ohtlike ainete seireprogrammi uuendamine, EKUK, 2007.

4.3 Nitraaditundliku ala seirekava korrigeerimine. Aruanne (Person responsible I. Tamm), AS MAVES, document no. 8147, Tallinn, 2008, 35 p.

5. Methods used and quality assurance

5.1. Sampling schedule and methods, handling of samples

Samples were taken in two periods of time, i.e. in **two sampling rounds**. In spring, from the end of April to the beginning of May of 2010 8 effluent and 8 sewage sludge samples were taken from eight waste water treatment plants and 24 surface water and 14 bottom sediment samples were taken from internal water bodies and coastal waters. In the middle of September, 8 effluent, 8 sewage sludge, 8 surface water and 6 bottom sediment samples were taken.

Samples were taken by EERC specialists accredited according to requirements of 11 January 2002 Regulation of the Minister of the Environment no. 3 "The Procedure for Accreditation of People Responsible for Taking Samples for Water Research". The Estonian Environmental Research Centre is accredited in the field of sampling by the Estonian Accreditation Centre.

The taking, storage and handling of effluent, surface water and sewage sludge samples was in accordance with the requirements of 6 May 2002 Regulation of the Minister of the Environment no. 30 "Sampling Methods". The regulation prescribes the methods for taking samples from sea water, surface water, ground water, waste water, effluent, and sewage sludge in the process of water research. This Regulation is based on part 1 of standard EN 25667-1:1993 and parts 3, 4, 9, 10, 11, 13 and 15 of Estonian standard EVS-EN 5667. Standard EVS-EN 5667 is in compliance with the requirements of the respective ISO 5667 standard. Upon sampling, parts 1 and 2 of Estonian standard EVS-EN 25667 (EVS-EN 25667-1:2005 and EVS-EN 25667-2:2005) were taken into account.

Pursuant to subsection 7 of part B of Annex I of Directive 76/464/EEC, samples have to be taken from quite near to the place of waste water release into the surface waters so that the samples would represent the quality of water affected by waste water.

The effluent (treated wastewater) samples were taken from the outlets of waste water treatment plants in places indicated in the water permit from well-mixed water as spot samples.

The river water samples were taken from flowing water from approximately 30 cm under the surface by a container attached to a long rod. The lake and sea water samples were taken on boats or launches also from 30 cm under the surface.

The sewage sludge samples were taken from fresh sludge from baths under the filter press or centrifuge straight to a sample container .

The taking of samples from the bottom sediment was in accordance with the requirements of parts 1 and 2 of Estonian standard EVS-EN 25667 (EVS-EN 25667-1:2005 and EVS-EN 25667-2:2005) and parts 12, 15 and 19 of ISO 5667 standard. The samples were surfaced by sediment scoops especially made for that purpose.

The samples were collected in plastic or glass containers. The samples were transported to the laboratory in thermo boxes equipped with cold batteries and were placed in the refrigerator after arrival. The analyses of taken samples were started on the day of arrival in the EERC laboratory. In order to analyse the substances at the GALAB laboratories, the samples were delivered by a courier to Germany in thermo boxes equipped with cold batteries.

From surface water and effluent samples only samples of heavy metals and cyanide were taken and placed into 500 ml plastic bottles. Into the cyanide bottles a preservative (2.5 ml of NaOH solution) was added before the sampling. The rest of the water samples were taken in 1-litre glass bottles, although for samples meant for analysing cresols 500 ml glass bottles were used. The insides of plastic caps of the glass bottles were covered with aluminium folio.

All bottom sediment and sewage sludge samples were collected into 500 ml glass jars.

All samples were taken as double samples, in case during transportation to Germany one of the sample bottles or jars should break.

The samples sent to the GALAB laboratory were packed by the chemists of the EERC laboratory, who have previous experience in such activity. All samples sent to the GALAB laboratories arrived unbroken.

Table 5.1.1. Sampling points and schedule for taking water and sediment samples

No.	Sampling point	Description of sampling point	Sampling	
			1st round	2nd round
Waste water treatment plants (WWTP)				
1.	Tallinn WWTP	Outlet of Tallinn WWTP	21.04.2010	14.09.2010
2.	Kohtla-Järve WWTP	Outlet of Kohtla-Järve WWTP	3.05.2010	14.09.2010
3.	Narva WWTP	Outlet of Narva WWTP	3.05.2010	13.09.2010
4.	Pärnu WWTP	Outlet of Pärnu WWTP	30.04.2010	13.09.2010
5.	Kuressaare WWTP	Outlet of Kuressaare WWTP	30.04.2010	13.09.2010
6.	Haapsalu WWTP	Outlet of Haapsalu WWTP	30.04.2010	13.09.2010
7.	Keila WWTP	Outlet of Keila WWTP	21.04.2010	14.09.2010
8.	Tartu WWTP	Outlet of Tartu WWTP	28.04.2010	13.09.2010
Rivers				
9.	Narva	state monitoring station No. 32*	3.05.2010	13.09.2010
10.	Kohtla	flowing into the River Purtse	3.05.2010	14.09.2010
11.	Pühajõgi	state monitoring station No. 33* (the mouth of the river)	3.05.2010	13.09.2010
12.	Kunda	state monitoring station No. 36* (the mouth of the river)	3.05.2010	
13.	Mustajõgi	state monitoring station No. 60*	3.05.2010	
14.	Jägala	state monitoring station No. 42* (the mouth of the river, Linnamäe)	3.05.2010	
15.	Keila	state monitoring station No. 47*	3.05.2010	14.09.2010
16.	Vääna	state monitoring station No. 45* (the mouth of the river)	3.05.2010	
17.	Vasalemma	the mouth of the river	3.05.2010	14.09.2010
18.	Kasari	state monitoring station No. 49*	30.04.2010	13.09.2010
19.	Pärnu	state monitoring station No. 52*	30.04.2010	
Coastal waters				
20.	Coast of Sillamäe	Sillamäe Bay	3.05.2010	13.09.2010
21.	BLRT Grupp AS (Baltic Ship Repair Company), Tallinn	Effluents flow into Tallinn Bay	29.04.2010	
22.	BLRT Grupp AS	Company Baltic Premator dock No. 2 effluents flow into Tallinn Bay	29.04.2010	13.09.2010
23.	BLRT Grupp AS	Company Baltic Premator dock No. 34 effluents flow into Tallinn Bay	29.04.2010	
24.	BLRT Grupp AS	Company Baltic Premator dock No. 3 effluents flow into Tallinn Bay	29.04.10*	
Lakes				
25.	Lake Peipus	State monitoring point of Peipus No. 17**	3.05.2010	13.09.2010
26.	Lake Peipus	State monitoring point of Peipus No. 38 **	3.05.2010	
Agricultural regions				
27.	Alastvere	Main ditch of Alastvere (Võhma-Nõmme Village)	27.04.2010	
28.	Tõrve	Outlet to the River Pedja	27.04.2010	
29.	Võisiku	State monitoring station No. 61* (the main ditch of Võisiku)	27.04.2010	
30.	River Pedja	State monitoring station No. 14* (Jõgeva Plant Breeding Station)	27.04.2010	
31.	River Jänijõgi	State monitoring station No. 64*	3.05.2010	
32.	Rannu	The main ditch of Konguta before flowing into Lake Liivaku (Tartu County)	27.04.2010	
33.	Rõhu	Rõhu stream before the collection lake (Tartu County)	27.04.2010	

* Since Company Baltic Premator dock No. 3 was not operating during the time of the planned sampling, it was not possible to take effluent samples from there.

5.2. Methods of chemical analyses

Technical operations which ensure the quality and comparability of the results should be in compliance with internationally recognised practices of quality management systems.

The Commission directive No. 2009/90/EC of 31 July 2009 prescribes that laboratory methods of analysis shall be validated and documented according to standard EN ISO/IEC-17025.

The chemical analyses were carried out in two laboratories – in the laboratory of Estonian Environmental Research Centre (EERC, Marja 4D, 10617 Tallinn) and the GALAB laboratories (GALAB Laboratories GmbH, Max-Planck-Strasse 1, Geesthacht, Germany).

The scope of accreditation of both chosen laboratories is in compliance with the specificity of the analyses and the requirement stipulated in article 6 "Quality Assurance and Control" of the aforementioned directive on implementing standard EN ISO/IEC-17025 has been fulfilled by them.

The quality management system of the Estonian Environmental Research Centre has been accredited by the Estonian Accreditation Centre since 1998. In 2009 it was certified by AS Metrocert and declared to be in compliance with the requirements of standards ISO 9001 and ISO 14001. The Estonian Accreditation Centre has declared the activity of the laboratory of the Estonian Environmental Research Centre to be in conformity with the requirements of standard EN ISO/IEC 17025. Also, the Minister of the Environment has appointed the laboratory as the reference laboratory in the field of waste water and effluent.

The activity of GALAB laboratories has been declared to be in conformity with the requirements of standard EN ISO/IEC 17025. The Accreditation Centre of Germany has also declared the activity of GALAB to be in conformity with the requirements of standard DAC-PL-0114-00-10.

Table 5.2.1 presents the methods of analyses of the laboratories used to analyse the chosen substances.

The substances analysed, limits of detection, limits of quantification and measurement uncertainties of the GALAB laboratory and the respective annual average values of the environment quality standards are presented in Table 5.2.2. The substances analysed, limits of quantification and measurement uncertainties of the EERC laboratories and the respective annual average values of the environment quality standards are presented in Table 5.2.3.

In order to identify one group of substances and substances therein chosen for the project, the limit of quantification used by the laboratory was not low enough to check the quality of water and discover concentrations exceeding the applicable value of environment quality standard. It concerns polybrominated diphenylethers identified by the GALAB laboratories, especially derivatives PBDE-28, PBDE-47, PBDE-99, PBDE-100, PBDE-153, PBDE-154, while their annual average value of the environment quality standard in inland surface waters is 0.0005 µg/l but the limit of quantification of analysis method used by the laboratory was higher – 0.005 µg/l.

Table 5.2.1. Various methods of analyses used by the laboratories of the Estonian Environmental Research Centre and GALAB in different matrixes.

Substance/ Group of substances	Laboratory	Surface water / Effluent	Bottom sediment/ Sewage sludge
Heavy metals except mercury	EERC	Inductively coupled mass spectometry (ICP-MS), EVS EN ISO 17294-2:2004; flame atomic absorption spectrophotometry (FAAS) , ISO 8288	Inductively coupled mass spectometry (ICP-MS), STJ No. M/U 91 (EN ISO 11885)
Heavy metals: mercury	EERC	Cold vapour method, (EVS – EN 1483).	Cold vapour method, (EVS – EN 1483).
Benzene	EERC	Gas chromatography, flame ionisation detector (GC-FID), ISO 11423-2. STJ No. U62B	-
Volatile organic compounds, including chlorobenzenes	EERC	Gas chromatography, electron capture detector (GC-ECD), EVS-EN ISO 10301, STJ No. V75	-
Chlororganic pesticides	EERC	Gas chromatography, electron capture detector (GC-ECD) (EN ISO 6468); STJ No. U63;	Gas chromatography, electron capture detector (GC-ECD) (EN ISO 6468); STJ No. U63;

Substance/ Group of substances	Labora-tory	Surface water / Effluent	Bottom sediment/ Sewage sludge
Cyanide	EERC	Spectrophotometric method (ISO 6703-1), STJ No. V37.	-
Pentachlorophenol	EERC	Liquid chromatography, diode array detector (HPLC-DAD), STJ No. U12A	Liquid chromatography, diode array detector (HPLC-DAD), STJ No. U12A
Phenols	EERC	Liquid chromatography, electrochemical detector (HPLC-ECD), STJ No. U12	Liquid chromatography, electrochemical detector (HPLC-ECD), STJ No. U12
Alkylphenols and their ethoxylates	GALAB	Gas chromatography, mass spectrometric detector (GC-MSD), SOP No. 23, 156.	Gas chromatography, mass spectrometric detector (GC-MSD), SOP No. 23.
Polyaromatic hydrocarbons (PAH)	GALAB	Gas chromatography, mass spectrometric detector (GC-MSD), SOP No. 103.	Gas chromatography, mass spectrometric detector (GC-MSD), DIN 38414 -21
Organotin compounds	GALAB	Gas chromatography (GC-AED), DIN EN ISO 17353. .	Gas chromatography (GC-AED), DIN EN ISO 19744.
Polybrominated biphenyls, diphenylethers and polybrominated organic compounds	GALAB	Gas chromatography, mass spectrometric detector (GC-MSD), SOP No. 42.	Gas chromatography, mass spectrometric detector (GC-MSD), SOP No. 42.
Pesticides	GALAB	Liquid chromatography -mass spectrometry (LC-MS-MS), SOP No. 27 ; Gas chromatography, mass spectrometric detector (GC-MSD) and liquid chromatography -mass spectrometry (LC-MS-MS), SOP No. 117.	-
Pesticides (AMPA)	GALAB	Liquid chromatography -mass spectrometry (LC-MS-MS), SOP 234	Liquid chromatography -mass spectrometry (LC-MS-MS), SOP 233
Phthalates and their ethoxylates	GALAB	Gas chromatography, mass spectrometric detector (GC-MSD), SOP No. 154	Gas chromatography, mass- spectrometric detector (GC-MSD), SOP No. 154
Short- and medium-chain chlorinated paraffins (chloroalkanes) C_{10-13}- chloroalkanes (SCCP) C_{14-17}- chloroalkanes (MCCP	GALAB	Gas chromatography with negative chemical ionisation, mass-spectrometry (GC-MS(NCI)	Gas chromatography with negative chemical ionisation, mass-spectrometry (GC-MS(NCI)
Perfluoro-compounds (PFOA, PFOS)	GALAB	Liquid chromatography - mass spectrometry (LC-MS/MS), SOP No. 229	Liquid chromatography -mass spectrometry (LC-MS/MS)
Sodium tripolyphosphate	GALAB	Ion chromatography conductivity detector, (IC-LFD)	Ion chromatography conductivity detector, (IC-LFD)

Table 5.2.2. The substances analysed, limits of quantification and measurement uncertainties of the GALAB laboratories and the respective annual average values of the environment quality standards

CAS Nr.	Substance/group of substances	Surface water/ effluent LOQ (µg/l)	MU %	Bottom sediment/ Sewage sludge LOQ (µg/kg)	MU %	AA-EQS Inland surfaces waters (µg/l)	AA-EQS Other surface waters (µg/l)
Alkylphenols and their ethoxylates							
104-40-5	4-nonylphenol	0,01	15	0,1	15	0,3	0,3
25154-52-3	Isononylphenol	0,1	15	0,1	15		
27986-36-3	Isononylphenol-monoethoxylate	0,1		0,1			
20427-84-3	Isononylphenol-diethoxylate	0,1		0,1			
-	Isononylphenol-triethoxylate			0,1			
-	Isononylphenol-tetraethoxylate			0,1			
-	Isononylphenol-pentaethoxylate			0,1			
-	Isononylphenol-hexaethoxylate			0,1			
1806-26-4	4-octylphenol	0,01	15	0,01	15		
140-66-9	4-tert-octylphenol	0,01	15	0,01	15	0,1	0,01
9036-19-5	4-t-octylphenol-monoethoxylate	0,01		0,01			
-	4-t-octylphenol-diethoxylate	0,01		0,01			
-	4-t-octylphenol-triethoxylate			0,01			
-	4-t-octylphenol-tetraethoxylate			0,01			
-	4-t-octylphenol-pentaethoxylate			0,01			
-	4-t-octylphenol-hexaethoxylate			0,01			
98-54-4	4-tert-butylphenol	0,01		0,01			
80-46-6	4-tert-pentylphenol	0,01		0,01			
Polyaromatic hydrocarbons							
120-12-7	Anthracene	0,01		0,01		0,1	0,1
50-32-8	Benzo(a)pyrene	0,01	8	0,01	10	0,05	0,05
205-99-2	Benzo(b)fluoranthene	0,01		0,01		Σ 0,03	Σ 0,03
207-08-9	Benzo(k)fluoranthene	0,01		0,01			
191-24-2	Benzo[g,h,i]perylene	0,002	8	0,002	10	Σ 0,002	Σ 0,002
193-39-5	Indeno[1,2,3-cd]pyrene	0,002	8	0,002	10		
91-20-3	Naphthalene	0,01	8	0,01		2,4	1,2
206-44-0	Fluoranthene	0,01	8	0,01	10	0,1	0,1
Organotin compounds							
3664-73-3	Tributyltin	0,0002	15	0,0002	15	0,0002	0,0002
78763-54-9	Monobutyltin	0,001		0,001			
1002-53-5	Dibutyltin	0,001		0,001			
1461-25-2	Tetrabutyltin	0,001		0,001			
-	Monooctyltin	0,001		0,001			
-	Dioctyltin	0,001		0,001			
-	Tricyclohexyltin	0,001		0,001			
-	Monophenyltin	0,001		0,001			
-	Diphenyltin	0,001		0,001			
668-34-8	Triphenyltin	0,001		0,001			
Phthalates							
117-81-7	Di(2-ethylhexyl)phthalate	0,05	15	0,05	15	1,3	1,3
84-74-2	Dibutylphthalate	0,05		0,05			
113-11-3	Dimethylphthalate	0,05		0,05			
84-66-2	Diethylphthalate	0,05		0,05			
120-51-4	Benzylbenzonate	0,05		0,05			
84-69-5	Diisobutylphthalate	0,05		0,05			
117-82-8	Dimetoxyethylphthalate	0,05		0,05			

–	Diisohexylphthalate	0,05		0,05			
605-54-9	Di-2-ethoxyethylphthalate	0,05		0,05			
131-18-0	Dipentylphthalate	0,05		0,05			
85-68-7	Benzylbutylphthalate	0,05		0,05			
–	Hexyl-2-etylhexylphthalate	0,05		0,05			
117-83-9	Dibutoxyethylphthalate	0,05		0,05			
84-61-7	Dicyclohexylphthalate	0,05		0,05			
28553-12-0	Diisononylphthalate	0,05		0,05			
117-84-0	Di-n-octylphalate	0,05		0,05			
26761-40-0	Diisodecylphthalate	1		1			
–	Di-n-hexylphthalate	0,05					
Polybrominated biphenyls, diphenylethers and polybrominated organic compounds							
60348-60-9	Pentabromodiphenylether, PBDE-99	0,005	10	0,005	10	0,0005	0,0002
189084-66-0	Pentabromodiphenylether, PBDE-100	0,005	10	0,005	10	0,0005	0,0002
32536-52-0	Octabromodiphenylether, PBDE-203	0,005		0,005			
79-94-7	3,3',5,5'-tetrabromobisphenol A, TBBPA	0,005		0,005			
59080-37-4	Tetrabromobiphenyl, PBB-52	0,005		0,005			
67888-96-4	Pentabromobiphenyl, PBB-101	0,005		0,005			
59080-40-9	Hexabromobiphenyl, PBB-153						
–	Tribromodiphenylether, PBDE-28	0,005	10	0,005	10	0,0005	0,0002
5436-43-1	Tetrabromodiphenylether, PBDE-47	0,005	10	0,005	10	0,0005	0,0002
182677-30-1	Hexabromodiphenylether, PBDE-138	0,005		0,005			
68631-49-2	Hexabromodiphenylether, PBDE-153	0,02	10	0,02	10	0,0005	0,0002
207122-15-4	Hexabromodiphenylether, PBDE-154	0,005	10	0,005	10	0,0005	0,0002
207122-16-5	Heptabromodiphenylether, PBDE-183	0,02		0,02			
189084-68-2	Heptabromodiphenylether, PBDE-190	0,1		0,1			
1163-19-5	Decabromodiphenylether, PBDE-209	0,1		0,1			
–	The sum of pentabromodiphenylethers	0,05		0,05			
	The sum of octabromodiphenylethers	0,05		0,05			
87-82-1	Hexabromobenzene	0,005		0,005			
25637-99-4	Hexabromocyclodecane	0,2		0,2			
1715-40-8	Bromocyclene	0,005		0,005			
Short- and medium-chain chlorinated paraffins							
85535-84-8	C_{10-13} chloroalkanes (SCCP)	0,3	20	0,3		0,4	0,4
85535-85-9	C_{14-17} chloroalkanes (MCCP)	0,3	20	0,3			
Perfluoro-compounds							
335-67-1	Perfluorooctanoic acid (PFOA)	0,03	10				
1763-23-1	Perfluorooctane sulfonate (PFOS)	0,03	10				
Pesticides							
470-90-6	Chlorfenvinphos	0,01	8			0,1	0,1
15972-60-8	Alachlor	0,01	8			0,3	0,3
1912-24-9	Atrazine	0,01	8			0,6	0,6
34123-59-6	Isoproturon	0,01	8			0,3	0,3
2921-88-2	Chlorpyriphos	0,01	8			0,03	0,03
1582-09-8	Trifluralin	0,01	8			0,03	0,03
122-34-9	Simazine	0,01				1	1
1071-83-6	Glyphosate	10	8				
1066-51-9	AMPA	10	8				
7085-19-0	MCPP	0,5	8				
Other substances							
9010-08-6	Sodium tripolyphosphate	1000	20				

AA-EQS – annual average value of the environmental quality standard
LOQ – limit of quantification (decision limit)
LOD – limit of detection

MU – measurement uncertainty
Σ – sum

Tabel 5.2.3. The substances analysed, limits of detection, limits of quantification and measurement uncertainties of the EERC laboratory and the respective annual average values of the environment quality standards

CAS Nr.	Substance/group of subs-tances	Surface water/ effluent		MU %	Bottom sediment/ Sewage sludge		MU %	AA-EQS Inland surfaces waters	AA-EQS Other surface waters
		LOQ (µg/l)	LOD (µg/l)		LOQ (µg/kg)	LOD (µg/kg)		(µg/l)	(µg/l)
Heavy metals									
7439-92-1	Lead and its compounds	1	0,3	12	2000	1500	28	7,2	7,2
7440-02-0	Nickel and its compounds	1	0,3	12	1000	500	23	20	20
7439-97-6	Mercury and its compounds	0,05	0,02	29	20	10	17	0,05	0,05
7440-43-9	Cadmium and its compounds	0,1	0,007	11	1000	500	38,5	0,2	≤0,08-0,25
7440-66-6	Zinc and its compounds	10	4	9	1000	500	25	5*	10*
7440-47-3	Chromium	0,1	0,05	16	1000	500	17,6	5*	5*
7440-50-8	Copper and its compounds	1	0,2	13	1000	500	16,5	5*	15*
7440-38-2	Arsenic and its compounds	1	0,02	12	2500	1250	42	10*	10*
Phenols									
106-44-5	p- and m-cresol	2	0,4	20	100	50	20		
95-48-7	o-cresol	2	0,4	25	100	50	20		
108-46-3	Resorcin	10			500				
95-87-4	2,5-dimethylresorcin	10			500				
504-15-4	5-methylresorcin	10			500				
108-95-2	Phenol	2			100				
526-75-0	2,3-dimethylphenol	2			100				
87-86-5	Pentachlorophenol	0,4			1				
Volatile organic compounds									
71-43-2	Benzene	0,2	0,05	20	-	-	-	8	10
107-06-2	1,2-dichloroethane	0,1	0,08	45	-	-	-	10	10
75-09-2	Dichloromethane	0,1	0,08	45	-	-	-	20	20
56-23-5	Tetrachloromethane	0,1	0,08	35	-	-	-	12	12
127-18-4	Tetrachloroethylene	0,1	0,08	44	-	-	-	10	10
67-66-3	Chloroform (trichloromethane)	0,1	0,08	35	-	-	-	2,5	2,5
79-01-6	Trichloroethylene	0,1	0,08	29	-	-	-	10	10
118-74-1	Hexachlorobenzene	0,005	0,0037	32	1	0,8	20	0,01	0,01
608-93-5	Pentachlorobenzene	0,005	0,0037	32	1	0,8	23	0,0007	0,007
75-27-4	Dichlorobromomethane	0,1			-				
75-25-2	Bromoform	0,1			-				
Pesticides									
309-00-2	Aldrin	0,005	0,0026	9	1	0,8	25	0,005	0,01
60-57-1	Dieldrin	0,005	0,003	12	1	0,8	25	0,005	0,01
72-20-8	Endrin	0,005	0,003	14	1	0,8	25	0,005	0,01
465-73-6	Isodrin	0,005	0,0022	19	1	0,8	23	0,005	0,01
115-29-7	Endosulfan	0,005	0,0037	10	1	0,8	25	0,0005	0,005
87-68-3	Hexachlorobutadien	0,1	0,08	12	-	-	-	0,1	0,1
319-84-6	alpha-hexachlorocyclohexane	0,003	0,002		1	0,8		0,002	0,02
319-85-7	beta-hexachlorocyclohexane	0,003	0,002		1	0,8		0,002	0,02
58-89-9	gamma-hexachlorocyclohexane	0,003	0,002		1	0,8		0,002	0,02
959-98-8	alpha-endosulfan	0,003	0,002					1	0,8
Other substances									
57-12-5	Cyanide	3	1,6	25	0,5	0,25	25	50*	100*

AA-EQS - annual average value of the environmental quality standard
LOQ - limit of quantification
LOD - limit of detection
MU - measurement uncertainty
*the limit value established in Estonia by 9 September 2010 Regulation of the Minister of the Environment No. 49

6. Screening results

In the evaluation of screening results the values for environmental quality standards as in the Regulation No. 49 of the Minister of the Environment of 9 September 2010 "The environmental quality standards for hazardous substances in surface water, including priority substances and priority hazardous substances and certain other pollutants, methods of application of environmental quality standards for priority substances and priority hazardous substances in surface water" were considered (Annex 2).

The Regulation prescribes the environmental quality standards for the content of 49 hazardous substances in surface waters:

- priority substances and priority hazardous substances and certain other pollutants – 33 hazardous substances the quality standards of which have been transposed from daughter directive 2008/105/EC of the Water Framework Directive;
- 16 hazardous substances or groups of substances to which quality standards have been established in Estonia.

For 33 priority substances, annual averages (AA-EQS) as well as maximum allowable concentration (MAC-EQS) values have been established. The annual average value of the environmental quality standard is the arithmetic mean of the concentrations of substance measured at different times during the year in each representative monitoring point within the water body. The maximum allowable concentration is the concentration of substance measured at any representative monitoring point within the water body.

The results of contents of hazardous substances found in the bottom sediments were compared with the standard values for the bottom sediments calculated in the fact sheets for priority hazardous substances which were used to implement the Water Framework Directive. The fact sheets are available on the web page at http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/thematic_documents/priority_substances/supporting_background/substance_sheets&vm=detailed&sb=Title.

In addition, upon comparing the content of hazardous substances found in waste water and sewage sludge, other limit values established in applicable legislation of Estonia have been used. They are indicated separately in the respective subsections.

6.1. Results of analyses of hazardous substances in water

6.1.1. Surface water – rivers, lakes

Heavy metals

The content of heavy metals in all rivers under the screening and Lake Peipus did not exceed the environmental quality standards established by Regulation No. 49 of 9 September 2010 of the Minister of the Environment.

In the first sampling round, the highest contents of lead – 0.65 µg/l (7.2 µg/l) and nickel – 2.90 µg/l (20 µg/l) were found in the water of the Pühajõgi River, the highest contents of zinc – 6.2 µg/l (10 µg/l) and 5.6 µg/l were found, respectively, in the water of the Vasalemma and the Pärnu Rivers and the highest content of copper – 10.3 µg/l (15 µg/l) and 8,6 µg/l were found in the water of, respectively, the Vasalemma and the Mustajõgi Rivers (Figure 6.1.1.1). The brackets contain the respective annual average value of the environmental quality standard in inland surface waters which were not exceeded. The maximum allowable concentrations have not been established for the contents of these heavy metals.

The contents of chromium exceeded the limit of quantification (0.1 µg/l) in the waters of the Pärnu and Vasalemma Rivers, respectively 0.81 µg/l and 0.57 µg/l. The annual average value of the environmental quality standard for chromium in inland surface waters is 5 µg/l.

The contents of mercury in all water samples taken from the rivers remained below the limit of quantification (0.05 µg/l).

Out of heavy metals nickel concentrations between 0.60 – 0.66 µg/l were found in the water samples taken from Lake Peipus at both monitoring points. However, the contents remained by far below the annual average value of the environmental quality standard of 20 µg/l.

No exceedances of environmental quality standards established for surface waters were discovered in the first sampling round. In the second sampling round heavy metals in river and lake water were not analysed.

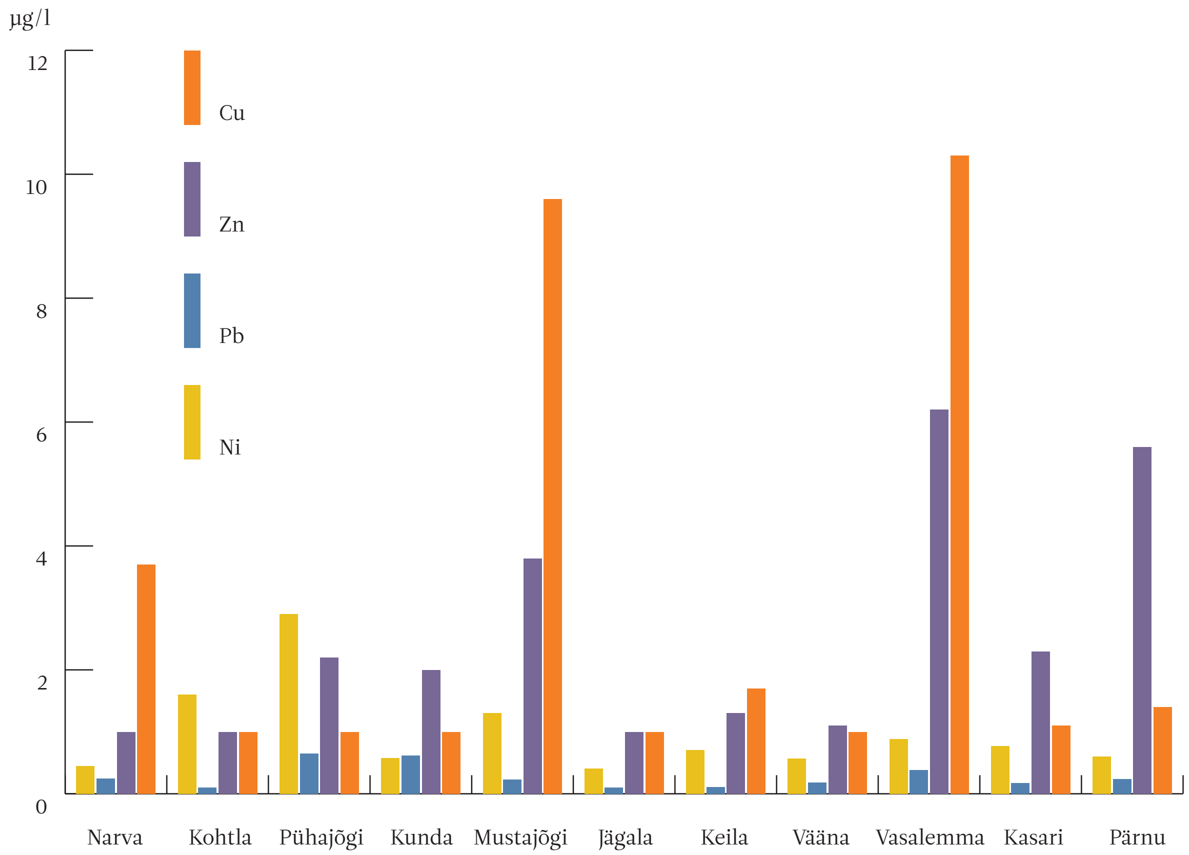

Figure 6.1.1.1. The contents of heavy metals in river water in the first sampling round.

Phenols, alkylphenols andtheir ethoxylates

The contents of all alkylphenols and their ethoxylates in the waters of rivers under the screening did not exceed the annual average values or the maximum allowable concentrations of environmental quality standards for inland surface waters. Two of all alkylphenols have environmental quality standards: 4-n-nonylphenol – annual average 0.3 µg/l and the maximum allowable 2.0 µg/l and 4-tert-octylphenol – annual average 0.1 µg/l.

The contents of monobasic (p-, m-, o-cresol, 3,4-, 3,5-, 2,3-, 2,6-dimethylphenol, phenol) and dibasic (resorcin, 2,5-dimethylresorcin, 5-methylresorcin) phenols were determined only in the second sampling round. Water samples were taken from the Rivers Narva, Kohtla, Keila and Vasalemma. High contents of monobasic phenols were determined in the surface water of all abovementioned rivers – Rivers Kohtla, Vasalemma, Narva and Keila, respectively 11.5 µg/l, 5.2 µg/l, 4.3 µg/l and 2.1 µg/l. The annual average value of the environmental quality standard for monobasic phenols is 1 µg/l. Out of cresols the contents of p- and m-cresols in the Rivers Keila and Narva were high, respectively 2.3 µg/l and 2.1 µg/l. The contents of resorcins in the surface water of screened rivers remained below the limit of quantification and the value of environmental quality standard (10 µg/l) established for dibasic phenols in sum.

Phenols in Lake Peipus were analysed in the water sample taken at state monitoring point No. 17 of Lake Peipus in the second round. The content of monobasic phenols was 6.7 µg/l and it exceeded the respective environmental quality standard for inland surface waters (1 µg/l). The content of p- and m-cresols was also high – 2.4 µg/l.

Polyaromatic hydrocarbons

The contents of polyaromatic hydrocarbons (PAH) in the water of rivers and Lake Peipus were analysed only in the second sampling round. The annual average value of the environmental quality standard for surface water has been not established for the total content of PAH. In regards to PAH substances the limit values established for each substance concentration, for example the annual average values of environmental quality standards for benzo(a)pyren 0.05 µg/l, anthracene 0,1 µg/l, naphtalene 2.4 µg/l (maximum allowable 1.2 µg/l) and fluoranthene 0.1 µg/l, must be followed. For the contents of benzo(b)fluoranthene and benzo(k)fluoranthene, in sum, an annual average value of environmental quality standard of 0.03µg/l and for benzo(g,h,i)perylene and indeno(1,2,3-cd)pyren, in sum, an annual average value of environmental quality standard of 0,002 µg/l has been established.

In all cases the contents of PAHs in surface water remained under the limits of quantification which for anthracene, benzo(a)pyren, naphtalene, fluoranthene, benzo(b)fluoranthene and benzo(k)fluoranthene was 0.01 µg/l and for benzo(g,h,i) perylene and indeno(1,2,3-cd)pyrene 0.002 µg/l.

Organotin compounds

Organotin compounds were analysed in the water of Rivers Narva, Keila, Kasari and lake Peipus. Out of organotin compounds environmental quality standards are established only for tributyltin (TBT) – annual average value 0.0002 µg/l and the maximum allowable concentration 0.0015 µg/l which are both very low values.

Relatively high contents of monobutyltin (MBT) and dibutyltin (DBT) which are degradation compounds of TBT were found in the water of the Rivers Narva, Kasari and Keila, but the content of TBT, however, remained below the limit of quantification (0.0002 µg/l). In the water of the Narva River the content of MBT in the first sampling round was 0.0019 µg/l. In the second round the content of MBT in the Keila River was determined to be 0.0053 µg/l and DBT 0.0015 µg/l, in the Kasari River respectively 0.0054 µg/l and 0.0013 µg/l.

In the water of Lake Peipus the contents of all organotin compounds remained below the limits of quantification which for TBT was 0.0002 µg/l and for others 0.001 µg/l.

Phthalates

Out of phthalates only for di(2-ethylhexyl)phthalate (DEHP) an annual average value of the environmental quality standard in inland surface water, 1.3 µg/l, has been established. The maximum allowable concentration shall not be applied to DEHP.

Most of the contents of the identified phthalates in surface waters remained below the limit of quantification (0.05 µg/l). Only the contents of a few phthalates, like diisobutylphthalate, di(2-ethylhexyl)phthalate and dimethylphthalate, exceeded the limit of quantification but they were not high. The content of diisobutylphthalate in the water of the River Kohtla in the first sampling round was 0.26 µg/l. The content of di(2-ethylhexyl)phthalate in the water of the River Jägala in the first sampling round was 0.28 µg/l and the content of dimethylphthalate in this river was 0.39 µg/l. From the River Vääna 0.1 µg/l of di(2-ethylhexyl) phthalate and 0.16 µg/l of diisobutylphthalate was found. The water of the River Vasalemma in the first sampling round contained 0.24 µg/l of diisobutylphthalate.

In the second sampling round phthalates were only analysed in the water of the Rivers Kohtla and Vasalemma. All contents remained below the limit of quantification.

The phthalate contents in the water of Lake Peipus remained mostly below the limit of quantification. Only the content of dibutylphthalate (0.11µg/l), taken from national sampling point No. 17 of Lake Peipus, exceeded the limit of quantification.

Polybrominated biphenyls, diphenylethers and polybrominated organic compounds

The contents of polybrominatedbiphenyls (PBB), diphenylethers (PBDE) and other polybrominated organic compounds in the water samples of the screened rivers and Lake Peipus remained below the limit of quantification (for most PBB and PBDE compounds 0.005 µg/l).

Since the annual average value of environmental quality standard in inland surface waters for pentabromodiphenylether derivates no. 28, 47, 99, 100, 153 and 154 is 0.0005 µg/l, the limit of quantification of the analysis method used by GALAB laboratories (0.005 µg/l) did not enable to detect the contents lower than this value and to find out the exceedances of environmental quality standards for this substance.

Volatile organic compounds

The contents of volatile organic compounds remained mainly below the limit of quantification. The contents of benzene, trichloromethane (chloroform), dichloromethane and tetrachloroethylene exceeded the limit of quantification in the water of the rivers and Lake Peipus but they did not exceed the established environmental quality standards.

In the first sampling round higher contents of benzene – 19.7 µg/l and 13.3 µg/l (50 µg/l is the maximum allowable concentration in inland surface waters and 10 µg/l is the annual average EQS) were determined in the water of the Rivers Kunda and Pühajõe. The contents of trichloromethane (chloroform) – 0.89 µg/l, 0.84 µg/l and 0.58 µg/l were found respectively in the water of the Rivers Pühajõe, Kasari and Jägala. The annual average value of environmental quality standard for trichloromethane is 2.5 µg/l.

In the second sampling round the sample taken from the water of the River Pühajõe contained 0.28 µg/l of trichloromethane and the sample taken from the water of the River Keila contained 0.35 µg/l of tetrachloroethylene (AA-EQS 10 µg/l).

In the water of Lake Peipus, the limit of quantification for volatile organic compounds was exceeded by the contents of trichloromethane (0.73 µg/l) and dichloromethane (0.35 µg/l) (AA-EQS 20 µg/l) taken in the first sampling round from state sampling point No. 17 and in the second round by the content of trichloromethane (0.34 µg/l). However, the exceedances of the respective environmental quality standards were not established. The contents of volatile organic compounds taken from the other sampling point of Lake Peipus remained all below the limit of quantification.

Short- and medium-chain chlorinated paraffins, perfluoro-compounds, pesticides, cyanide and sodium tripolyphosphate

Short- and medium-chain chlorinated paraffins, perfluoro-compounds, pesticides, cyanide and sodium polyphosphate were only screened in the first sampling round and the contents of all these substances remained below the limits of quantification of analysis methods. Therefore, the environmental quality standards established for some of these substances were not exceeded, for example, AA-EQS 0.4 µg/l and MAC-EQS 1.4 µg/l for short-chained chlorinated paraffins or 0.03 µg/l for the pesticide trifluralin.

Currently, there are no environmental quality standards established for perfluoro-compounds but the new AA-EQS for perfluorooctane sufonate (PFOS) suggested by the respective EC working group is 0.00065 µg/l, which is considerably lower than the limit of quantification (0.03 µg/l) used in the screening of the project.

6.1.2. Surface water – coastal regions

Coastal region of Sillamäe

From the coastal region of Sillamäe heavy metals, alkylphenols and their ethoxylates, polyaromatic hydrocarbons, volatile organic compounds, organotin compounds, phthalates, polybrominated biphenyls, diphenylethers and polybrominated organic compounds, sodium tripolyphosphate, perfluoro-compounds, cyanide and pesticides were determined in the first round. The contents of most compounds remained below the limit of quantification.

Out of heavy metals the content of zinc – 1.3µg/l, nickel – 0.5 µg/l and lead – 0.17 µg/l and out of volatile organic compounds trichloromethane – 0.12 µg/l exceeded the limit of quantification.

In the water samples taken in the second round the content of monobasic phenols and volatile organic compounds were determined. The limit of quantification was exceeded only by the content of trichloromethane – 0.49 µg/l. The content of phenols was 5.8 µg/l. The environmental quality standard established for monobasic phenols is 1 µg/l, which means that the limit value was exceeded.

BLRT Grupp AS (Baltic Ship Repair Company) coastal area

In the water samples taken from the effluents of Baltic Ship Repair Company and Company Baltic Premator and which flow into Tallinn Bay very high contents of organotin compounds were found.

The effluent of dock No. 2 of Baltic Predator Company belonging to BLRT Grupp contained MBT – 614 ng/l; DBT – 7058 ng/l; TBT – 9090 ng/l; monophenyltin – 51 ng/l; diphenyltin – 25 ng/l. The effluent of dock No. 34 contained DBT – 56 ng/l and TBT – 66 ng/l. The effluent from the Baltic Ship Repair Company contained TBT – 2370 ng/l and DBT – 1840 ng/l.

Out of organotin compounds a environmental quality standard in other surface waters has only been established to TBT: annual average 0.0002 µg/l (0.2 ng/l) and the maximum allowable concentration 0.0015 µg/l (1.5 ng/l).

The highest content of TBT of 9090 ng/l found exceeded the maximum allowable concentration by more than 6000 times.

6.1.3. Surface water – agricultural regions

The content of active ingredients of plant protection products – chlorfenvinphos, alachlor, atrazine, isoproturon, chlorpyriphos, trifluralin, simazine, glyphosate, AMPA and MCPP – in the samples taken from the inland water bodies situated in regions of Estonia with intensive agricultural activity were analysed. The contents of all these compounds remained below the limits of quantification.

Also, the contents of chlororganic pesticides (aldrin, dieldrin, endrin, isodrin, hexachlorocyclohexane) which have never been manufactured in Estonia, and the import of which to Estonia was banned in 1968, according to the Regulation of the Council of Ministers of the Estonian SSR of 21 October 1967 [6.1], remained below the limits of quantification. The limits of quantification for all pesticides have been listed in Chapter 5.

Unlike in this screening, the contents of AMPA and glyphosate in water exceeded the limit of quantification in the research ordered by the Ministry of the Environment in 2010 [6.2]. In that research the content of plant protection products in the surface water of regions with intensive agricultural activity was analysed, and the contents of AMPA and glyphosate exceeded the limits of quantification. In the fall, out of all plant protection products, AMPA content exceeded the limit of quantification in the water of four sampling points: Artma Räpu (under the Kabala ditch, code SJA3989000), Lähtru (Kirna Rägina, code SJA1807000), the River Põltsamaa (Kamari bridge, 190 metres downstream from monitoring station SJA9158005) and the River Pärnu (Jändja bridge, code SJA7749000). In samples taken in spring, glyphosate was found in the water of the River Räpu and in fall in the water of the River Räpu and the Rägina ditch. The highest content of plant protection products was found in the water sample taken from the River Räpu in fall and which contained 0.93 µg/l of AMPA. However, the identified contents of AMPA and glyphosate were not high and the future potential environmental quality standard for AMPA would be dozens of times higher than the content found in the water samples.

6.1.4. Effluent – waste water treatment plants

Upon assessment of the pollution of effluents from water treatment plants, in addition to the aforementioned Regulation of the Minister of the Environment, the 31 July 2001 Regulation of the Government of the Republic No. 269 "Requirements for Waste Water Discharged into Water Bodies or into Soil" may be implemented. The Regulation sets out the limit values for the content of hazardous substances in treated waste water which may be discharged into water body or into soil.

Heavy metals

The content of screened heavy metals in the effluents did not exceed the currently applicable limit values set for the content of heavy metals in treated waste waters. The effluents of all waste water treatment plants, in regard to content of heavy metals, was in compliance with the requirements.

However, the contents of some heavy metals were still very high. The contents of heavy metals in the effluents of the following water treatment plants were the highest (in brackets limit values have been indicated).

In the first sampling round, the contents of arsenic 0.9 µg/l (200 µg/l), lead – 6.2 µg/l (500 µg/l), nickel – 9.6 µg/l (1000 µg/l) and zinc – 35 µg/l (2000 µg/l) were the highest in the effluent of the Tallinn waste water treatment plant. The contents of copper – 58 µg/l (2000 µg/l) and chromium – 12.5 µg/l (100 µg/l) were high in the effluent of the Keila Waste Water Treatment Plant (Figure 6.1.3.1).

In the second sampling round, the contents of arsenic – 5.3 µg/l, lead – 1.2 µg/l, nickel – 6.7 µg/l, zinc – 33.9 µg/l and copper – 59.4 µg/l were the highest in the effluent of the Kohtla-Järve Waste Water Treatment Plant, and the content of chromium – 16.3 µg/l in the effluent of the Keila Waste Water Treatment Plant (Figure 6.1.3.2).

The contents of mercury in all effluent samples remained below the limit of quantification (0.05 µg/l).

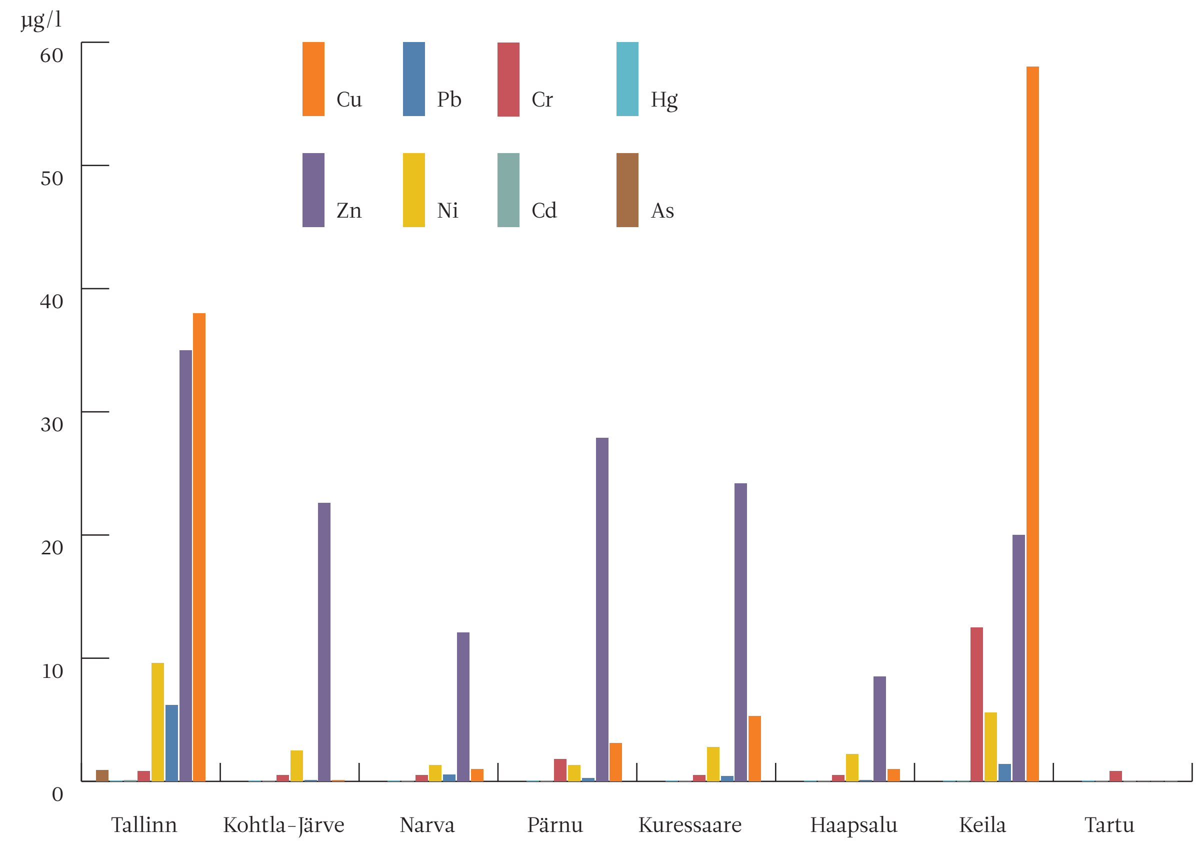

Figure 6.1.3.1. The content of heavy metals in the effluents of waste water treatment plants in the first sampling round.

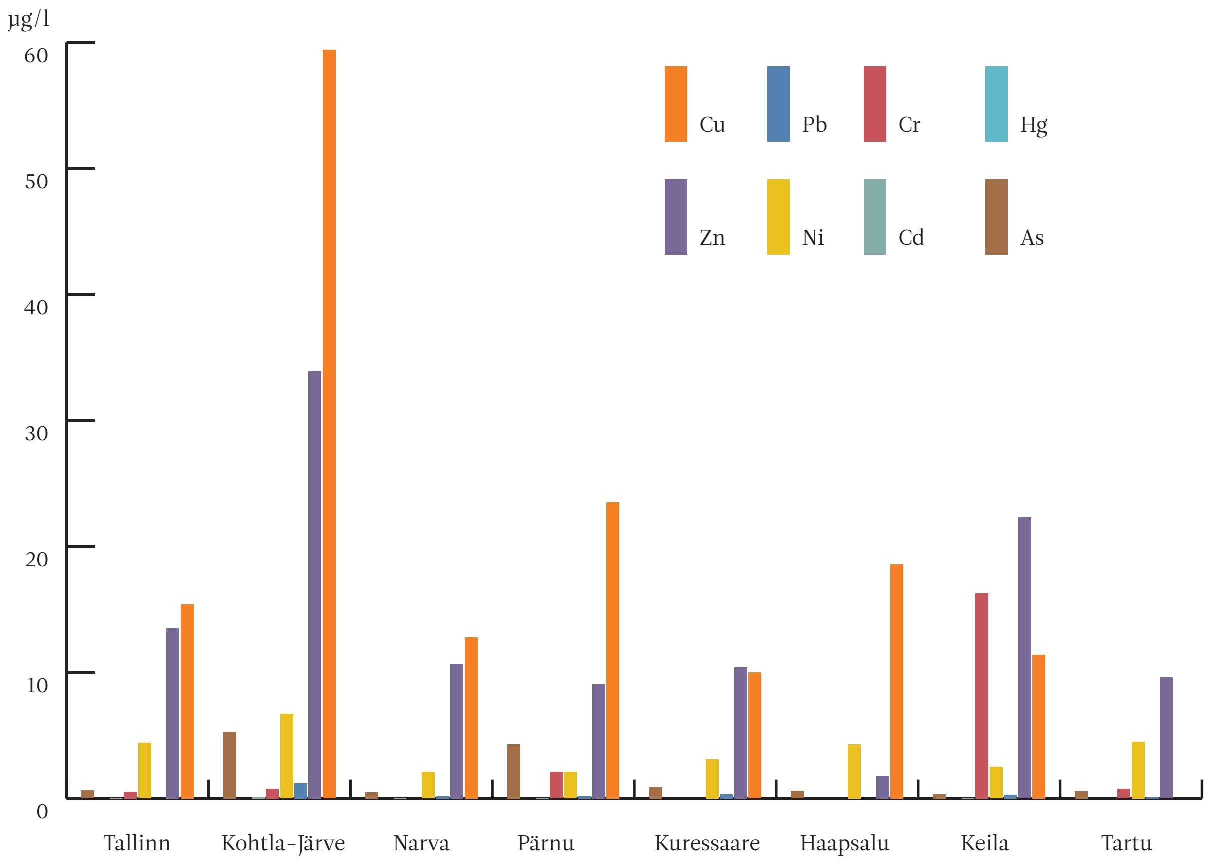

Figure 6.1.3.2. The content of heavy metals in the effluents of waste water treatment plants in the second sampling round.

Phenols, alkylphenols and their ethoxylates

Relatively high contents of monobasic phenols were found in the first sampling round in the effluent of the Kohtla-Järve (12.8 µg/l), Keila (9.3 µg/l), Tallinn (3.3 µg/l) and Narva (2,8 µg/l) waste water treatment plants and in the second sampling round from the effluent of the Kohtla-Järve (9 µg/l) waste water treatment plant. Also, quite high contents of cresols, mainly total p- and m- cresol content, were found in the effluent of the Kohtla-Järve (5 µg/l), Narva (3.6 µg/l), Keila (2.6 µg/l) and Tallinn (2.1 µg/l) waste water treatment plants and in the second sampling round from the effluent of Kohtla-Järve (4.3 µg/l) waste water treatment plant. Still, the values did not exceed the limit value (100 µg/l) established for monobasic phenols in treated waste water.

The content of pentachlorophenol in the treated waste water dicharged into a water body may not exceed 0.2 µg/l, and there were no exceedances of that limit value.

There are no limit values established for the content of alkylphenols and their ethoxylates in treated waste water discharged into a water body. The results could only be compared with the environmental quality standards set for surface waters.

During the screening in the first sampling round (from 21 April to 3 May 2010) very high contents of alkylphenols and their ethoxylates were found in the effluents of some waste water treatment plants, especially from the outlet of the Keila waste water treatment plant.

Table 6.1.3.1. The contents of alkylphenols and their ethoxylates in the effluent of the Keila waste water treatment plant in the first sampling round.

Substance	Content - µg/l
4-t-octylphenolmonoethoxylate	0,52
4-t-octylphenoldiethylethoxylate	0,39
iso-nonylphenolmonoethoxylate	1,42
iso-nonylphenoldiethoxylate	0,86
4-tert-octylphenol	0,03
4-tert-butylphenol	0,07

If these results are compared, for example, to the annual average value of the environmental quality standard for 4-tert-octylphenol in surface water, which in inland surface waters is 0.1 µg/l and in other surface waters 0.01 µg/l, the latter limit value was exceeded by both the content of 4-tert-octylphenol and other alkylphenols.

Also, the effluent of the Kuressaare waste water treatment plant contained quite a lot of alkylphenols and their ethoxylates. For example, in the first sampling round the content of iso-nonylphenolmonoethoxylate in the effluent was 0.46 µg/l and the contents of 4-t-octylphenolmonoethoxylate and 4-tert-octylphenol were 0.056 µg/l and 0.016 µg/l, respectively.

Also, the effluent of the Tallinn waste water treatment plant contained 0.016 µg/l of 4-tert-octylphenol. In the first sampling round 4-tert-butylphenol between 0.044 – 0.063 µg/l was found in the effluents of all screened waste water treatment plants, except Kohtla-Järve, Tartu and Haapsalu.

In the second sampling round no such high contents of alkylphenols and their ethoxylates were found. Only the outlet of the Haapsalu waste water treatment plant contained 0.06 µg/l of 4-tert-butylphenol and 0.03 µg/l of 4-tert-octylphenol and the outlet of the Tartu waste water treatment plant contained 0.022 µg/l of 4-tert-octylphenol.

Polyaromatic hydrocarbons

The contents of polyaromatic hydrocarbons in effluents were analysed only in the first sampling round. The PAH contents in the treated waste water did not exceed the limits of quantification and the total PAH content in effluents did not exceed the limit value of 10 µg/l set for the total content of these substances in treated waste water discharged into water bodies.

Organotin compounds

Since organotin compounds are bioaccumulative and mainly accumulate in sediments/sludge, in the first sampling round they were only determined from the effluents of the Tallinn and Keila waste water treatment plants. From the effluent of the Tallinn waste water treatment plant no organotin compounds exceeding the limit of quantification (TBT – 0.0002 µg/l, others – 0.001 µg/l) were found. From the effluent of the Keila waste water treatment plant 8.3 ng/l monobutyltin was found.

To the content of organotin compounds in treated waste water discharged into water body no limit values have been set. The results could also be compared only to the limit values established for surface water. An environmental quality standard in inland and in other surface waters has only been established for TBT: annual average 0.0002 µg/l (0.2 ng/l) and the maximum allowable 0.0015 µg/l (1.5 ng/l). The both limit values were exceeded by the measured MBT content value.

Phthalates

There were only a few phthalates found in effluents and the content of most of them remained below the limit of quantification (0.05 µg/l). The contents of diisobutylphthalate, di(2-ethylhexyl)phthalate and diisononylphthalate in effluents exceeded the limit of quantification.

In the first sampling round the highest contents of diisobutylphthalate – 0.70 µg/l anddi(2-ethylhexyl)phthalate – 0.22 µg/l were determined in the effluents of the Haapsalu and Keila waste water treatment plants.

In the second sampling round the highest contents of diisobutylphthalate – 0.14 µg/l, di(2-ethyllhexyl)phthalate – 0.32 µg/l and diisononylphthalate – 1.10 µg/l were determined from the effluents of respectively the Narva, Kuressaare and Tartu waste water treatment plants.

No limit values have been set for phthalate content in the treated waste water discharged into water bodies. The results could in this case also only be compared to the limit values established for surface water. An environmental quality standard in inland as well as other surface waters has only been established for DEHP: annual average 1.3 µg/l. The results obtained did not exceed this limit value.

Polybrominated biphenyls, diphenylethers and polybrominated organic compounds

The contents of these substances in the effluents of waste water treatment plants remained below the limit of quantification (for the most PBDE compounds 0.005 µg/l).

Volatile organic compounds

The most of the contents of these substances in the effluents of waste water treatment plants remained below the limit of quantification. The contents of benzene, trichloromethane (chloroform), trichloroethylene and dichloromethane found in effluents exceeded the limits of quantification.

In the first sampling round the highest contents of benzene – 0.41 µg/l, trichloromethane (chloroform) – 1.36 µg/l and trichloroethylene – 0.31 µg/l were found in the effluents of respectively the Pärnu, Narva and Tallinn waste water treatment plants.

In the second sampling round the highest contents of trichloromethane (chloroform) – 1.12 µg/l and trichloroethylene – 0.36 µg/l were found in the effluents of respectively the Narva and Keila waste water treatment plants.

The content of trichloroethylene in the treated waste water discharged into water body may not exceed 100 µg/l, the content of hexachlorobenzene may not exceed 5 µg/l and the content of trichloromethane may not exceed 1000 µg/l. The exceedances of these limit values were not determined.

Short- and medium-chain chlorinated paraffins, perfluoro-compounds, pesticides, cyanide and sodium tripolyphosphate

Short- and medium-chain chlorinated paraffins, perfluoro-compounds, pesticides, cyanide and sodium tripolyphosphate were only determined in the first sampling round, and the contents of these compounds remained below their limits of quantification.

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6.2 Euroopa Parlamendi ja Nõukogu 6. detsembri 2008 direktiivi 2008/105/EÜ nõuete täitmiseks prioriteetsete ainete inventuur ning seirekorralduse analüüs (Koostaja Tamm, I.), MAVES, Tallinn, 2010, Job no. 10028, 24 pp. (http://www.envir.ee/.../Direktiivi+2008_105_EÜ+prioriteetsete+ainete+inventuur.pdf).

6.2. Results of the analyses of hazardous substances in sediment

Pursuant to the Water Framework Directive, the purpose of the hazardous substances monitoring programme is to monitor the content of hazardous substances in the water, biota and sediments of inland surface water bodies. The Member States shall not have to submit a report to EC on the two latter matrixes. This is also one of the reasons why there are still no unique environmental quality standards set for sediments. However, on the fact sheets of priority hazardous substances in CIRCA web-page, compiled in order to implement the Water Framework Directive, the environmental quality standards for these substances have been calculated, which could be used for interpretation of the results.

In addition, Regulation No. 78 of the Minister of the Environment of 30 December 2002 "The Requirements for Using Sewage Sludge in Agriculture, Landscaping and Re-cultivation", which regulates the use of sewage sludge in order to prevent its damaging effect on surface and ground water, soil, plants, animals and people's health, was used. The Regulation establishes limit values for seven heavy metals.

6.2.1. Bottom sediment – rivers, lakes

Heavy metals

The contents of heavy metals were determined in the first sampling round in the bottom sediments of the River Narva and sampling points No. 17 and No. 38 of Lake Peipus and in the second sampling round in the bottom sediments of sampling point No. 17 of Lake Peipus.

In the bottom sediment of the River Narva the content of nickel was found to be 3.91 mg/kg dry matter (DM). For nickel, the PNEC value in sediment was used as a limit value which is 2.94 mg/kg dry matter, and in this case this value has been exceeded. The contents of other heavy metals were the following: Cd < 1; Cu –14.9; Pb – 6.7; Zn – 29; Hg – 0.003; As < 2.5 and Cr – 24.6 (all mg/kg DM).

In the first sampling round the samples taken from the sediments of sampling points No. 17 and No. 38 of Lake Peipus, contained the following contents of heavy metals: Cd – 1.7; Ni – 2.4 ; Zn – 3.3-14.5; Cr – 1.2-3.7 and Cu – 6.3-6.5; all mg/kg DM. In the second sampling round, in the sediment sample taken from sampling point No. 17 of Lake Peipus, the contents of heavy metals were higher than in the first sampling round. The content of nickel at 12.2 mg/kg DM, for example, exceeded the PNEC value established for that heavy metal. In the first sampling round, the contents of lead and cadmium in the sediments of both sampling points did not exceed the limit of quantification (respectively 2 mg/kg DM and 1 mg/kg DM), however, in the second sampling round, in the sediments of sampling point No. 17, 5.5 mg/kg DM of lead and 1.7 mg/kg DM of cadmium was found. The content of zinc was relatively high – 49.1 mg/kg DM. The content of mercury in the sediment was low – 0.05 mg/kg DM, and it was also below the environmental quality standard value of 9.3 mg/kg DM calculated in the fact sheet of the WFD. The content of arsenic in the sediment samples did not exceed the limit of quantification of the applied analysis method at any time.

Phenols, alkylphenols and their ethoxylates

The content of alkylphenols and their ethoxylates were measured in the bottom sediments of the River Narva and sampling points No. 17 and 38 of Lake Peipus in the first sampling round.

In the sediments of the River Narva the contents of all alkylphenols and their ethoxylates remained below the limit of quantification. The only exception was 4-tert-butylphenol, the content of which was 14 µg/kg DM. On the fact sheets of the WFD only for 4-n-nonylphenol (180 µg/kg DM) and 4-tert-octylphenol (34 µg/kg DM) environmental quality standards have been calculated, and these values were not exceeded.

From the sediments of sampling points No. 17 and 38 of Lake Peipus no alkylphenols or their ethoxylates were found to exceed their limits of quantification.

Out of dibasic phenols the highest contents of 2.5-dimethylresorcin were determined in the first sampling round in the sediments of the River Narva and the River Pühajõe – respectively 1.28 mg/kg DM and 1.59 mg/kg DM. The total of p- and m-cresols in the River Mustajõe was 0.14 mg/kg DM.

In second sampling round 7.54 mg/kg DM of 2.5-dimethylresorcin was found from the sediments of the River Keila, and it was also the highest content of phenols established from the bottom sediments of surface water.

The contents of pentachlorophenol in the sediment samples taken from the River Narva and from sampling points No. 17 and 38 of Lake Peipus remained below the limit of quantification (0.1 µg/kg DM). The environmental quality standard of pentachlorophenol in the bottom sediments calculated on the WFD fact sheet is 119 µg/kg DM.

Polyaromatic hydrocarbons

Polyaromatic hydrocarbons were analysed in the sediments of the River Narva and sampling points No. 17 and 38 of Lake Peipus in the first sampling round, and all results remained below the limit of quantification, which, for most of these compounds, was 10 µg/kg DM. Out of PAHs the environmental quality standard for sediment has been calculated for benzo(a) pyrene on the WFD fact sheet and it is 2497 µg/kg DM.

Organotin compounds

The contents of organotin compounds were measured in the bottom sediments of all screened rivers and the two sampling points of Lake Peipus. All results remained below the limits of quantification of used analysis methods, which for TBT was 0.2 µg/kg DM and for all other compounds 1 µg/kg DM. The environmental quality standard calculated for TBT in the bottom sediment is 0.02 µg/kg DM, but since the limit of quantification used by the GALAB laboratories was higher than that, it cannot be said for certain that the results obtained in the screening exceeded the limit value of environmental quality.

Phthalates, polybrominated biphenyls, diphenylethers and polybrominated organic compounds, short- and medium-chain chlorinated paraffins and cyanide

The contents of phthalates, polybrominated biphenyls, diphenylethers and polybrominated organic compounds, short- and medium-chain chlorinated paraffins and cyanide were analysed in the bottom sediments of the River Narva and sampling points No. 17 and 38 of Lake Peipus in the first sampling round. The contents of all these substances remained below the limits of quantification of the used analysis methods. For example, the limit of quantification for phthalates was 50 µg/kg (0.05 mg/kg) DM, for DEPH the environmental quality standard calculated on the WFD fact sheet is 100,000 µg/kg (100 mg/kg) DM.

6.2.2. Bottom sediment – coastal regions

Sillamäe coastal region

In the sediment sample taken from the Sillamäe coastal region in the first sampling round, the content of nickel was 4.91 mg/kg DM. The PNEC value used for nickel on the WFD fact sheet is 2.94 mg/kg DM. In addition, out of heavy metals Pb – 8.8 mg/kg DM, Zn – 57.3 mg/kg DM, Cu – 20 mg/kg DM and As – 9.4 mg/kg DM were found from the sediments. The contents of Hg and Cd remained below the limits of quantification.

Out of dibasic phenols 0.79 mg/kg DM of 2.5-dimethylresourcin was found. The contents of all other phenols, alkylphenols and their ethoxylates remained below the limit of quantification.

The contents of phthalates, polybrominated biphenyls, diphenylethers and polybrominated organic compounds, short- and medium-chained chlorinated paraffins and cyanide remained below the limits of quantification of the used analysis methods.

Coastal region of Baltic Ship Repair Company

The sediment sample was taken from the bottom sediment of Tallinn Bay 50 metres away from the dock No. 2 of Baltic Premator Company, which belongs to BLRT Grupp AS (Baltic Ship Repair Company), during the second sampling round. One sample was taken also from the sewage sludge of outlet of dock No. 2. During the screening only the contents of organotin compounds were determined.

The sediments of the coastal region alongside the dock 2 of Baltic Premator Company contained very high concentrations of organotin compounds.

From the sewage sludge of Baltic Premator Company dock no. 2 outlet the following contents of organotin compounds were found: MBT – 152 µg/kg DM, DBT – 150 µg/kg DM, TBT – 22,500 µg/kg Dm, tetrabutyltin – 27 µg/kg DM, monophenyltin – 59 µg/kg DM, diphenyltin – 34 µg/kg DM and triphenyltin – 15 µg/kg DM.

In the bottom sediment of the coastal waters 50 metres away from the dock No. 2 the following contents of organotin compounds were found: MBT – 45 µg/kg DM, BDT – 322 µg/kg DM, TBT – 4,490 µg/kg DM, tetrabutyltin – 4 µg/kg DM, monophenyltin – 8.6 µg/kg DM, diphenyltin – 4.1 µg/kg DM. The content of organotin compounds in the bottom sediment was lower than in the sewage sludge of the outlet.

Never before in Estonia have organotin compounds been determined in the sediment of the coastal waters in the area alongside the docks of Baltic Ship Repair Company in Tallinn Bay. The results of this screening showed that there are huge amounts of organotin compounds accumulated in the sediment of the harbour. If the results of TBT content were compared with the environmental quality standard in bottom sediments (0.02 µg/kg DM) calculated on the WFD fact sheet, then this value is exceeded by hundreds of thousands of times.

6.2.3. Sewage sludge – waste water treatment plants

Heavy metals

From the sewage sludge of all waste water treatment plants included in the screening, high contents of heavy metals were found.

The content of chromium in the sewage sludge of two waste water treatment plants – in the first sampling round in the Keila WWTP (1155 mg/kg DM) and in the second sampling round in the Keila WWTP (3902 mg/kg DM) and in the Narva WWTP (1221 mg/kg DM) – exceeded, for example, the limit value set for sludge used in agriculture, landscaping and re-cultivation, which is 1000 mg/kg DM.

The following is a list of contents of heavy metals in sewage sludge obtained as a result of this screening, and the brackets contain the waste water treatment plant with the highest content in sewage sludge:

Cr	18,8 – 3902 mg/kg DM (the highest in the Keila WWTP)
Zn	194 – 745 mg/kgDM (the highest in the Pärnu WWTP)
Cu	64,5 – 499 mg/kg DM (the highest in the Kuressaare WWTP)
Ni	8 – 164 mg/kg DM (the highest in the Tartu WWTP)
Pb	10,2 – 39 mg/kg DM (the highest in the Narva WWTP)
As	2,5 – 9,3 mg/kg DM (the highest in the Kohtla-Järve WWTP)
Cd	1,0 – 5,7 mg/kg DM (the highest in the Narva WWTP)
Hg	0,28 – 5,74 mg/kg DM (the highest in the Narva WWTP)

The contents of heavy metals in the sewage sludge of waste water treatment plants obtained in the first and the second sampling round have also been indicated on Figures 6.2.3.1 and 6.2.3.2.

Phenols, alkylphenols and their ethoxylates

From the sewage sludge of most of the waste water treatment plants included in the screening, high contents of alkylphenols and their ethoxylates were found.

In the first sampling round, the sewage sludge of the Tallinn WWTP contained 5.2 mg/kg DM of iso-nonylphenol and 2.59 mg/kg DM of iso-nonylphenolmonoethoxylate, and in the second sampling round 12 mg/kg DM of iso-nonylphenol, 5.14 mg/kg DM of iso-nonylphenolmonoethoxylate and 0.44 mg/kg DM of 4-tert-octylphenol.

In the sewage sludge of the Kohtla-Järve WWTP and the Keila WWTP no high contents of alkylphenols and their ethoxylates were found, however, the concentrations of mono- and dibasic phenols in sludge were very high. The content of phenols in the case of the Kohtla-Järve WWTP was 5.36 mg/kg DM, the content of 2.5-dimethylresorcin was 39.0 mg/kg DM and the total content of p- and m-cresol was 466 mg/kg DM. The sewage sludge of the Keila WWTP contained 19.3 mg/kg DM of phenol and 573 mg/kg DM of 2.5-dimethylresorcin.

In the sludge of waste water treatment plants the highest contents of pentachlorophenol was found in the sewage sludge of the Keila WWTP and the Narva WWTP – respectively 599 µg/kg DM and 449 µg/kg DM.

Polyaromatic hydrocarbons

The contents of polyaromatic hydrocarbons in sewage sludge was determined only in the first sampling round and the highest contents were found from the sewage sludge of the Tallinn WWTP – 1302 µg/kg DM of benzo(g,h,i) perylene, 323 µg/kg DM of indeno(1,2,3-cd)pyrene and 547 µg/kg DM of naphthalene.

Organotin compounds

Very high contents of organotin compounds were found from the sewage sludge of all waste water treatment plants included in the screening.

In the first and the second sampling rounds, the following amounts of organotin compounds were found in sewage sludge (the brackets contain the waste water treatment plant with the highest content in sewage sludge).

	The first sampling round	The second sampling round
MBT	33 – 237 µg/kg DM (Keila)	17 – 98 µg/kg DM (Keila)
DBT	24 –269 µg/kg DM (Haapsalu)	17 – 135 µg/kg DM (Tallinn)
TBT	0.2 –16 µg/kg DM (Tallinn)	0.2 – 31 µg/kg DM (Tallinn)
monooctyltin	3.8 – 110 µg/kg DM (Keila)	8,9 –14 µg/kg DM (Keila)
dioctyltin	11 –56 µg/kg DM (Narva)	11 – 18 µg/kg DM (Keila)

Phthalates

Very high contents of phthalates were found from the sewage sludge of all waste water treatment plants included in the screening.

The content of di(2-ethylhexyl)phthalate was the highest. In the first sampling round it was found in high concentrations, between 22-58 mg/kg DM, in the sewage sludge of all waste water treatment plants, whereby the concentration was the highest in the Haapsalu WWTP. In the second sampling round DEHP between 19-39 mg/kg DM was found.

Out of other phthalates high contents of diisononylphthalate between 10-46 mg/kg DM (the highest content in the Tallinn WWTP) and dibutylphthalate between 0.28-1.2 mg/kg DM (the highest content in the Narva WWTP) were found from sewage sludge.

Polybrominated biphenyls, diphenylethers and polybrominated organic compounds

Polybrominated biphenyls, diphenylethers and polybrominated organic compounds were found from sewage sludge only in spring, in the first sampling round, and out of all results the contents of three compounds exceeded the limit of quantification - PBDE-209; PBDE-138 and 3.3',5.5'-tetrabromobisphenyl A.

The content of PBDE-209 over the limit of quantification (100 µg/kg DM) measured in the sewage sludge of two waste water treatment plants - Pärnu WWTP (850 µg/kg DM) and Haapsalu WWTP (390 µg/kg DM). PBDE-138 exceeded the limit of quantification (5 µg/kg DM) in the sewage sludge of the Tallinn WWTP (130 µg/kg DM). 32 µg/kg DM of 3.3',5.5'-tetrabromobisphenyl A (LOQ - 5 µg/kg DM) was found in the sewage sludge of the Keila WWTP.

Short- and medium-chain chlorinated paraffins

The contents of short- and medium-chain chlorinated paraffins in the sewage sludge of all waste water treatment plants included in the screening did not exceed the limit of quantification of the used analysis methods (300 µg/kg DM), except the content of medium-chain chlorinated paraffins in the Tallinn WWTP which was 606 µg/kg DM.

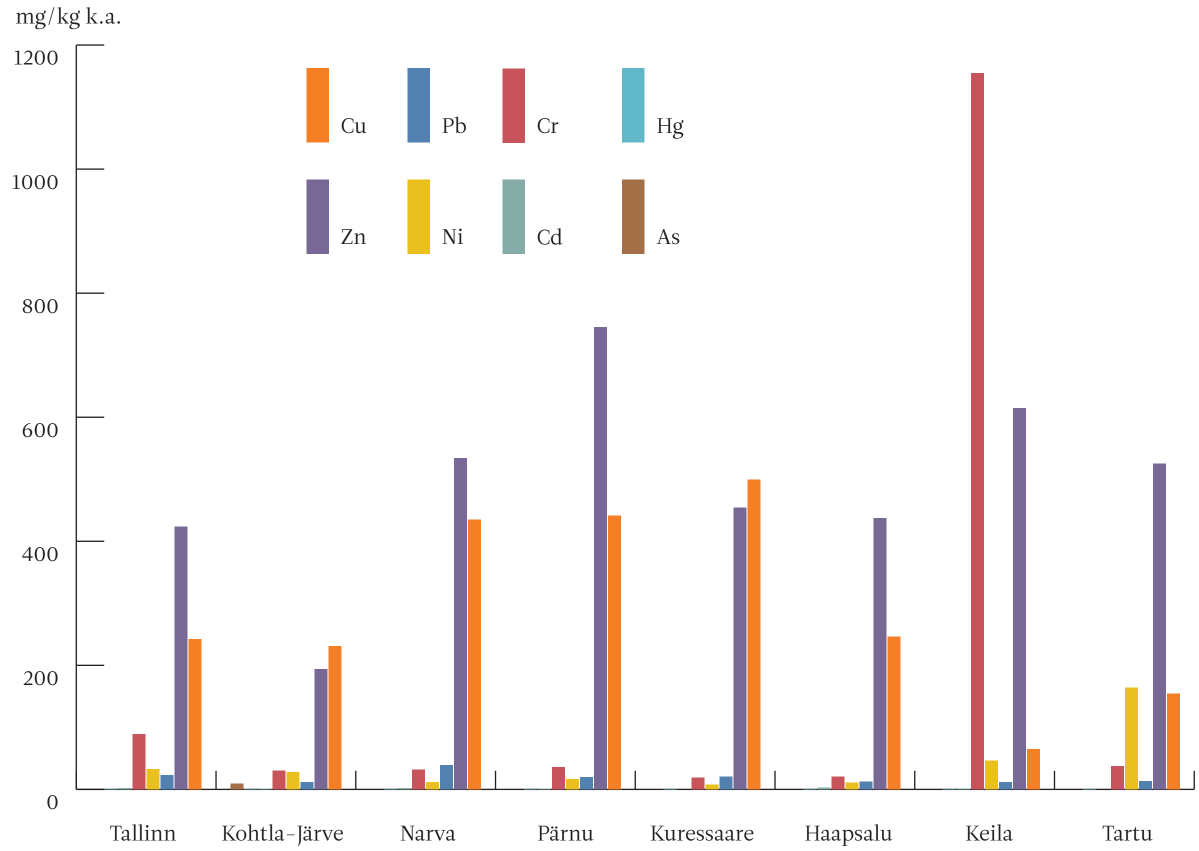

Figure 6.2.3.1. Contents of heavy metals in sewage sludge in the first sampling round

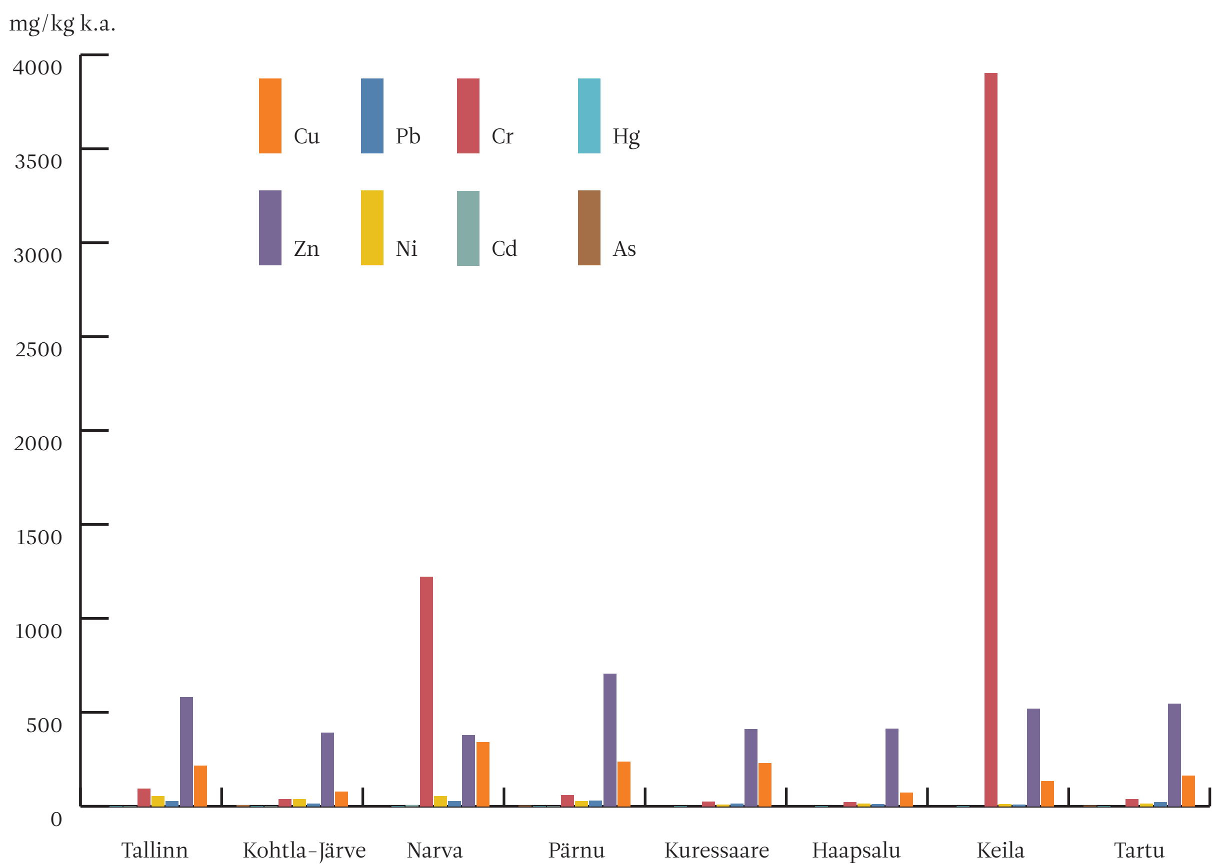

Figure 6.2.3.2. Contents of heavy metals in sewage sludge in the second sampling round

7. Summary and recommendations

The purpose of the screening carried out in the project "Baltic Actions for Reduction of Pollution of the Baltic Sea from Priority Hazardous Substances" (BaltActHaz) was to investigate the content of substances and groups of substances hazardous to the aquatic environment, substances in lists 1 and 2 and priority substances, priority hazardous substances, hazardous substances of HELCOM and other pollutants in Estonian surface waters (water and the bottom sediment of rivers, lakes, coastal regions) and in the effluents and sewage sludge of waste water treatment plants.

The contents of various substances, like alkylphenols and their ethoxylates, organotin compounds, phthalates, polybrominated biphenyls, diphenylethers and polybrominated organic compounds, short- and medium-chain chlorinated paraffins, perfluoro-compounds, some pesticides and sodium tripolyphosphate, had never been determined in Estonia before, as the laboratories have no such capabilities. The respective analyses during this screening were performed in the GALAB laboratories in Germany (GALAB Laboratories GmbH, Geesthacht, Germany).

The substances and groups of substances found from surface waters as well as the outlets of waste water treatment plants in the highest concentrations during the screening, and which turned out to be the most problematic, have been listed below.

Out of new substances, i.e. substances that had never been identified in Estonia before, relatively high amounts of organotin compounds, alkylphenols and their ethoxylates and phthalates were found from various sample matrixes. Sewage sludge was the most polluted by them.

The contents of hazardous substances and their groups determined from the **surface waters (rivers, Lake Peipus) of Estonia** remained below the limits of quantifications of used analysis methods in most cases and did not exceed the applicable environmental quality standards. The contents of only a few phthalates, e.g. diisobutylphthalate, di(2-ethylhexyl)phthalate and dimethylphtalate, exceeded the limit of quantification but they remained below the quality standard. However, high contents of monobasic phenols were determined in the water samples taken from the rivers Kohtla, Vasalemma, Narva and Keila and from state sample point No. 17 of Lake Peipus. Mono- and dibutyltin was found from the rivers Narva, Keila and Kasari. A high content of benzene was measured in the water of rivers Kunda and Pühajõe.

From the **water of coastal regions** high contents of monobasic phenols and organotin compounds were found. In the water samples taken from the Sillamäe coastal region the content of monobasic phenols was high. In the water samples taken from the effluents of Baltic Ship Repair Company (BLRT Grupp) and Company Baltic Prema tor and which flow into Tallinn Bay, extremely high contents of organotin compounds were found, whereby the content of tributyltin exceeded its maximum allowable concentration of 0.0015 µg/l by more than 6,000 times.

The contents of pesticides, measured from **the inland water bodies located on the sites of the most intensive agricultural activity**, remained below the limits of quantification of the used analysis methods.

The contents of hazardous substances and their groups measured from the **bottom sediment of surface waters (rivers, Lake Peipus)** remained below the limits of quantification of the used analysis methods in most cases. However, quite large amounts of heavy metals, like nickel, chromium, zinc and copper were determined in the sediments of the River Narva as well as Lake Peipus, and high contents of 2.5-dimethylresorcin was found in the sediments of the River Keila, the River Narva and the River Pühajõe.

From the **bottom sediments of surface water of coastal regions**, out of heavy metals, the highest contents of nickel, arsenic and zinc were found in the sediment samples taken from the Sillamäe coastal region. In the sediment samples taken from Tallinn Bay, from the coastal region alongside the Baltic Ship Repair Company's territory of docks, extremely high contents of organotin compounds, like tributyltin, dibutyltin, monobutyltin, etc., were found.

Effluent of waste water treatment plants contained large amounts of some heavy metals, monobasic phenols, alkylphenols and their ethoxylates. From the effluents of the Tallinn, Keila and Kohtla-Järve waste water treatment plants high concentrations of arsenic, lead, nickel, chromium, copper and zinc were determined. High contents of monobasic phenols were found in the effluents of the Kohtla-Järve, Keila, Tallinn and Narva waste water treatment plants. The effluent of the Keila waste water treatment plant was highly polluted by alkylphenols and their ethoxylates, like 4-tert-octylphenol, 4-tert-butylphenol, iso-nonylphenolmonoethoxylate, 4-t-octylphenolmonoethoxylate and 4-t-octylphenoldiethylethoxylate. Also, the effluents of the Tallinn and Kuressaare waste water treatment plants contained 4-tert-octylphenol and 4-tert-butylphenol in a considerable amount.

From the **sewage sludge of waste water treatment plants** very high contents of heavy metals, organotin compounds, mono- and dibasic phenols, alkylphenols and their ethoxylates and phthalates were found. The concentration of chromium was very high in the sewage sludge of the Keila and Narva waste water treatment plants. From the sewage sludge of most of the waste water treatment plants included in the screening very high contents of tributyltin, dibutyltin, monobutyltin, monooctyltin and dioctyltin were found. The sewage sludge of the Tallinn waste water treatment plant contained high concentrations of iso-nonylphenol, iso-nonylphenolmonoethoxylate and 4-tert-octylphenol. In the sewage sludge of the Kohtla-Järve and Keila waste water treatment plants, very high contents of mono- and dibasic phenols were determined. Also, the content of pentachlorophenol in the sewage sludge of the Keila and Narva waste water treatment plants was high. Out of phthalates, the content of di(2-ethylhexyl)phthalate was the highest, and high concentrations of it were found from the sewage sludge of all waste water treatment plants. Polybrominated diphenylethers and tetrabromobisphenyl A were found from sewage sludge as well.

Based on the results of the screening it can be said that out of substances hazardous to the aquatic environment investigated in Estonia up until now, the content of heavy metals and mono- and dibasic phenols in our surface waters may still be problematic.

Out of substances that have not been identified in Estonia before, organotin compounds and phthalates were determined in inland surface waters as well as in bottom sediments. However, the contents in surface water found during the screening still remained below the environmental quality standards set for these substances by legislation.

The occurrence of some hazardous substances in surface waters that had never been identified in Estonia needs to be checked in supplementary investigations. If their occurrence in surface waters is validated, then these substances must be added to the monitoring programme.

When it comes to the identification of substances that had never been measured in Estonia before, the results of this screening were new and provide material for planning further investigations and for implementation of measures for the purposes of improving the status of the environment.

In the screening, large amounts of organotin compounds were discovered in the effluents of Baltic Ship Repair Company (BLRT Grupp) and Company Baltic Premator and in sediments of Tallinn Bay, alongside the dock territory of the Baltic Ship Repair Company. Organotin compounds used widely before as additives in the composition of antifouling ship paints. The fact that organotin compounds occur in the effluents and sediments in such amounts probably shows the carelessness of ship repairers in removing old paint from ships. It should be determined whether this is a practice that is no more existing or still going on. Unfortunately, dangerous pollution in the sea exists and still poses a threat to the marine biota. Based on the results of this screening, more thorough research near the docks of the Baltic Ship Repair Company, and in the general area of the port basin, should be carried out and measures should be proposed, if necessary. The participation of the Baltic Ship Repair Company in funding such research and implementing measures should be assumed.

In the screening it became obvious that the treated waste water discharged from the waste water treatment plants still pollutes the surface water as well the coastal waters as, in addition to heavy metals and phenols, it contains large amounts of hazardous substances like alkylphenols and their ethoxylates and phthalates which were previously considered "exotic". There may be several reasons why the treated waste water discharged from waste water treatment plants is still polluted with some hazardous substances – (a) some organic substances cannot be removed during the treatment processes (biodegradation and settling of organic substances), (b) the technological processes and modes of the operation of waste water treatment plants do not enable to degrade or settle even the most common pollutants, the operation of waste water treatment plants is inefficient and equipment is operated carelessly, (c) the outlet of pollutants is so extensive that the treatment of them in these concentrations is even theoretically impossible.

The results of the screening indicate that there is a need for more thorough research in order to determine the sources of pollution and the behaviour of some hazardous pollutants in waste water treatment plants and treatment processes.

Upon using the sewage sludge in agriculture, landscaping and re-cultivation, extra attention must be paid because, in addition to the content of heavy metals previously determined in Estonia and regulated by legislation, it may contain hazardous substances like organotin compounds, alkylphenols and their ethoxylates, phthalates and decabromodiphenylether.

Concerning sewage sludge as a type of waste, the possibility of its re-utilisation, i.e. the possibility to redirect it back to nature or soil, is an important aspect. Currently, this is regulated by a directive dating from 1986 in the European Union and in Estonia by a regulation in compliance with this directive. However, they are both completely outdated and only set out the limit value for the content of seven heavy metals in sewage sludge. There are no limit values for any organic pollutants, for tin out of heavy metals or for any organotin compounds which can be found in certain sewage sludge quite often and in considerable amounts. If only the limit values for these seven metals set out in formal requirements were kept in mind, sewage sludge could be used on the fields or in landscaping in certain conditions. However, the large amounts of other hazardous substances identified in the sewage sludge during the screening should make a farmer extra careful when using sewage sludge.

Abbreviations

AA-EQS	annual average value of environmental quality standard in surface water
AMPA	aminomethyl phosphonic acid, degradation compound of a plant protection product glyphosate
BCF	bioconcentration factor
BLRT	Baltic Ship Repair Company
DBT	dibutyltin
DEHP	di(2-ethylhexyl)phthalate
DM	dry matter
DDT	dichlorodiphenyltrichloroethane
EDC	1.2-dichloroethane
EERC	Estonian Environmental Research Centre
EU	the European Union
ECC	the European Economic Community
EC	the European Community
GPS	satellite-based navigation system
HBCDD	hexabromocyclododecane
HCB	hexachlorobenzene
HCH	hexachlorocyclohexane
HELCOM	the Helsinki Commission
DM	dry matter
K_{ow}	octanol/water partition coefficient
LOD	limit of detection
LOQ	limit of quantification
MAC-EQS	maximum allowable concentration of environmental quality standard in surface water
MBT	monobutyltin

MCCP	medium-chain chlorinated paraffins
MCPA	2-methyl-4-chlorophenoxyacetic acid (plant protection product)
MCPP	mecoprop-p (plant protection product)
MU	measurement uncertainty
PAH	polycyclic aromatic hydrocarbons
PBB	polybrominated biphenyls
PER	perchloroethylene
PCB	polychlorinated biphenyls
PBDE	polbrominated diphenylethers
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PLC	the Baltic Sea Pollution Load Compilation
POS	persistant organic pollutants
BAT	best available techniques
REACH	the European Community Regulation on chemicals and their safe use (EC) No. 1907/2006 of 18 December 2006, concerning Registration, Evaluation, Authorisation and Restriction of Chemical substances
PNEC	Predicted No Effect Concentration of a substance in the environment
WWTP	waste water treatment plant
SCCP	short-chain chlorinated paraffins
SEJ	thermal power station
SOP	standard operating procedure (standard work instructions)
STJ	standard work instructions
TBBPA	3.3',5.5'-tetrabromobisphenol A
TBT	tributyltin
TRI	trichloroethylene
VKG	Viru Keemia Grupp AS
WFD	the European Union Water Framework Directive (2000/60/EC)

Annexes

Annex 1.

Lists 1 and 2 of substances and groups of substances hazardous to the aquatic environment and lists of priority substances, priority hazardous substances and their substance groups.

Regulation No. 32 of 21 July 2010 of the Minister of the Environment

The Regulation is established on the basis of § 265 (7) of the «Water Act».

§ 1. List 1 of hazardous substances and groups of substances

Belonging to list 1 (hereinafter List 1) of hazardous substances and groups of substances:

1) organohalogen compounds and substances, which may form such compounds in the aquatic environment;

2) organophosphorous compounds;

3) organotin compounds;

4) substances which have carcinogenic properties in or via the aquatic environment;

5) mercury and its compounds;

6) cadmium and its compounds;

7) stable mineral oils and hydrocarbons of petroleum origin;

8) stable synthetic substances, which may float on the surface of the water, remain suspended or settle and impede the use of water.

§ 2. List 2 of hazardous substances and groups of substances

Belonging to list 2 (hereinafter List 2) of hazardous substances and groups of substances:

1) those types and groups of substances belonging to List 1, the emission limit values of which have not been identified in the directives listed in Annex IX of the 2000/60/EC of the European Parliament and Council establishing a framework for community action in the field of water policy;

2) the following metalloids, metals and their compounds, which have a harmful impact on the aquatic environment, the extent of distribution of which depends upon the properties and location of the receiving body of water: antimony, arsenic, barium, beryllium, boron, silver, cobalt, chromium, molybdenum, nickel, lead, selenium, thallium, tellurium, tin, titanium, zinc, uranium, vanadium and copper;

3) plant protection products, biocides and their derivatives, which do not belong to List 1;

4) substances which ruin the taste and or smell of products obtained from the aquatic environment for the purposes of human consumption, as well as compounds which may cause the occurrence of such substances in the aquatic environment;

5) toxic or stable silicon organic compounds and substances, which may cause the formation of such compounds in water, except for silicone organic compounds that are biologically harmless or rapidly decay to a harmless state;

6) inorganic phosphorous compounds and the element phosphorus;

7) unstable mineral oils and petroleum origin hydrocarbons;

8) cyanides and fluorides;

9) substances having a negative impact on oxygen content, particularly ammonia and nitrites;

10) monobasic phenols.

§ 3 Lists of priority substances, priority hazardous substances and their substance groups.

No	CASi number[1]	EU number[2]	Name of priority substance[3]	Identified as priority hazardous substance
1	15972-60-8	240-110-8	Alachlor	
2	120-12-7	204-371-1	Anthracene	X
3	1912-24-9	217-617-8	Atrazine	
4	71-43-2	200-753-7	Benzene	
5	not applicable	not applicable	Brominated diphenylethers [4]	X[5]
	32534-81-9	not applicable	Pentabromodiphenylether (derivate numbers 28, 47, 99, 100, 153 and 154)	
6	7440-43-9	321-152-8	Cadmium and its compounds	X
7	85535-84-8	287-476-5	chloroalkanes, C_{10-13}[4]	X
8	470-90-6	207-432-0	Chlorfenvinphos	
9	2921-88-2	220-864-4	Chlorpyrifos (chlorpyrifos ethyl)	
10	107-06-2	203-458-1	1,2-dichlorethane	
11	75-09-2	200-838-9	Dichloromethane	
12	117-81-7	204-211-0	Di(2-ethylhexyl)phthalate (DEHP)	
13	330-54-1	206-354-4	Diuron	
14	115-29-7	204-079-4	Endosulfan	X
15	206-44-0	205-912-4	Fluoranthene [6]	
16	118-74-1	204-273-9	Hexachlorobenzene	X
17	87-68-3	201-765-5	Hexachlorobutadiene	X
18	608-73-1	210-158-9	Hexachlorocyclohexane	X
19	34123-59-6	251-835-4	Isoproturon	
20	7439-92-1	231-100-4	Lead and its compounds	
21	7439-97-6	231-106-7	Mercury and its compounds	X
22	91-20-3	202-049-5	Naphthalene	
23	7440-02-0	231-111-14	Nickel and its compounds	
24	25154-52-3	246-672-0	Nonylphenol	X
	104-40-5	203-199-4	(4-nonylphenol)	
25	1806-26-4	217-302-5	Octylphenols	
	140-66-9	not applicable	(4-tert-octylphenol)	
26	608-93-5	210-172-5	Pentachlorobenzene	X
27	87-86-5	231-152-8	Pentachlorophenol	
28	not applicable	not applicable	Polyaromatic hydrocarbons	X
	50-32-8	200-028-5	(Benzo[a]pyrene)	
	205-99-2	205-911-9	(Benzo[b]fluoranthene)	
	191-24-2	205-883-8	(Benzo[ghi]perylene)	
	207-08-9	205-916-6	Benzo[k]fluoranthene	
	193-39-5	205-893-2	Indeno[1,2,3-cd]pyrene	
29	122-34-9	204-535-2	Simazine	
30	not applicable	not applicable	Tributyltin compounds	
	36643-28-4	not applicable	(Tributyltin-cation)	
31	12002-48-1	234-413-4	Trichlorobenzenes	
32	67-66-3	200-663-8	Trichloromethane (Chloroform)	
33	1582-09-8	216-428-8	Trifluralin	

[1] CAS: Chemical Abstracts Service.
[2] EU number: European Inventory of Existing Commercial Chemical Substances (EINECS) or European List of Notified Chemical Substances (ELINCS).
[3] In the case of a substance group, the typical representative (in brackets and without numbers) of the group is presented in the table as the recommended parameter. In regards to this group of substances the recommended parameters are to be identified via analytical method.
[4] In these substance groups there are typically many individual compounds. Currently not possible to submit corresponding recommended parameters.
5 Only Pentabromodiphenyl ether (CAS No. 32534-81-9).
[6] Fluoranthene is presented in the list as an indicator of other more hazardous polyaromatic hydrocarbons.

Annex 2.

The environmental quality standards for hazardous substances in surface water, including priority substances and priority hazardous substances and certain other pollutants, methods of application of environmental quality standards for priority substances and priority hazardous substances in surface water

Regulation No. 49 of 9 September 2010 of the Minister of the Environment

The Regulation is established on the basis of § 265 (10) of the «Water Act».

§ 1. Environmental quality standards for hazardous substances in surface water

Environmental quality standards for hazardous substances in surface water are as follows:

No	Substance name	CAS number[1]	Environmental quality standard for hazardous substance	
			inland surface waters[2] µg/l	other surface waters µg/l
1	Acrylamide	79-06-1	0,1	0,1
2	Arsenic and its compounds3	7440-38-2	10	10
3	Barium and its compounds[3]	7440-39-3	50	50
4	Dimethylnaphthalene [4]	–	1	1
5	Fluorides4		1,5	1,5
6	Dibasic phenols4	–	10	10
7	Xylenes[2]	–	10	10
8	Petroleum products (C_{10}–C_{40} hydrocarbons)[4]	–	10	10
9	Polychlorinated biphenyls (PCB) [4]	1336-36-3	0,5	0,5
10	Tin and its compounds[3]	7440-31-5	3	1,5
11	Toluene	108-88-3	0,05	0,04
12	Zinc and its compounds[3]	7440-66-6	10	5
13	Cyanides (total)	57-12-5	100	50
14	Copper and its compounds[3]	7440-50-8	15	5
15	Monobasic phenols[4]	–	1	1
16	Chromium[3]	7440-47-3	5	5

Table comments:
[1] CAS: Chemical Abstracts Service.
[2] Inland surface waters are rivers, lakes and artificial water bodies connected to them and strongly altered bodies of water.
[3] The environmental quality standard for metal is the concentration of metal during the solution state, meaning a water sample that was processed through filtering or with another pre-treatment method, if the filter's pore size is 0.45 µm.
[4] The environmental quality standard for a hazardous substances group is the total limit value for the concentration of individual substances in this group, if it is not prescribed otherwise.

§ 2. The environmental quality standards for priority substances and priority hazardous substances and certain other pollutants in surface water.

The environmental quality standards for priority substances and priority hazardous substances and certain other pollutants in surface water are as follows:

No.	Substance name	CAS number[1]	Annual average value[2]		Maximum allowable concentration	
			inland surface waters[3] µg/l	other surface waters µg/l	inland surface waters µg/l	other surface waters µg/l
1	Alachlor	15972-60-8	0,3	0,3	0,7	0,7
2	Anthracene	120-1-7	0,1	0,1	0,4	0,4
3	Atrazine	1912-24-9	0,6	0,6	2	2
4	Benzene	71-43-2	10	8	50	50
5	Brominated diphenylethers[4]	32534-81-9	0,0005	0,0002	N.A.	N.A.
6	Cadmium and its compounds (depending on water hardness class) [5]	7440-43-9	≤0,08 (Class 1) 0,08 (Class 2) 0,09 (Class 3) 0,15 (Class 4) 0,25 (Class 5)	0,2	≤0,45 (Class 1) 0,45 (Class 2) 0,6 (Class 3) 0,9 (Class 4) 1,5 (Class 5)	≤0,45 (Class 1) 0,45 (Class 2) 0,6 (Class 3) 0,9 (Class 4) 1,5 (Class 5)
6a	Carbon-tetrachloride[6]	56-23-5	12	12	N.A.	N.A.
7	C_{10-13} Chloroalkanes	85535-84-8	0,4	0,4	1,4	1,4
8	Chlorfenvinphos	470-90-6	0,1	0,1	0,3	0,3
9	Chlorpyrifos (chlorpyrifos-ethyl)	2921-88-2	0,03	0,03	0,1	0,1
9a	Cyclodiene pesticides: Aldrin[6] Dieldrin[6] Endrin[6] Isodrine[6]	 309-00-2 60-57-1 72-20-8 465-73-6	Σ=0,01	Σ=0,005	N.A.	N.A.
9b	DDT total [6,7]	N.A.	0,025	0,025	N.A.	N.A.
	Para-para-DDT[6]	50-29-3	0,01	0,01	N.A.	N.A.
10	1,2-dichloroethane	107-06-2	10	10	N.A.	N.A.
11	Dichloromethane	75-09-2	20	20	N.A.	N.A.
12	Di(2-ethylhexyl)- phthalate (DEHP)	117-81-7	1,3	1,3	N.A.	N.A.
13	Diuron	330-54-1	0,2	0,2	1,8	1,8
14	Endosulfan	115-29-7	0,005	0,0005	0,01	0,004
15	Fluoranthene	206-44-0	0,1	0,1	1	1
16	Hexachlorobenzene	118-74-1	0,01[8]	0,01[8]	0,05	0,05
17	Hexachlorobutadiene	87-68-3	0,1[8]	0,1[8]	0,6	0,6
18	Heksaklorotsükloheksaan	608-73-1	0,02	0,002	0,04	0,02
18	Hexachlorocyclohexane	608-73-1	0,02	0,002	0,04	0,02
19	Isoproturon	34123-59-6	0,3	0,3	1	1
20	Lead and its compounds	7439-92-1	7,2	7,2	N.A.	N.A.
21	Mercury and its compounds	7439-97-6	0,05[8]	0,05[8]	0,07	0,07
22	Naphthalene	91-20-3	2,4	1,2	N.A.	N.A.
23	Nickel and its compounds	7440-02-0	20	20	N.A.	N.A.
24	Nonylphenol (4-Nonylphenol)	104-40-5	0,3	0,3	2	2
25	Octylphenol (4-tert-Octylphenol)	140-66-9	0,1	0,01	N.A.	N.A.
26	Pentachlorobenzene	608-93-5	0,007	0,0007	N.A.	N.A.
27	Pentachlorophenol	87-86-5	0,4	0,4	1	1

No.	Substance name	CAS number[1]	Annual average value[2]		Maximum allowable concentration	
			inland surface waters[3] µg/l	other surface waters µg/l	inland surface waters µg/l	other surface waters µg/l
28	Polyaromatic hydrocarbons (PAH)10[10]	N.A.	N.A.	N.A.	N.A.	N.A.
	(Benzo[a]pyrene)	50-32-8	0,05	0,05	0,1	0,1
	Benzo[b]fluoranthene	205-99-2	Σ=0,03	Σ=0,03	N.A.	N.A.
	Benzo[k]fluoranthene	207-08-9				
	Benzo[ghi]perylene	191-24-2	Σ=0,002	Σ=0,002	N.A.	N.A.
	Indeno[1,2,3-cd]pyrene	193-39-5				
29	Simazine	122-34-9	1	1	4	4
29a	Tetrachloroethylene[6]	127-18-4	10	10	N.A.	N.A.
29b	Trichloroethylene[6]	79-01-6	10	10	N.A.	N.A.
30	Tributyltin compounds (Tributyltin-cation)	36643-28-4	0,0002	0,0002	0,0015	0,0015
31	Trichlorobenzene	12002-48-1	0,4	0,4	N.A.	N.A.
32	Trichloromethane	67-66-3	2,5	2,5	N.A.	N.A.
33	Trifluralin	1582-09-8	0,03	0,03	N.A.	N.A.

Table comments:
N.A. - Not Applicable
[1] CAS: Chemical Abstracts Service.
[2] If is not prescribed otherwise, this standard is applied in regards to the total concentration of all isomers.
[3] Inland surface waters are rivers, lakes and artificial water bodies connected to them and strongly altered bodies of water.
[4] European Parliament and Council Decision No. 2455/2001/EC, establishing the list of priority substances in the field of water policy and amending Directive 2000/60/EC, standards only established for derivatives number 28, 47, 99, 100, 153 and 154 of priority substances belonging to the listed group of brominated diphenylethers.
[5] Environmental standards for cadmium and its compounds are dependent upon the hardness of water. Calcium carbonate content in water corresponds to water hardness classes as follows: 1. class: 40 mg CaCO3/l; Class 2: 40 to 50 mg CaCO3/l; Class 3: 50 to 100 mg CaCO3/l; Class 4: 100 to 200 mg CaCO3/l; Class 5: ≥200 mg CaCO3/l.
[6] Is not a priority substance, but belongs among other pollutants, the environmental standards for which are identical to those which were prescribed in EU legislation, which were applied prior to 13 January 2009 (82/176/EMC, 83/513/EMC, 84/156/EMC, 84/491/EMC and 86/280/EMC).
[7] The overall concentration of DDT is the sum of isomers 1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane (CAS number 50-29-3; EL number 200-024-3), 1,1,1-Trichloro-2-(2-chlorophenyl)-2-(4-chlorophenyl)ethane (CAS number 789-02-6; EL number 212-332-5), 1,1-Dichloro-2,2-bis(4-chlorophenyl) ethene (CAS number 72-55-9; EL number 200-784-6) and 1,1-Dichloro-2,2-bis(4-chlorophenyl)ethane (CAS number 72-54-8; EL number 200-783-0).
[8] If instead of environmental quality standard for the substance in water the environmental quality standard for aquatic biota has been established,, the latter standard shall be adhered to.
[9] Regarding priority substance group belonging to polycyclic aromatic hydrocarbons (PAH), the established concentration limits for each single substance must be adhered to, i.e., the environmental standard for benzo(a)pyrene, and the environmental standard for sum of the benzo(b)fluoranthene and benzo(k)fluoranthene, as well as the environmental standard for sum of the of benzo(ghi)perylene and indeno(1,2,3-cd)pyrene.

§ 3. The methods of application of environmental quality standards for priority substances and priority hazardous substances in surface water.

(1) The annual average value of the environmental quality standard for priority substances and priority hazardous substances means the arithmetic mean of the concentrations of substance measured at different times during the year in each representative monitoring point within the water body.
(2) The maximum allowable concentration for priority substances and priority hazardous substances means the concentration of substance measured at any representative monitoring point within the water body.
(3) When assessing conformity of monitoring results with the maximum allowable concentrations, the statistical method may be used to ensure reliability and precision.
(4) The environmental quality standards prescribed in this regulation are identified as the total concentration within the total volume of a water sample, except in the case of cadmium, lead, mercury and nickel (hereinafter Metals). The concentration of Metals is identified during the Metal's solution state in a filtered water sample, in which the filter's pore size is 0.45 µm, or a water sample processed using an equivalent pre-treatment method.
(5) When assessing the conformity of monitoring results with environmental quality standards, the following may be taken into account:

1) natural background concentrations, if these are high and hinder the achievement of compliance of the concentration of metals and their compounds with the environmental quality standard;
2) hardness of water, pH level and other water quality indicators, which affect the metabolism of metals in biota.

(6) The arithmetic mean named in subsection 1 of this section is calculated and the environmental quality standard established within this regulation is applied in accordance with the requirements for performing water studies established on the basis of the Water Act.

Annex 3. Chemical analysis results for surface and waste water: Rivers

Substance/ Group of Substances	CAS no	Annual avrg value of the EQS in inland surface waters	Max. allowable concentr. of EQS in inland surf. waters	River Narva monitoring station no. 32		River Kohtla, flowing into River Purtse		River Pühajõgi monitoring station no. 33 (in the mouth)		River Kunda monito-ring
				I	II	I	II	I	II	I
		µg/l								
Heavy metals										
Lead and its compounds	7439-92-1	7,2	N.A.	0,25	-	< 0,1	-	0,65	-	0,62
Nickel and its compounds	7440-02-0	20	N.A.	0,45	-	1,6	-	2,9	-	0,58
Mercury and its compounds	7439-97-6	0,05	0,07	< 0,05	-	< 0,05	-	< 0,05	-	< 0,05
Cadmium and its compounds	7440-43-9	<0,25	<1,5	< 0,02	-	< 0,02	-	< 0,02	-	<0,02
Zink and its compounds	7440-66-6	10		< 1	-	< 1	-	2,2	-	2
Chromium	7440-47-3	5		< 0,5	-	< 0,5	-	< 0,5	-	< 0,5
Copper and its compounds	7440-50-8	15		3,7	-	< 1	-	< 1	-	< 1
Phenols, alkylphenols and their ethoxylates										
4-t- octylphenol-monoethoxylate	9036-19-5			<0,01	-	<0,01	<0,01	<0,01	-	<0,01
4-t- octylphenol-diethoxylate	-			<0,01	-	<0,01	<0,01	<0,01	-	<0,01
Isononylphenol-monoethoxylate	27986-36-5			<0,1	-	<0,1	<0,1	<0,1	-	<0,1
Isononylphenol-diethoxylate	-			<0,1	-	<0,1	<0,1	<0,1	-	<0,1
4-octylphenol	1806-26-4			<0,01	-	<0,01	<0,01	<0,01	-	<0,01
4-tert-octylphenol	140-66-9	0,1	N.A.	<0,01	-	<0,01	<0,01	<0,01	-	<0,01
4-nonylphenol	104-40-5	0,3	2	<0,01	-	<0,01	<0,01	<0,01	-	<0,01
Isononylphenol	25154-52-3			<0,1	-	<0,1	<0,1	<0,1	-	<0,1
4-tert-butylphenol	98-54-4			<0,01	-	<0,01	<0,01	<0,01	-	<0,01
4-tert-pentylphenol	80-46-6			<0,01	-	<0,01	<0,01	<0,01	-	<0,01
Pentachlorophenol	87-86-5	0,4	1	< 0,4	-	< 0,4	-	< 0,4	-	< 0,4
2,3-dimethylphenol	526-75-0			-	<2	-	<2	-	-	-
2,6-dimethylphenol	576-26-1			-	<2	-	<2	-	-	-
3,4-dimethylphenol	95-65-8			-	<2	-	<2	-	-	-
3,5-dimethylphenol	108-68-9			-	<2	-	<2	-	-	-
Phenol	108-95-2			-	4,3	-	11,5	-	-	-
o-cresol	95-48-7			-	<2	-	<2	-	-	-
p- and m-cresol (the sum)	106-44-5, 108-39-4			-	2,1	-	<2	-	-	-
Resorcin	108-46-3			-	<10	-	<10	-	-	-
2,5-dimethylresorcin	95-87-4			-	<10	-	<10	-	-	-
5-methylresorcin	504-15-4			-	<10	-	<10	-	-	-
Polyaromatic hydrocarbons										
Anthracene	120-12-7			<0,01	-	<0,01	-	<0,01	-	<0,01
Benzo(a)pyrene	50-32-8	0,05	0,1	<0,01	-	<0,01	-	<0,01	-	<0,01
Benzo(b)fluoranthene	205-99-2	Σ=0,03	N.A.	<0,01	-	<0,01	-	<0,01	-	<0,01
Benzo(k)fluoranthene	207-08-9			<0,01	-	<0,01	-	<0,01	-	<0,01
Fluoranthene	206-44-0	0,1	1	<0,01	-	<0,01	-	<0,01	-	<0,01
Benzo[g,h,i]perylene	191-24-2			<0,002	-	<0,002	-	<0,002	-	<0,002
Indeno[1,2,3-cd]pyrene	193-39-5			<0,002	-	<0,002	-	<0,002	-	<0,002

station no. 36 (in the mouth)	River Mustajõ-gi monitoring station no. 60		River Jägala monit. station no. 42 (in mouth, in Linnamäe)		River Keila monitoring station no. 47		River Vääna monitoring station no. 45 (in the mouth)		River Vasalem-ma (the mouth of the river)		River Kasari monitoring station no. 49		River Pärnu monitoring station no. 52	
II	I	II	I	II	I	II	I	II	I	II	I	II	I	II
µg/l														
–	0,23	–	< 0,1	–	0,11	–	0,18	–	0,38	–	0,17	–	0,24	–
–	1,3	–	0,41	–	0,71	–	0,57	–	0,88	–	0,77	–	0,60	–
–	< 0,05	–	< 0,05	–	< 0,05	–	< 0,05	–	< 0,05	–	<0,05	–	< 0,05	–
–	0,04	–	<0,02	–	<0,02	–	< 0,02	–	< 0,02	–	<0,02	–	< 0,02	–
–	3,8	–	< 1	–	1,3	–	1,1	–	6,2	–	2,3	–	5,6	–
–	< 0,5	–	< 0,5	–	< 0,5	–	< 0,5	–	0,57	–	0,81	–	< 0,5	–
–	9,6	–	< 1	–	1,7	–	< 1	–	10,3	–	1,1	–	1,4	–
–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–
–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–
–	<0,1	–	<0,1	–	<0,1	–	<0,1	–	<0,1	–	<0,1	–	<0,1	–
–	<0,1	–	<0,1	–	<0,1	–	<0,1	–	<0,1	–	<0,1	–	<0,1	–
–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–
–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–
–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–
–	<0,1	–	<0,1	–	<0,1	–	<0,1	–	<0,1	–	<0,1	–	<0,1	–
–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–
–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–
–	< 0,4	–	< 0,4	–	< 0,4	–	< 0,4	–	< 0,4	–	< 0,4	–	< 0,4	–
–	–	–	–	–	–	<2	–	–	–	<2	–	–	–	–
–	–	–	–	–	–	<2	–	–	–	<2	–	–	–	–
–	–	–	–	–	–	<2	–	–	–	<2	–	–	–	–
–	–	–	–	–	–	<2	–	–	–	<2	–	–	–	–
–	–	–	–	–	–	2,1	–	–	–	5,2	–	–	–	–
–	–	–	–	–	–	<2	–	–	–	<2	–	–	–	–
–	–	–	–	–	–	2,3	–	–	–	<2	–	–	–	–
–	–	–	–	–	–	<10	–	–	–	<10	–	–	–	–
–	–	–	–	–	–	<10	–	–	–	<10	–	–	–	–
–	–	–	–	–	–	<10	–	–	–	<10	–	–	–	–
–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–
–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–
–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–
–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–
–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–
–	<0,002	–	<0,002	–	–	–	<0,002	–	<0,002	–	<0,002	–	<0,002	–
–	<0,002	–	<0,002	–	–	–	<0,002	–	<0,002	–	<0,002	–	<0,002	–
–	<0,002	–	<0,002	–	<0,002	–	<0,002	–	<0,002	–	<0,002	–	<0,002	–

Substance/ Group of Substances	CAS no	Annual avrg value of the EQS in inland surface waters	Max. allowable concentr. of EQS in inland surf. waters	River Narva monitoring station no. 32		River Kohtla, flowing into River Purtse		River Pühajõgi monitoring station no. 33 (in the mouth)		River Kunda monito-ring
				I	II	I	II	I	II	I
		µg/l								
Benzo[g,h,i]perylene/Indeno[1,2,3-cd]pyrene (the sum)	–	Σ=0,002	N.A.	<0,002	–	<0,002	–	<0,002	–	<0,002
Naphtalene	91-20-3	2,4	N.A.	<0,01	–	<0,01	–	<0,01	–	<0,01
Volatile organic compounds										
Benzene	71-43-2	10	50	< 0,2	–	< 0,2	–	13,3	<0,2	19,7
1,2-dichloroethane	107-06-2	10	N.A.	< 0,1	–	< 0,1	<0,1	< 0,1	<0,1	< 0,1
Dichloromethane	75-09-2	20	N.A.	–	–	–	<0,1	–	<0,1	–
Tetrachloromethane (carbon tetrachloride)	56-23-5	12	N.A.	< 0,1	–	< 0,1	<0,1	< 0,1	<0,1	< 0,1
Tetrachloroethylene	127-18-4	10	N.A.	< 0,1	–	< 0,1	<0,1	< 0,1	<0,1	< 0,1
Chloroform (trichloromethane)	67-66-3	2,5	N.A.	< 0,1	–	< 0,1	<0,1	0,89	0,28	0,12
Trichloroethylene	79-01-6	10	N.A.	< 0,1	–	< 0,1	<0,1	< 0,1	<0,1	< 0,1
Bromoform	75-25-2			–	–	–	0,22	–	0,16	–
Dichlorobromomethane	75-27-4			–	–	–	<0,1	–	<0,1	–
Chlorobenzenes										
Hexachlorobenzene	118-74-1	0,01	0,05	<0,005	–	<0,005	–	<0,005	–	<0,005
Organotin compounds										
Monobutyltin	78763-54-9			0,0019	<0,001	–	–	–	–	–
Dibutyltin	1002-53-5			<0,001	<0,001	–	–	–	–	–
Tributyltin	688-73-3	0,0002	0,0015	<0,0002	<0,0002	–	–	–	–	–
Tetrabutyltin	1461-25-2			<0,001	<0,001	–	–	–	–	–
Monooctyltin				<0,001	<0,001	–	–	–	–	–
Dioctyltin	94410-05-6			<0,001	<0,001	–	–	–	–	–
Tricyclohexyltin	6056-50-4			<0,001	<0,001	–	–	–	–	–
Monophenyltin	2406-68-0			<0,001	<0,001	–	–	–	–	–
Diphenyltin	6381-06-2			<0,001	<0,001	–	–	–	–	–
Triphenyltin	668-34-8			<0,001	<0,001	–	–	–	–	–
Phthalates										
Dimethylphthalate	113-11-3			<0,05	–	<0,05	<0,05	<0,05	–	<0,05
Diethylphthalate	84-66-2			<0,05	–	<0,05	<0,05	<0,05	–	<0,05
Benzylbenzonate	120-51-4			<0,05	–	<0,05	<0,05	<0,05	–	<0,05
Diisobutylphthalate	84-69-5			<0,05	–	0,26	<0,05	<0,05	–	0,093
Dibutylphthalate - DBP	84-74-2			<0,05	–	<0,05	<0,05	<0,05	–	<0,05
Dimethylethylphthalate	117-82-8			<0,05	–	<0,05	<0,05	<0,05	–	<0,05
Diisohexylphthalate	–			<0,05	–	<0,05	<0,05	<0,05	–	<0,05
Di-2-ethoxyethylphthalate	605-54-9			<0,05	–	<0,05	<0,05	<0,05	–	<0,05
Dipentylphthalate	131-18-0			<0,05	–	<0,05	<0,05	<0,05	–	<0,05
Di-n-hexylphthalate	84-75-3			<0,05	–	<0,05	<0,05	<0,05	–	<0,05
Benzylbutylphthalate	85-68-7			<0,05	–	<0,05	<0,05	<0,05	–	<0,05
Hexyl-2-etylhexylphthalate	–			<0,05	–	<0,05	<0,05	<0,05	–	<0,05
Dibutoxyethylphthalate	117-83-9			<0,05	–	<0,05	<0,05	<0,05	–	<0,05
Dicyclohexylphthalate	84-61-7			<0,05	–	<0,05	<0,05	<0,05	–	<0,05

station no. 36 (in the mouth)	River Mustajõ-gi monitoring station no. 60		River Jägala monit. station no. 42 (in mouth, in Linnamäe)		River Keila monitoring station no. 47		River Vääna monitoring station no. 45 (in the mouth)		River Vasalem-ma (the mouth of the river)		River Kasari monitoring station no. 49		River Pärnu monitoring station no. 52	
II	I	II	I	II	I	II	I	II	I	II	I	II	I	II
µg/l														
–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–
–	0,76	–	<0,2	–	<0,2	–	< 0,2	–	< 0,2	–	<0,2	–	<0,2	–
–	< 0,1	–	< 0,1	–	< 0,1	<0,1	< 0,1	–	< 0,1	<0,1	< 0,1	< 0,1	< 0,1	–
–	–	–	–	–	–	<0,1	–	–	–	<0,1	< 0,1	< 0,1	< 0,1	–
–	< 0,1	–	< 0,1	–	< 0,1	<0,1	< 0,1	–	< 0,1	<0,1	< 0,1	< 0,1	< 0,1	–
–	< 0,1	–	< 0,1	–	< 0,1	0,35	< 0,1	–	< 0,1	<0,1	< 0,1	< 0,1	< 0,1	–
–	< 0,1	–	0,58	–	< 0,1	<0,1	< 0,1	–	0,1	<0,1	0,12	<0,1	0,84	–
–	< 0,1	–	< 0,1	–	< 0,1	<0,1	< 0,1	–	< 0,1	<0,1	< 0,1	–	< 0,1	–
–	–	–	–	–	–	<0,1	–	–	–	<0,1	–	<0,1	–	–
–	–	–	–	–	–	<0,1	–	–	–	<0,1	–	<0,1	–	–
–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
–	–	–	–	–	–	0,0053	–	–	–	–	–	0,0054	–	–
–	–	–	–	–	–	0,0015	–	–	–	–	–	0,0013	–	–
–	–	–	–	–	–	<0,0002	–	–	–	–	–	<0,0002	–	–
–	–	–	–	–	–	<0,001	–	–	–	–	–	<0,001	–	–
–	–	–	–	–	–	<0,001	–	–	–	–	–	<0,001	–	–
–	–	–	–	–	–	<0,001	–	–	–	–	–	<0,001	–	–
–	–	–	–	–	–	<0,001	–	–	–	–	–	<0,001	–	–
–	–	–	–	–	–	<0,001	–	–	–	–	–	<0,001	–	–
–	–	–	–	–	–	<0,001	–	–	–	–	–	<0,001	–	–
–	–	–	–	–	–	<0,001	–	–	–	–	–	<0,001	–	–
–	<0,05	–	0,39	–	<0,05	–	<0,05	–	<0,05	<0,05	<0,05	–	<0,05	–
–	<0,05	–	<0,05	–	<0,05	–	<0,05	–	<0,05	<0,05	<0,05	–	<0,05	–
–	<0,05	–	<0,05	–	<0,05	–	<0,05	–	<0,05	<0,05	<0,05	–	<0,05	–
–	<0,05	–	<0,05	–	<0,05	–	0,16	–	0,24	<0,05	0,21	–	0,17	–
–	<0,05	–	<0,05	–	<0,05	–	<0,05	–	<0,05	<0,05	<0,05	–	<0,05	–
–	<0,05	–	<0,05	–	<0,05	–	<0,05	–	<0,05	<0,05	<0,05	–	<0,05	–
–	<0,05	–	<0,05	–	<0,05	–	<0,05	–	<0,05	<0,05	<0,05	–	<0,05	–
–	<0,05	–	<0,05	–	<0,05	–	<0,05	–	<0,05	<0,05	<0,05	–	<0,05	–
–	<0,05	–	<0,05	–	<0,05	–	<0,05	–	<0,05	<0,05	<0,05	–	<0,05	–
–	<0,05	–	<0,05	–	<0,05	–	<0,05	–	<0,05	<0,05	<0,05	–	<0,05	–
–	<0,05	–	<0,05	–	<0,05	–	<0,05	–	<0,05	<0,05	<0,05	–	<0,05	–
–	<0,05	–	<0,05	–	<0,05	–	<0,05	–	<0,05	<0,05	<0,05	–	<0,05	–
–	<0,05	–	<0,05	–	<0,05	–	<0,05	–	<0,05	<0,05	<0,05	–	<0,05	–
–	<0,05	–	<0,05	–	<0,05	–	<0,05	–	<0,05	<0,05	<0,05	–	<0,05	–
–	<0,05	–	0,28	–	<0,05	–	0,14	–	<0,05	<0,05	<0,05	–	<0,05	–
–	<0,05	–	<0,05	–	<0,05	–	<0,05	–	<0,05	<0,05	<0,05	–	<0,05	–
–	<0,05	–	<0,05	–	<0,05	–	<0,05	–	<0,05	<0,05	<0,05	–	<0,05	–
–	<1	–	<1	–	<1	–	<1	–	<1	<1	<1	–	<1	–

Substance/ Group of Substances	CAS no	Annual avrg value of the EQS in inland surface waters	Max. allowable concentr. of EQS in inland surf. waters	River Narva monitoring station no. 32		River Kohtla, flowing into River Purtse		River Pühajõgi monitoring station no. 33 (in the mouth)		River Kunda monito-ring
				I	II	I	II	I	II	I
		µg/l								
Di(2-ethylhexyl)phthalate (DEHP)	117-81-7	1,3	N.A.	<0,05	–	0,09	<0,05	<0,05	–	0,087
Diisononylphthalate	28553-12-0			<0,05	–	<0,05	<0,05	<0,05	–	<0,05
Di-n-octylphthalate	117-84-0			<0,05	–	<0,05	<0,05	<0,05	–	<0,05
Diisodecylphthalate	26761-40-0			<1	–	<1	<1	<1	–	<1
Polybrominated biphenyls, diphenylethers and polybrominated organic compounds										
Tribromodiphenylether, PBDE-28		0,0005	N.A.	<0,005	–	<0,005	–	–	–	<0,005
Tetrabromodiphenylether, PBDE-47	5436-43-1	0,0005	N.A.	<0,005	–	<0,005	–	–	–	<0,005
Pentabromodiphenylether, PBDE-99	60348-60-9	0,0005	N.A.	<0,005	–	<0,005	–	–	–	<0,005
Pentabromodiphenylether, PBDE-100	189084-66-0	0,0005	N.A.	<0,005	–	<0,005	–	–	–	<0,005
Hexabromodiphenylether, PBDE-153	68631-49-2	0,0005	N.A.	<0,02	–	<0,02	–	–	–	<0,02
Hexabromodiphenylether, PBDE-154	207122-15-4	0,0005	N.A.	<0,005	–	<0,005	–	–	–	<0,005
Hexabromodiphenylether, PBDE-138	182677-30-1			<0,005	–	<0,005	–	–	–	<0,005
Heptabromodiphenylether, PBDE-183	207122-16-5			<0,02	–	<0,02	–	–	–	<0,02
Heptabromodiphenylether, PBDE-190	189084-68-2			<0,1	–	<0,1	–	–	–	<0,1
Octabromobiphenylether, PBDE-203	32536-52-0			<0,005	–	<0,005	–	–	–	<0,005
Decabromobiphenylether, PBDE-209	1163-19-5			<0,1	–	<0,1	–	–	–	<0,1
Tetrabromobiphenyl, PBB-52	59080-37-4			<0,005	–	<0,005	–	–	–	<0,005
Pentabromobiphenyl, PBB-101	67888-96-4			<0,005	–	<0,005	–	–	–	<0,005
Hexabromobiphenyl, PBB-153	59080-40-9			<0,01	–	<0,01	–	–	–	<0,01
3,3',5,5'-tetrabromobisphenol A, (tetrabromobisphenol)	79-74-7			<0,005	–	<0,005	–	–	–	<0,005
Bromocyclene	1715-40-8			<0,005	–	<0,005	–	–	–	<0,005
Hexabromobenzene	87-82-1			<0,005	–	<0,005	–	–	–	<0,005
Hexabromocyclodecane (HBCDD)	25637-99-4			<0,2	–	<0,2	–	–	–	<0,2
Short- and medium-chain chlorinated paraffins										
C_{10-13} chloroalkanes (SCCP)	85535-84-8	0,4	1,4	–	–	<0,3	–	–	–	<0,3
C_{14-17} chloroalkanes (MCCP)	–			<0,3	–	<0,3	–	–	–	<0,3
Perfluoro-compounds										
Perfluorooctanoic acid (PFOA)	335-67-1			<0,03	–	<0,03	–	–	–	<0,03
Perfluorooctane sulfonate (PFOS)	1763-23-1			<0,03	–	<0,03	–	–	–	<0,03
Other substances										
Cyanides	57-12-5	100		< 3	–	< 3	–	< 3	–	< 3
Heptachlorepoxyde	1024-57-3			–	–	–	0,0079	–	–	–
General indicators										
Water temperature (outside)				9,1	16,7	10,2	14,3	9,4	14,1	8,5
Conductivity (outside)				258	288	1040	1187	942	967	452
Dissolved oxygen (O_2) (outside)				13,8	8,5	13,5	9,9	13,2	10	13,4
pH (outside)		6 – 9		8,15	8,14	8,17	8,17	8,29	8,3	8,33

station no. 36 (in the mouth)	River Mustajõgi monitoring station no. 60		River Jägala monit. station no. 42 (in mouth, in Linnamäe)		River Keila monitoring station no. 47		River Vääna monitoring station no. 45 (in the mouth)		River Vasalemma (the mouth of the river)		River Kasari monitoring station no. 49		River Pärnu monitoring station no. 52	
II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II
µg/l																
–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	–	–	<0,005	–
–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	–	–	<0,005	–
–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	–	–	<0,005	–
–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	–	–	<0,005	–
–	<0,02	–	<0,02	–	<0,02	–	<0,02	–	<0,02	–	–	–	<0,02	–
–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	–	–	<0,005	–
–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	–	–	<0,005	–
–	<0,02	–	<0,02	–	<0,02	–	<0,02	–	<0,02	–	–	–	<0,02	–
–	<0,1	–	<0,1	–	<0,1	–	<0,1	–	<0,1	–	–	–	<0,1	–
–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	–	–	<0,005	–
–	<0,1	–	<0,1	–	<0,1	–	<0,1	–	<0,1	–	–	–	<0,1	–
–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	–	–	<0,005	–
–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	–	–	<0,005	–
–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–	–	–	<0,01	–
–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	–	–	<0,005	–
–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	–	–	<0,005	–
–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–	–	–	<0,005	–
–	<0,2	–	<0,2	–	<0,2	–	<0,2	–	<0,2	–	–	–	<0,2	–
–	<0,3	–	<0,3	–	<0,3	–	<0,3	–	<0,3	–	–	–	<0,3	–
–	<0,3	–	<0,3	–	<0,3	–	<0,3	–	<0,3	–	–	–	<0,3	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	< 3	–	< 3	–	< 3	–	< 3	–	< 3	–	< 3	–	<3	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	14,6	–	9,4	–	9,4	14,1	11,4	–	8,3	14,4	9,3	14,8	9,2	–
–	441	–	358	–	455	586	331	–	450	577	365	449	387	–
–	12,9	–	11,2	–	10,5	9,5	6,9	–	11,8	9,9	11,9	8,3	12,4	–
–	7,87	–	8,15	–	7,81	8,11	8,30	–	8,22	8,14	8,07	7,81	8,01	–

Annex 3. Chemical analysis results for surface and waste water: Lakes

Substance/ Group of Substances	CAS no.	Annual average value of the EQS in inland surface waters	Max allowable concentr of EQS in inland surface waters	Monitoring point of Lake Peipus no. 17		Monitoring point of Lake Peipus no. 38	
				I	II	I	II
		µg/l					
Heavy metals							
Lead and its compounds	7439-92-1	7,2	N.A.	0,28	–	< 0,1	–
Nickel and its compounds	7440-02-0	20	N.A.	0,66	–	0,6	–
Mercury and its compounds	7439-97-6	0,05	0,07	< 0,05	–	< 0,05	–
Cadmium and its compounds	7440-43-9	<0,25	<1,5	< 0,02	–	< 0,02	–
Zink	7440-66-6	10		< 1	–	< 1	–
Chromium	7440-47-3	5		< 0,5	–	< 0,5	–
Copper	7440-50-8	15		< 1	–	< 1	–
Phenols, alkylphenols and their ethoxylates							
4-t- octylphenol-monoethoxylate	9036-19-5			<0,01	–	<0,01	–
4-t- octylphenol-diethoxylate	–			<0,01	–	<0,01	–
Isononylphenol-monoethoxylate	27986-36-5			<0,1	–	<0,1	–
Isononylphenol-diethoxylate	–			<0,1	–	<0,1	–
4-octylphenol	1806-26-4			<0,01	–	<0,01	–
4-tert-octylphenol	140-66-9	0,1	N.A.	<0,01	–	<0,01	–
4-nonylphenol	104-40-5	0,3	2	<0,01	–	<0,01	–
Isononylphenol	25154-52-3			<0,1	–	<0,1	–
4-tert-butylphenol	98-54-4			<0,01	–	<0,01	–
4-tert-pentylphenol	80-46-6			<0,01	–	<0,01	–
Pentachlorophenol	87-86-5	0,4	1	< 0,4	–	< 0,4	–
2,3-dimethylphenol	526-75-0			–	<2	–	–
2,6-dimethylphenol	576-26-1			–	<2	–	–
3,4-dimethylphenol	95-65-8			–	<2	–	–
3,5-dimethylphenol	108-68-9			–	<2	–	–
Phenol	108-95-2			–	6,7	–	–
o-cresol	95-48-7			–	<2	–	–

Substance/ Group of Substances	CAS no.	Annual average value of the EQS in inland surface waters	Max allowable concentr of EQS in inland surface waters	Monitoring point of Lake Peipus no. 17		Monitoring point of Lake Peipus no. 38	
				I	II	I	II
		µg/l					
p- and m-cresol (the sum)	106-44-5, 108-39-4			-	2,4	-	-
Resorcin	108-46-3			-	<10	-	-
2,5-dimethylresorcin	95-87-4			-	<10	-	-
5-methylresorcin	504-15-4			-	<10	-	-
Polyaromatic hydrocarbons							
Anthracene	120-12-7			<0,01	-	<0,01	-
Benzo(a)pyrene	50-32-8	0,05	0,1	<0,01	-	<0,01	-
Benzo(b)fluoranthene	205-99-2	Σ=0,03	N.A.	<0,01	-	<0,01	-
Benzo(k)fluoranthene	207-08-9			<0,01	-	<0,01	-
Fluoranthene	206-44-0	0,1	1	<0,01	-	<0,01	-
Benzo[g,h,i]perylene	191-24-2		N.A.	<0,002	-	<0,002	-
Indeno[1,2,3-cd]pyrene	193-39-5			<0,002	-	<0,002	-
Benzo[g,h,i]perylene/Indeno[1,2,3-cd] pyrene (the sum)	193-39-5	Σ=0,002		<0,002	-	<0,002	-
Naphtalene	91-20-3	2,4	N.A.	<0,01	-	<0,01	-
Volatile organic compounds							
Benzene	71-43-2	10	50	< 0,2	-	< 0,2	-
1,2-dichloroethane	107-06-2	10	N.A.	< 0,1	<0,1	< 0,1	-
Dichloromethane	75-09-2	20	N.A.	12,06	<0,1	-	-
Tetrachloromethane (carbon tetrachloride)	56-23-5	12	N.A.	< 0,1	<0,1	< 0,1	-
Tetrachloroethylene	127-18-4	10	N.A.	< 0,1	<0,1	< 0,1	-
Chloroform (trichloromethane)	67-66-3	2,5	N.A.	0,73	0,34	< 0,1	-
Trichloroethylene	79-01-6	10	N.A.	< 0,1	<0,1	< 0,1	-
Chlorobenzenes							
Hexachlorobenzene	118-74-1	0,01	0,05	<0,005	-	<0,005	-
Organotin compounds							
Monobutyltin	78763-54-9			<0,001	-	<0,001	-
Dibutyltin	1002-53-5			<0,001	-	<0,001	-

Substance/ Group of Substances	CAS no.	Annual average value of the EQS in inland surface waters	Max allowable concentr of EQS in inland surface waters	Monitoring point of Lake Peipus no. 17		Monitoring point of Lake Peipus no. 38	
				I	II	I	II
		µg/l					
Tributyltin	688-73-3	0,0002	0,0015	<0,0002	-	<0,0002	-
Tetrabutyltin	1461-25-2			<0,001	-	<0,001	-
Monooctyltin	-			<0,001	-	<0,001	-
Dioctyltin	94410-05-6			<0,001	-	<0,001	-
Tricyclohexyltin	6056-50-4			<0,001	-	<0,001	-
Monophenyltin	2406-68-0			<0,001	-	<0,001	-
Diphenyltin	6381-06-2			<0,001	-	<0,001	-
Triphenyltin	668-34-8			<0,001	-	<0,001	-
Phthalates							
Dimethylphthalate	113-11-3			<0,05	-	<0,05	-
Diethylphthalate	84-66-2			<0,05	-	<0,05	-
Benzylbenzonate	120-51-4			<0,05	-	<0,05	-
Diisobutylphthalate	84-69-5			<0,05	-	<0,05	-
Dibutylphthalate - DBP	84-74-2			0,11	-	<0,05	-
Dimethylethylphthalate	117-82-8			<0,05	-	<0,05	-
Diisohexylphthalate	-			<0,05	-	<0,05	-
Di-2-ethoxyethylphthalate	605-54-9			<0,05	-	<0,05	-
Dipentylphthalate	131-18-0			<0,05	-	<0,05	-
Di-n-hexylphthalate	84-75-3			<0,05	-	<0,05	-
Benzylbutylphthalate	85-68-7			<0,05	-	<0,05	-
Hexyl-2-etylhexylphthalate	-			<0,05	-	<0,05	-
Dibutoxyethylphthalate	117-83-9			<0,05	-	<0,05	-
Dicyclohexylphthalate	84-61-7			<0,05	-	<0,05	-
Di(2-ethylhexyl)phthalate (DEHP)	117-81-7	1,3	N.A.	<0,05	-	<0,05	-
Diisononylphthalate	28553-12-0			<0,05	-	<0,05	-
Di-n-octylphthalate	117-84-0			<0,05	-	<0,05	-

Substance/ Group of Substances	CAS no.	Annual average value of the EQS in inland surface waters	Max allowable concentr of EQS in inland surface waters	Monitoring point of Lake Peipus no. 17		Monitoring point of Lake Peipus no. 38	
				I	II	I	II
		µg/l					
Diisodecylphthalate	26761-40-0			<1	-	<1	-
Polybrominated biphenyls, diphenylethers and polybrominated organic compounds							
Tribromodiphenylether, PBDE-28		0,0005	N.A.	<0,005	-	<0,005	-
Tetrabromodiphenylether, PBDE-47	5436-43-1	0,0005	N.A.	<0,005	-	<0,005	-
Pentabromodiphenylether, PBDE-99	60348-60-9	0,0005	N.A.	<0,005	-	<0,005	-
Pentabromodiphenylether, PBDE-100	189084-66-0	0,0005	N.A.	<0,005	-	<0,005	-
Hexabromodiphenylether, PBDE-138	182677-30-1			<0,005	-	<0,005	-
Hexabromodiphenylether, PBDE-153	68631-49-2	0,0005	N.A.	<0,02	-	<0,02	-
Hexabromodiphenylether, PBDE-154	207122-15-4	0,0005	N.A.	<0,005	-	<0,005	-
Heptabromodiphenylether, PBDE-183	207122-16-5			<0,02	-	<0,02	-
Heptabromodiphenylether, PBDE-190	189084-68-2			<0,1	-	<0,1	-
Octabromobiphenylether, PBDE-203	32536-52-0			<0,005	-	<0,005	-
Decabromobiphenylether, PBDE-209	1163-19-5			<0,1	-	<0,1	-
Tetrabromobiphenyl, PBB-52	59080-37-4			<0,005	-	<0,005	-
Pentabromobiphenyl, PBB-101	67888-96-4			<0,005	-	<0,005	-
Hexabromobiphenyl, PBB-153	59080-40-9			<0,01	-	<0,01	-
3,3',5,5'-tetrabromobisphenol A, (tetrabromobisphenol)	79-74-7			<0,005	-	<0,005	-
Bromocyclene	1715-40-8			<0,005	-	<0,005	-
Hexabromobenzene	87-82-1			<0,005	-	<0,005	-
Hexabromocyclodecane (HBCDD)	25637-99-4			<0,2	-	<0,2	-
Perfluoro-compounds							
Perfluorooctanoic acid (PFOA)	335-67-1			<0,03	-	<0,03	-
Perfluorooctane sulfonate (PFOS)	1763-23-1			<0,03	-	<0,03	-
Other substances							
Cyanides	57-12-5	100		< 3	-	< 3	-

Annex 3. Chemical analysis results for surface and waste water: Coastal regions

Substance/ Group of Substances	CAS no	Annual average value of the EQS in other surface waters µg/l	Max. allowable concentr. of EQS in other surface waters µg/l	Coast of Sillamäe Sillamäe bay	
				I round µg/l	II round µg/l
Heavy metals					
Lead and its compounds	7439-92-1	7,2	N.A.	0,17	–
Nickel and its compounds	7440-02-0	20	N.A.	0,5	–
Mercury and its compounds	7439-97-6	0,05	0,07	< 0,05	–
Cadmium and its compounds	7440-43-9	0,2	<1,5	< 0,02	–
Zink	7440-66-6		5	1,3	–
Chromium	7440-47-3		5	< 0,5	–
Copper	7440-50-8		5	< 1	–
Phenols, alkylphenols and their ethoxylates					
4-t- octylphenol-monoethoxylate	9036-19-5			<0,01	–
4-t- octylphenol-diethoxylate	–			<0,01	–
Isononylphenol-monoethoxylate	27986-36-5			<0,1	–
Isononylphenol-diethoxylate	–			<0,1	–
4-octylphenol	1806-26-4			<0,01	–
4-tert-octylphenol	140-66-9	0,01	N.A.	<0,01	–
4-nonylphenol	104-40-5	0,3	2	<0,01	–
Isononylphenol	25154-52-3			<0,1	–
4-tert-butylphenol	98-54-4			<0,01	–
4-tert-pentylphenol	80-46-6			<0,01	–
Pentachlorophenol	87-86-5	0,4	1	< 0,4	–
2,3-dimethylphenol	526-75-0			–	<2
2,6-dimethylphenol	576-26-1			–	<2
3,4-dimethylphenol	95-65-8			–	<2
3,5-dimethylphenol	108-68-9			–	<2
Phenol	108-95-2			–	5,8
o-cresol	95-48-7			–	<2
p- and m-cresol (the sum)	106-44-5, 108-39-4			–	<2
Resorcin	108-46-3			–	<10
2,5-dimethylresorcin	95-87-4			–	<10
5-methylresorcin	504-15-4			–	<10
Polyaromatic hydrocarbons					
Anthracene	120-12-7			<0,01	–
Benzo(a)pyrene	50-32-8	0,05	0,1	<0,01	–
Benzo(b)fluoranthene	205-99-2	Σ=0,03	N.A.	<0,01	–
Benzo(k)fluoranthene	191-24-2		N.A.	<0,002	–

Coast of BLRT Grupp AS, Tallinn bay Outlet of effluent		Coast of BLRT Grupp AS, Tallinn bay Company Baltic Premator dock no. 2 outlet		Coast of BLRT Grupp AS, Tallinn bay Company Baltic Premator dock no. 34 outlet	
I round µg/l	II round µg/l	I round µg/l	II round µg/l	I round µg/l	II round µg/l
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Substance/ Group of Substances	CAS no	Annual average value of the EQS in other surface waters µg/l	Max. allowable concentr. of EQS in other surface waters µg/l	Coast of Sillamäe Sillamäe bay	
				I round µg/l	II round µg/l
Fluoranthene	206-44-0	Σ=0,002	N.A	<0,01	-
Benzo[g,h,i]perylene	207-08-9			<0,01	-
Indeno[1,2,3-cd]pyrene	193-39-5	0,1	1	<0,002	-
Benzo[g,h,i]perylene/Indeno[1,2,3-cd] pyrene (the sum)	-			<0,002	-
Naphtalene	91-20-3	1,2	N.A	<0,01	-
Volatile organic compounds					
Benzene	71-43-2	8	50	< 0,2	-
1,2-dichloroethane	107-06-2	10	N.A	< 0,1	<0,1
Dichloromethane	75-09-2	20	N.A	< 0,1	<0,1
Tetrachloromethane (carbon tetrachloride)	56-23-5	12	N.A	< 0,1	<0,1
Tetrachloroethylene	127-18-4	10	N.A	< 0,1	<0,1
Chloroform (trichloromethane)	67-66-3	2,5	N.A	0,12	0,49
Trichloroethylene	79-01-6	10	N.A	< 0,1	<0,1
Dichlorobromomethane	75-27-4			-	<0,1
Bromoform	75-25-2			-	<0,1
Chlorobenzenes					
Hexachlorobenzene	118-74-1	0,01	0,05	<0,005	-
Pentachlorobenzene	608-93-5	0,0007	N.A	<0,005	-
Organotin compounds					
Monobutyltin	78763-54-9			<0,001	-
Dibutyltin	1002-53-5			<0,001	-
Tributyltin	688-73-3	0,0002	0,0015	<0,0002	-
Tetrabutyltin	1461-25-2			<0,001	-
Monooctyltin	-			<0,001	-
Dioctyltin	94410-05-6			<0,001	-
Tricyclohexyltin	6056-50-4			<0,001	-
Monophenyltin	2406-68-0			<0,001	-
Diphenyltin	6381-06-2			<0,001	-
Triphenyltin	668-34-8			<0,001	-
Phthalates					
Dimethylphthalate	113-11-3			<0,05	-
Diethylphthalate	84-66-2			<0,05	-
Benzylbenzonate	120-51-4			<0,05	-
Diisobutylphthalate	84-69-5			<0,05	-
Dibutylphthalate - DBP	84-74-2			<0,05	-
Dimethylethylphthalate	117-82-8			<0,05	-
Diisohexylphthalate	-			<0,05	-
Di-2-ethoxyethylphthalate	605-54-9			<0,05	-

Coast of BLRT Grupp AS, Tallinn bay Outlet of effluent		Coast of BLRT Grupp AS, Tallinn bay Company Baltic Premator dock no. 2 outlet		Coast of BLRT Grupp AS, Tallinn bay Company Baltic Premator dock no. 34 outlet	
I round µg/l	II round µg/l	I round µg/l	II round µg/l	I round µg/l	II round µg/l
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–	–	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–
0,074	–	0,614	–	0,0092	–
1,84	–	7,058	–	0,056	–
2,37	–	9,09	–	0,066	–
<0,001	–	<0,001	–	0,06	–
<0,001	–	<0,001	–	<0,001	–
<0,001	–	<0,001	–	<0,001	–
<0,001	–	<0,001	–	<0,001	–
<0,001	–	<0,001	–	0,051	–
<0,001	–	<0,001	–	0,025	–
<0,001	–	<0,001	–	<0,001	–
–	–	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–
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Substance/ Group of Substances	CAS no	Annual average value of the EQS in other surface waters µg/l	Max. allowable concentr. of EQS in other surface waters µg/l	Coast of Sillamäe Sillamäe bay	
				I round µg/l	II round µg/l
Dipentylphthalate	131-18-0			<0,05	-
Di-n-hexylphthalate	84-75-3			<0,05	-
Benzylbutylphthalate	85-68-7			<0,05	-
Hexyl-2-etylhexylphthalate	-			<0,05	-
Dibutoxyethylphthalate	117-83-9			<0,05	-
Dicyclohexylphthalate	84-61-7			<0,05	-
Di(2-ethylhexyl)phthalate (DEHP)	117-81-7	1,3	N.A.	<0,05	-
Diisononylphthalate	28553-12-0			<0,05	-
Di-n-octylphthalate	117-84-0			<0,05	-
Diisodecylphthalate	26761-40-0			<1	-
Polybrominated biphenyls, diphenylethers and polybrominated organic compounds					
Tribromodiphenylether, PBDE-28		0,0002	N.A	<0,005	-
Tetrabromodiphenylether, PBDE-47	5436-43-1	0,0002	N.A	<0,005	-
Pentabromodiphenylether, PBDE-99	60348-60-9	0,0002	N.A	<0,005	-
Pentabromodiphenylether, PBDE-100	189084-66-0	0,0002	N.A	<0,005	-
Hexabromodiphenylether, PBDE-138	182677-30-1			<0,005	-
Hexabromodiphenylether, PBDE-153	68631-49-2	0,0002	N.A	<0,02	-
Hexabromodiphenylether, PBDE-154	207122-15-4	0,0002	N.A	<0,005	-
Heptabromodiphenylether, PBDE-183	207122-16-5			<0,02	-
Heptabromodiphenylether, PBDE-190	189084-68-2			<0,1	-
Octabromobiphenylether, PBDE-203	32536-52-0			<0,005	-
Decabromobiphenylether, PBDE-209	1163-19-5			<0,1	-
Tetrabromobiphenyl, PBB-52	59080-37-4			<0,005	-
Pentabromobiphenyl, PBB-101	67888-96-4			<0,005	-
Hexabromobiphenyl, PBB-153	59080-40-9			<0,01	-
3,3',5,5'-tetrabromobisphenol A, (tetrabromobisphenol)	79-74-7			<0,005	-
Bromocyclene	1715-40-8			<0,005	-
Hexabromobenzene	87-82-1			<0,005	-
Hexabromocyclodecane (HBCDD)	25637-99-4			<0,2	-
Perfluoro-compounds					
Perfluorooctanoic acid (PFOA)	335-67-1			<0,03	-
Perfluorooctane sulfonate (PFOS)	1763-23-1			<0,03	-
Other substances					
Cyanides	57-12-5		50	< 3	-
General indicators					
Water temperature (outside)				7,2	12,4
Conductivity (outside)				5640	7440
Dissolved oxygen (O_2) (outside)				15,4	8,6
pH (outside)			6 – 9	7,65	7,59

Coast of BLRT Grupp AS, Tallinn bay Outlet of effluent		Coast of BLRT Grupp AS, Tallinn bay Company Baltic Premator dock no. 2 outlet		Coast of BLRT Grupp AS, Tallinn bay Company Baltic Premator dock no. 34 outlet	
I round µg/l	II round µg/l	I round µg/l	II round µg/l	I round µg/l	II round µg/l
–	–	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–
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Annex 3. Chemical analysis results for surface and waste water: Agricultural regions

Substance/ Group of Substances	CAS no	Annual average value of the EQS in inland surface waters	Max. allowable concentr. of EQS in inland surface waters	Main ditch of Alastvere (Võhma-Nõmme Village)		Main ditch of Tõrve outlet to the River Pedja		Main ditch of Võisiku monitoring station no. 61	
				I round	II round	I round	II round	I round	II round
		µg/l							
Pesticides									
Chlorfenvinphos	470-90-6	0,1	0,3	<0,010	-	<0,010	-	<0,010	-
Alachlor	15972-60-8	0,3	0,7	<0,010	-	<0,010	-	<0,010	-
Atrazine	1912-24-9	0,6	2	<0,010	-	<0,010	-	<0,010	-
Isoproturon	34123-59-6	0,3	1	<0,010	-	<0,010	-	<0,010	-
Chlorpyriphos	2921-88-2	0,03	0,1	<0,010	-	<0,010	-	<0,010	-
Trifluralin	1582-09-8	0,03	N.A.	<0,010	-	<0,010	-	<0,010	-
Simazine	122-34-9	1	4	<0,010	-	<0,010	-	<0,010	-
Glyphosate	1071-83-6			<10	-	<10	-	<10	-
AMPA	1066-51-9			<10	-	<10	-	<10	-
Mecoprop (MCPP)	7085-19-0			<0,5	-	<0,5	-	<0,5	-
Aldrin	309-00-2	Σ=0,01	N.A.	< 0,005	-	< 0,005	-	< 0,005	-
Dieldrin	60-57-1			< 0,005	-	< 0,005	-	< 0,005	-
Endrin	72-20-8			< 0,005	-	< 0,005	-	< 0,005	-
Isodrin	465-73-6			< 0,005	-	< 0,005	-	< 0,005	-
Endosulfan	115-29-7	0,005	0,01	< 0,005	-	< 0,005	-	< 0,005	-
Hexachlorobutadiene	87-68-3	0,1	0,6	< 0,1	-	< 0,1	-	< 0,1	-
Hexachlorocyclohexane	608-73-1	0,02	0,04	< 0,005	-	< 0,005	-	< 0,005	-
alpha-endosulfan	959-98-8			< 0,005	-	< 0,005	-	< 0,005	-
Hexachlorobutadiene	87-68-3	0,1	0,6	< 0,005	-	< 0,005	-	< 0,005	-
Heptachlor endoepoxide	28044-83-9			< 0,005	-	< 0,005	-	< 0,005	-
beta-hexachlorocyclohexane	319-85-7			< 0,005	-	< 0,005	-	< 0,005	-
alpha-hexachlorocyclohexane	319-84-6			< 0,005	-	< 0,005	-	< 0,005	-
gamma-hexachlorocyclohexane	58-89-9			< 0,005	-	< 0,005	-	< 0,005	-
General indicators									
Water temperature (outside)				-	-	-	-	-	-
Conductivity (outside)				-	-	-	-	-	-
Dissolved oxygen (O_2) (outside)				-	-	-	-	-	-
pH (outside)				-	-	-	-	-	-

River Pedja monitoring station no. 14 (Jõgeva Plant Breeding Institute)		River Jänijõgi monitoring station no. 64		The main ditch of Konguta (Rannu, Tartu County, before Lake Liivaku)		Stream Rõhu (before reservoir Rõhu, Tartu County)		River Vasalemma (the mouth of the river)	
I round	II round	I round	II round	I round	II round	I round	II round	I round	II round
µg/l									
<0,010	–	<0,010	–	<0,010	–	<0,010	–	–	<0,010
<0,010	–	<0,010	–	<0,010	–	<0,010	–	–	<0,010
<0,010	–	<0,010	–	<0,010	–	<0,010	–	–	<0,010
<0,010	–	<0,010	–	<0,010	–	<0,010	–	–	<0,010
<0,010	–	<0,010	–	<0,010	–	<0,010	–	–	<0,010
<0,010	–	<0,010	–	<0,010	–	<0,010	–	–	<0,010
<0,010	–	<0,010	–	<0,010	–	<0,010	–	–	<0,010
<10	–	<10	–	<10	–	<10	–	–	<10
<10	–	<10	–	<10	–	<10	–	–	<10
<0,5	–	<0,5	–	<0,5	–	<0,5	–	–	<0,5
< 0,005	–	< 0,005	–	< 0,005	–	< 0,005	–	–	–
< 0,005	–	< 0,005	–	< 0,005	–	< 0,005	–	–	–
< 0,005	–	< 0,005	–	< 0,005	–	< 0,005	–	–	–
< 0,005	–	< 0,005	–	< 0,005	–	< 0,005	–	–	–
< 0,005	–	< 0,005	–	< 0,005	–	< 0,005	–	–	–
< 0,1	–	< 0,1	–	< 0,1	–	< 0,1	–	–	–
< 0,005	–	< 0,005	–	< 0,005	–	< 0,005	–	–	–
< 0,005	–	< 0,005	–	< 0,005	–	< 0,005	–	–	–
< 0,005	–	< 0,005	–	< 0,005	–	< 0,005	–	–	–
< 0,005	–	< 0,005	–	< 0,005	–	< 0,005	–	–	–
< 0,005	–	< 0,005	–	< 0,005	–	< 0,005	–	–	–
< 0,005	–	< 0,005	–	< 0,005	–	< 0,005	–	–	–
< 0,005	–	< 0,005	–	< 0,005	–	< 0,005	–	–	–
–	–	8,4	–	–	–	–	–	–	14,4
–	–	542	–	–	–	–	–	–	577
–	–	13,2	–	–	–	–	–	–	9,9
–	–	7,74	–	–	–	–	–	–	8,14

Annex 3. Chemical analysis results for surface and waste water: Waste water treatment plants

Substance/ Group of Substances	CAS no.	Limit value* µg/l	Outlet of Tallinn WWTP		Outlet of Kohtla-Järve WWTP		Outlet of Narva WWTP	
			I round µg/l	II round µg/l	I round µg/l	II round µg/l	I round µg/l	II round µg/l
Heavy metals								
Lead and its compounds	7439-92-1	500	6,2	<0,1	< 0,1	1,2	0,54	0,19
Nickel and its compounds	7440-02-0	1000	9,6	4,4	2,5	6,7	1,3	2,1
Mercury and its compounds	7439-97-6	50	< 0,05	<0,05	< 0,05	<0,05	< 0,05	<0,05
Cadmium and its compounds	7440-43-9	200	0,1	0,02	0,02	0,08	< 0,02	0,02
Zink and its compounds	7440-66-6	2000	35	13,5	22,6	33,9	12,1	10,7
Chromium	7440-47-3	100/500	0,83	0,54	< 0,5	0,76	< 0,5	<0,5
Copper and its compounds	7440-50-8	2000	38	15,4	< 1,0	59,4	< 1,0	12,8
Arsenic and its compounds	7440-38-2	200	0,9	0,63	-	5,3	-	0,5
Phenols, alkylphenols and their ethoxylates								
4-t- octylphenol-monoethoxylate	9036-19-5		<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
4-t- octylphenol-diethoxylate	-		<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Isononylphenol-monoethoxylate	27986-36-5		<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
Isononylphenol-diethoxylate	-		<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
4-octylphenol	1806-26-4		<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
4-tert-octylphenol	140-66-9		0,016	<0,01	<0,01	<0,01	<0,01	<0,01
4-nonylphenol	104-40-5		<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Isononylphenol	25154-52-3		<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
4-tert-butylphenol	98-54-4		0,052	<0,01	<0,01	<0,01	0,044	<0,01
4-tert-Pentylphenol	80-46-6		0,014	<0,01	<0,01	<0,01	<0,01	<0,01
Pentachlorophenol	87-86-5	0,2	-	-	< 0,4	-	< 0,4	-
2,3-dimethylphenol	526-75-0		< 2	-	< 2	<2	< 2	-
2,6-dimethylphenol	576-26-1		< 2	-	< 2	<2	< 2	-
3,4-dimethylphenol	95-65-8		< 2	-	< 2	<2	< 2	-
3,5-dimethylphenol	108-68-9		< 2	-	< 2	<2	< 2	-
Phenol	108-95-2		3,3	-	12,8	9	2,8	-
o-cresol	95-48-7		< 2	-	< 2	<2	<2	-
p- and m-cresol (the sum)	106-44-5, 108-39-4		2,1	-	5	4,3	3,6	-
Resorcin	108-46-3		< 10	-	< 10	<10	< 10	-
2,5-dimethylresorcin	95-87-4		< 10	-	< 10	<10	< 10	-
5-methylresorcin	504-15-4		< 10	-	< 10	<10	< 10	-
Polyaromatic hydrocarbons								
Anthracene	120-12-7		<0,01	-	<0,01	-	<0,01	-
Benzo(a)pyrene	50-32-8		<0,01	-	<0,01	-	<0,01	-
Benzo(b)fluoranthene	205-99-2		<0,01	-	<0,01	-	<0,01	-
Benzo(k)fluoranthene	207-08-9	Σ = 10	<0,01	-	<0,01	-	<0,01	-
Fluoranthene	206-44-0		<0,01	-	<0,01	-	<0,01	-
Benzo[g,h,i]perylene	191-24-2		<0,002	-	<0,002	-	<0,002	-
Indeno[1,2,3-cd]pyrene	193-39-5		<0,002	-	<0,002	-	<0,002	-
Naphtalene	91-20-3		<0,01	-	<0,01	-	<0,01	-

Outlet of Pärnu WWTP		Outlet of Kuressaare WWTP		Outlet of Haapsalu WWTP		Outlet of Keila WWTP		Outlet of Tartu WWTP	
I round µg/l	II round µg/l	I round µg/l	II round µg/l	I round µg/l	II round µg/l	I round µg/l	II round µg/l	I round µg/l	II round µg/l
0,27	0,19	0,41	0,32	<0,1	<0,1	1,4	0,3	<40	0,11
1,3	2,1	2,8	3,1	2,2	4,3	5,6	2,5	<20	4,5
< 0,05	< 0,05	<0,05	< 0,05	<0,05	< 0,05	< 0,05	<0,05	< 0,05	<0,05
0,02	<0,02	<0,02	<0,02	< 0,02	<0,02	0,06	0,02	<20	<0,02
27,9	9,1	24,2	10,4	8,5	1,8	20	22,3	<20	9,6
1,8	2,1	<0,5	<0,5	<0,5	<0,5	12,5	16,3	<20	0,75
3,1	23,5	5,3	10	<1	18,6	58	11,4	<20	<1
–	4,3	–	0,88	–	0,59	0,34	0,34	–	0,58
<0,01	<0,01	0,056	<0,01	<0,01	<0,01	0,519	<0,01	<0,01	<0,01
<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	0,39	<0,01	<0,01	<0,01
<0,1	<0,1	0,461	<0,1	<0,1	<0,1	1,42	<0,1	<0,1	<0,1
<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	0,862	<0,1	<0,1	<0,1
<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
<0,01	<0,01	0,016	<0,01	<0,01	0,025	0,027	<0,01	<0,01	0,022
<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
0,063	<0,01	0,048	<0,01	0,059	0,058	0,071	<0,01	0,022	<0,01
<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	0,03	<0,01	<0,01	<0,01
< 0,4	–	< 0,4	–	< 0,4	–	< 0,4	–	–	–
–	–	–	–	–	–	<2	–	–	–
–	–	–	–	–	–	<2	–	–	–
–	–	–	–	–	–	<2	–	–	–
–	–	–	–	–	–	<2	–	–	–
–	–	–	–	–	–	9,3	–	–	–
–	–	–	–	–	–	<2	–	–	–
–	–	–	–	–	–	2,6	–	–	–
–	–	–	–	–	–	<10	–	–	–
–	–	–	–	–	–	<10	–	–	–
–	–	–	–	–	–	<10	–	–	–
<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–
<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–
<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–
<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–
<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–
<0,002	–	<0,002	–	<0,002	–	<0,002	–	<0,002	–
<0,002	–	<0,002	–	<0,002	–	<0,002	–	<0,002	–
<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–

Substance/ Group of Substances	CAS no.	Limit value* µg/l	Outlet of Tallinn WWTP		Outlet of Kohtla-Järve WWTP		Outlet of Narva WWTP	
			I round µg/l	II round µg/l	I round µg/l	II round µg/l	I round µg/l	II round µg/l
Volatile organic compounds								
Benzene	71-43-2		< 0,2	–	< 0,2	–	< 0,2	–
1,2-dichloroethane	107-06-2	3	< 0,1	<0,1	< 0,1	<0,1	< 0,1	<0,1
Dichloromethane	75-09-2		<0,1	<0,1	<0,1	<0,1	11,3	<0,1
Tetrachloromethane (carbon tetrachloride)	56-23-5	1500	< 0,1	0,16	< 0,1	<0,1	< 0,1	<0,1
Tetrachloroethylene	127-18-4	100	< 0,1	<0,1	< 0,1	<0,1	< 0,1	<0,1
Chloroform (trichloromethane)	67-66-3	1000	1,03	<0,1	0,14	0,28	1,36	1,12
Trichloroethylene	79-01-6	100	0,31	<0,1	< 0,1	<0,1	< 0,1	<0,1
Dichlorobromomethane	124-48-1		–	<0,1	–	<0,1	–	<0,1
Bromoform	75-25-2		–	–	–	0,21	–	–
Chlorobenzenes								
Hexachlorobenzene	118-74-1	5	<0,005	–	<0,005	–	<0,005	–
Pentachlorobenzene	608-93-5		<0,005	–	<0,005	–	<0,005	–
Organotin compounds								
Monobutyltin	78763-54-9		<0,001	–	–	–	–	–
Dibutyltin	1002-53-5		<0,001	–	–	–	–	–
Tributyltin	688-73-3		<0,0002	–	–	–	–	–
Tetrabutyltin	1461-25-2		<0,001	–	–	–	–	–
Monooctyltin	–		<0,001	–	–	–	–	–
Dioctyltin	94410-05-6		<0,001	–	–	–	–	–
Tricyclohexyltin	6056-50-4		<0,001	–	–	–	–	–
Monophenyltin	2406-68-0		<0,001	–	–	–	–	–
Diphenyltin	6381-06-2		<0,001	–	–	–	–	–
Triphenyltin	668-34-8		<0,001	–	–	–	–	–
Phthalates								
Dimethylphthalate	113-11-3		<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Diethylphthalate	84-66-2		<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Benzylbenzonate	120-51-4		<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Diisobutylphthalate	84-69-5		<0,05	0,092	0,53	0,081	0,34	0,14
Dibutylphthalate - DBP	84-74-2		<0,05	0,081	<0,05	<0,05	<0,05	0,076
Dimethylethylphthalate	117-82-8		<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Diisohexylphthalate	–		<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Di-2-ethoxyethylphthalate	605-54-9		<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Dipentylphthalate	131-18-0		<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Di-n-hexylphthalate	84-75-3		<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Benzylbutylphthalate	85-68-7		<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Hexyl-2-etylhexylphthalate	–		<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Dibutoxyethylphthalate	117-83-9		<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Dicyclohexylphthalate	84-61-7		<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Di(2-ethylhexyl)phthalate (DEHP)	117-81-7		0,21	0,15	0,21	0,13	<0,05	0,077
Diisononylphthalate	28553-12-0		<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Di-n-octylphthalate	117-84-0		<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Diisodecylphthalate	26761-40-0		<1,0	<1,0	<1,0	<1,0	<1,0	<1,0

Outlet of Pärnu WWTP		Outlet of Kuressaare WWTP		Outlet of Haapsalu WWTP		Outlet of Keila WWTP		Outlet of Tartu WWTP	
I round µg/l	II round µg/l	I round µg/l	II round µg/l	I round µg/l	II round µg/l	I round µg/l	II round µg/l	I round µg/l	II round µg/l
0,41	–	0,3	–	0,36	–	<0,2	–	2,7	–
< 0,1	–	<0,1	–	<0,1	–	<0,1	<0,1	< 0,1	<0,1
< 0,1	–	< 0,1	–	< 0,1	–	<0,1	<0,1	<0,1	<0,1
< 0,1	–	<0,1	–	<0,1	–	<0,1	<0,1	< 0,1	<0,1
< 0,1	–	<0,1	–	<0,1	–	<0,1	5,33	–	0,59
0,34	–	0,47	–	0,15	–	0,19	<0,1	0,15	0,41
0,19	–	<0,1	–	<0,1	–	<0,1	0,36	< 0,1	<0,1
–	–	–	–	–	–	–	<0,1	< 0,1	<0,1
–	–	–	–	–	–	–	–	–	–
<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
–	–	–	–	–	–	0,0083	–	–	–
–	–	–	–	–	–	<0,001	–	–	–
–	–	–	–	–	–	<0,0002	–	–	–
–	–	–	–	–	–	<0,001	–	–	–
–	–	–	–	–	–	<0,001	–	–	–
–	–	–	–	–	–	<0,001	–	–	–
–	–	–	–	–	–	<0,001	–	–	–
–	–	–	–	–	–	<0,001	–	–	–
–	–	–	–	–	–	<0,001	–	–	–
–	–	–	–	–	–	<0,001	–	–	–
<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
0,32	<0,05	0,24	0,095	0,7	<0,05	<0,05	<0,05	0,2	<0,05
<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	0,079	<0,05	<0,05
<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
<0,05	0,085	<0,05	0,32	<0,05	0,11	0,22	<0,05	<0,05	0,12
<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	1,1
<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0	<1,0

Substance/ Group of Substances	CAS no.	Limit value* µg/l	Outlet of Tallinn WWTP		Outlet of Kohtla-Järve WWTP		Outlet of Narva WWTP	
			I round µg/l	II round µg/l	I round µg/l	II round µg/l	I round µg/l	II round µg/l
Polybrominated biphenyls, diphenylethers and polybrominated organic compounds								
Tribromodiphenylether, PBDE-28	41318-75-6		<0,005	-	<0,005	-	<0,005	-
Tetrabromodiphenylether, PBDE-47	5436-43-1		<0,005	-	<0,005	-	<0,005	-
Pentabromodiphenylether, PBDE-99	60348-60-9		<0,005	-	<0,005	-	<0,005	-
Pentabromodiphenylether, PBDE-100	189084-66-0		<0,005	-	<0,005	-	<0,005	-
Hexabromodiphenylether, PBDE-138	182677-30-1		<0,005	-	<0,005	-	<0,005	-
Hexabromodiphenylether, PBDE-153	68631-49-2		<0,02	-	<0,02	-	<0,02	-
Hexabromodiphenylether, PBDE-154	207122-15-4		<0,005	-	<0,005	-	<0,005	-
Heptabromodiphenylether, PBDE-183	207122-16-5		<0,02	-	<0,02	-	<0,02	-
Heptabromodiphenylether, PBDE-190	189084-68-2		<0,1	-	<0,1	-	<0,1	-
Octabromobiphenylether, PBDE-203	32536-52-0		<0,005	-	<0,005	-	<0,005	-
Decabromobiphenylether, PBDE-209	1163-19-5		<0,1	-	<0,1	-	<0,1	-
Tetrabromobiphenyl, PBB-52	59080-37-4		<0,005	-	<0,005	-	<0,005	-
Pentabromobiphenyl, PBB-101	67888-96-4		<0,005	-	<0,005	-	<0,005	-
Hexabromobiphenyl, PBB-153	59080-40-9		<0,01	-	<0,01	-	<0,01	-
3,3',5,5'-tetrabromobisphenol A, (tetrabromobisphenol)	79-74-7		<0,005	-	<0,005	-	<0,005	-
Bromocyclene	1715-40-8		<0,005	-	<0,005	-	<0,005	-
Hexabromobenzene	87-82-1		<0,005	-	<0,005	-	<0,005	-
Hexabromocyclodecane (HBCDD)	25637-99-4		<0,200	-	<0,200	-	<0,200	-
Short- and medium-chain chlorinated paraffins								
C_{10-13} chloroalkanes (SCCP)	85535-84-8		<0,300	-	-	-	-	-
C_{14-17} chloroalkanes (MCCP)	-		<0,300	-	-	-	-	-
Perfluoro-compounds								
Perfluorooctanoic acid (PFOA)	335-67-1		<0,03	-	<0,03	-	<0,03	-
Perfluorooctane sulfonate (PFOS)	1763-23-1		<0,03	-	<0,03	-	<0,03	-
Pesticides								
alpha-hexachlorocyclohexane	319-84-6		-	-	0,0138	-	-	-
Other substances								
Sodiumtripolyphosphate	9010-08-6		<1000	-	<1000	-	<1000	-
General indicators								
Water temperature (outside)			8,9	18,1	-	21,1	-	18,4
Conductivity (outside)			1134	953	-	1853	-	798
Dissolved oxygen (O_2) (outside)			9,8	3,9	-	5	-	7,6
pH (outside)		6 – 9	7,33	6,82	-	6,96	-	7,22

* limit value pursuant to the Government of the Republic Regulation no. 269 of 31 July 2001 (last amended 01.04.2010)

Outlet of Pärnu WWTP		Outlet of Kuressaare WWTP		Outlet of Haapsalu WWTP		Outlet of Keila WWTP		Outlet of Tartu WWTP	
I round µg/l	II round µg/l	I round µg/l	II round µg/l	I round µg/l	II round µg/l	I round µg/l	II round µg/l	I round µg/l	II round µg/l
<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
<0,02	–	<0,02	–	<0,02	–	<0,02	–	<0,02	–
<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
<0,02	–	<0,02	–	<0,02	–	<0,02	–	<0,02	–
<0,1	–	<0,1	–	<0,1	–	<0,1	–	<0,1	–
<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
<0,1	–	<0,1	–	<0,1	–	<0,1	–	<0,1	–
<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–
<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
<0,200	–	<0,200	–	<0,200	–	<0,200	–	<0,200	–
<0,300	–	–	–	–	–	<0,300	–	<0,300	–
<0,300	–	<0,300	–	<0,300	–	<0,300	–	<0,300	–
–	–	–	–	<0,03	–	–	–	<0,03	–
–	–	–	–	<0,03	–	–	–	<0,03	–
–	–	–	–	–	–	–	–	–	–
<1000	–	<1000	–	<1000	–	<1000	–	<1000	–
9,4	17,9	10,1	18,1	9,2	17,1	9,5	17,5	–	–
1325	1378	1392	1222	1497	1165	1973	2310	–	–
0,9	8,2	8,7	7,2	3,7	5,2	8,6	5,8	–	–
7,21	7,49	7,57	7,62	7,33	7,33	7,47	7,16	–	–

Annex 4. Chemical analysis results for sediment and sewage sludge: Rivers

Substance/ Group of Substances	CAS no.	Unit (dry matter, DM)	River Narva monitoring station no. 32		River Kohtla, flowing into River Purtse		River Pühajõgi monitoring station no. 33 (in the mouth)		River Kunda monitoring station no. 36 (in the mouth)	
			I round	II round	I round	II round	I round	II round	I round	II round
Heavy metals										
Lead and its compounds	7439-92-1	mg/kg	6,68	–	–	–	–	–	–	–
Nickel and its compounds	7440-02-0	mg/kg	3,91	–	–	–	–	–	–	–
Mercury and its compounds	7439-97-6	mg/kg	0,03	–	–	–	–	–	–	–
Cadmium and its compounds	7440-43-9	mg/kg	<1	–	–	–	–	–	–	–
Zink and its compounds	7440-66-6	mg/kg	29	–	–	–	–	–	–	–
Chromium	7440-47-3	mg/kg	24,6	–	–	–	–	–	–	–
Copper and its compounds	7440-50-8	mg/kg	14,9	–	–	–	–	–	–	–
Arsenic and its compounds	7440-38-2	mg/kg	<2,5	–	–	–	–	–	–	–
Phenols, alkylphenols and their ethoxylates										
4-t- octylphenol-monoethoxylate	9036-19-5	µg/kg	<10	–	–	–	–	–	–	–
4-t- octylphenol-diethoxylate	–	µg/kg	<10	–	–	–	–	–	–	–
4-t- octylphenol-triethoxylate	–	µg/kg	<10	–	–	–	–	–	–	–
4-t- octylphenol-tetraethoxylate	–	µg/kg	<10	–	–	–	–	–	–	–
4-t- octylphenol-pentaethoxylate	–	µg/kg	<10	–	–	–	–	–	–	–
4-t- octylphenol-hexaethoxylate	–	µg/kg	<10	–	–	–	–	–	–	–
Isononylphenol-monoethoxylate	27986-36-3	µg/kg	<100	–	–	–	–	–	–	–
Isononylphenol-diethoxylate	20427-84-3	µg/kg	<100	–	–	–	–	–	–	–
Isononylphenol-triethoxylate	---	µg/kg	<100	–	–	–	–	–	–	–
Isononylphenol-tetraethoxylate	---	µg/kg	<100	–	–	–	–	–	–	–
Isononylphenol-pentaethoxylate	---	µg/kg	<100	–	–	–	–	–	–	–
Isononylphenol-hexaethoxylate	---	µg/kg	<100	–	–	–	–	–	–	–
4-octylphenol	1806-26-4	µg/kg	<10	–	–	–	–	–	–	–
4-tert-octylphenol	140-66-9	µg/kg	<10	–	–	–	–	–	–	–
4-nonylphenol	104-40-5	µg/kg	<10	–	–	–	–	–	–	–
Isononylphenol	25154-52-3	µg/kg	<100	–	–	–	–	–	–	–
4-tert-butylphenol	98-54-4	µg/kg	14	–	–	–	–	–	–	–
4-tert-pentylphenol	80-46-6	µg/kg	<10	–	–	–	–	–	–	–
Pentachlorophenol	87-86-5	µg/kg	< 1	–	–	–	–	–	–	–
Resorcin	108-46-3	mg/kg	< 0,5	–	–	–	< 0,5	<0,5	–	–
2,5-dimethylresorcin	488-87-9	mg/kg	1,28	–	–	–	1,59	<0,5	–	–
5-methylresorcin	504-15-4	mg/kg	< 0,5	–	–	–	< 0,5	<0,5	–	–
Phenol	108-95-2	mg/kg	0,25	–	–	–	0,15	0,16	–	–
2,3-dimethylphenol	526-75-0	mg/kg	< 0,1	–	–	–	< 0,1	<0,1	–	–
2,6-dimethylphenol	576-26-1	mg/kg	< 0,1	–	–	–	< 0,1	<0,1	–	–
3,4-dimethylphenol	95-65-8	mg/kg	< 0,1	–	–	–	< 0,1	<0,1	–	–
3,5-dimethylphenol	108-68-9	mg/kg	< 0,1	–	–	–	< 0,1	<0,1	–	–
o-cresol	95-48-7	mg/kg	< 0,1	–	–	–	< 0,1	< 0,1	–	–
p- and m-cresol (total)	106-44-5, 108-39-4	mg/kg	< 0,1	–	–	–	< 0,1	< 0,1	–	–

River Mustajõgi monitoring station no. 60		River Jägala monitoring station no. 42 (in the mouth, in Linnamäe)		River Keila monitoring station no. 47		River Vääna monitoring station no. 45 (in the mouth)”		River Vasalem-ma (the mouth of the river)		River Kasari monitoring station no. 49		River Pärnu monitoring station no. 52	
I round	II round	I round	II round	I round	II round	I round	II round	I round	II round	I round	II round	I round	II round
–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–		–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
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–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–
< 0,5	–	–	–	< 0,5	<0,5	–	–	–	–	–	–	–	–
0,78	–	–	–	3,06	7,54	–	–	–	–	–	–	–	–
< 0,5	–	–	–	< 0,5	<0,5	–	–	–	–	–	–	–	–
0,41	–	–	–	0,54	0,73	–	–	–	–	–	–	–	–
< 0,1	–	–	–	< 0,1	< 0,1	–	–	–	–	–	–	–	–
< 0,1	–	–	–	< 0,1	< 0,1	–	–	–	–	–	–	–	–
< 0,1	–	–	–	< 0,1	< 0,1	–	–	–	–	–	–	–	–
< 0,1	–	–	–	< 0,1	< 0,1	–	–	–	–	–	–	–	–
< 0,1	–	–	–	< 0,1	<0,1	–	–	–	–	–	–	–	–
0,14	–	–	–	0,47	<0,1	–	–	–	–	–	–	–	–

Substance/ Group of Substances	CAS no.	Unit (dry matter, DM)	River Narva monitoring station no. 32		River Kohtla, flowing into River Purtse		River Pühajõgi monitoring station no. 33 (in the mouth)		River Kunda monitoring station no. 36 (in the mouth)	
			I round	II round	I round	II round	I round	II round	I round	II round
Polyaromatic hydrocarbons										
Anthracene	120-12-7	µg/kg	<10	<10	-	-	-	-	-	-
Benzo(a)pyrene	50-32-8	µg/kg	17	11	-	-	-	-	-	-
Benzo(b)fluoranthene	205-99-2	µg/kg	16	<10	-	-	-	-	-	-
Benzo(k)fluoranthene	207-08-9	µg/kg	10	<10	-	-	-	-	-	-
Benzo[g,h,i]perylene	191-24-2	µg/kg	29	7,5	-	-	-	-	-	-
Indeno[1,2,3-cd]pyrene	193-39-5	µg/kg	13	5,5	-	-	-	-	-	-
Fluoranthene	206-44-0	µg/kg	57	26	-	-	-	-	-	-
Naphtalene	91-20-3	µg/kg	<10	<10	-	-	-	-	-	-
Benzo[g,h,i]perylene/Indeno[1,2,3-cd]pyrene		µg/kg	42	13	-	-	-	-	-	-
Organotin compounds										
Monobutyltin	78763-54-9	µg/kg	<1,0	-	<1,0	-	<1,0	-	<1,0	-
Dibutyltin	1002-53-5	µg/kg	<1,0	-	<1,0	-	<1,0	-	<1,0	-
Tributyltin	3664-73-3	µg/kg	<0,2	-	<0,2	-	<0,2	-	<0,2	-
Tetrabutyltin	1461-25-2	µg/kg	<1,0	-	<1,0	-	<1,0	-	<1,0	-
Monooctyltin	---	µg/kg	<1,0	-	<1,0	-	<1,0	-	<1,0	-
Dioctyltin	94410-05-6	µg/kg	<1,0	-	<1,0	-	<1,0	-	<1,0	-
Tricyclohexyltin	6056-50-4	µg/kg	<1,0	-	<1,0	-	<1,0	-	<1,0	-
Monophenyltin	2406-68-0	µg/kg	<1,0	-	<1,0	-	<1,0	-	<1,0	-
Diphenyltin	6381-06-2	µg/kg	<1,0	-	<1,0	-	<1,0	-	<1,0	-
Triphenyltin	668-34-8	µg/kg	<1,0	-	<1,0	-	<1,0	-	<1,0	-
Phthalates										
Dimethylphthalate	113-11-3	µg/kg	<50	-	-	-	-	-	-	-
Diethylphthalate	84-66-2	µg/kg	<50	-	-	-	-	-	-	-
Benzylbenzonate	120-51-4	µg/kg	<50	-	-	-	-	-	-	-
Diisobutylphthalate	84-69-5	µg/kg	<50	-	-	-	-	-	-	-
Dibutylphthalate	84-74-2	µg/kg	<50	-	-	-	-	-	-	-
Dimetoxyethylphthalate	117-82-8	µg/kg	<50	-	-	-	-	-	-	-
Diisohexylphthalate	---	µg/kg	<50	-	-	-	-	-	-	-
Di-2-ethoxyethylphthalate	605-54-9	µg/kg	<50	-	-	-	-	-	-	-
Dipentylphthalate	131-18-0	µg/kg	<50	-	-	-	-	-	-	-
Benzylbutylphthalate	85-68-7	µg/kg	<50	-	-	-	-	-	-	-
Hexyl-2-etylhexylphthalate	---	µg/kg	<50	-	-	-	-	-	-	-
Dibutoxyethylphthalate	117-83-9	µg/kg	<50	-	-	-	-	-	-	-
Dicyclohexylphthalate	84-61-7	µg/kg	<50	-	-	-	-	-	-	-
Di(2-ethylhexyl)phthalate (DEHP)	117-81-7	µg/kg	<50	-	-	-	-	-	-	-
Diisononylphthalate	28553-12-0	µg/kg	<50	-	-	-	-	-	-	-
Di-n-octylphthalate	117-84-0	µg/kg	<50	-	-	-	-	-	-	-
Diisodecylphthalate	26761-40-0	µg/kg	<1000	-	-	-	-	-	-	-

River Mustajõgi monitoring station no. 60		River Jägala monitoring station no. 42 (in the mouth, in Linnamäe)		River Keila monitoring station no. 47		River Vääna monitoring station no. 45 (in the mouth)”		River Vasalem-ma (the mouth of the river)		River Kasari monitoring station no. 49		River Pärnu monitoring station no. 52	
I round	II round	I round	II round	I round	II round	I round	II round	I round	II round	I round	II round	I round	II round
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<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–
<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–
<0,2	–	<0,2	–	<0,2	–	<0,2	–	<0,2	–	<0,2	–	<0,2	–
<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–
<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–
<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–
<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–
<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–
<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–
<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–	<1,0	–
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Substance/ Group of Substances	CAS no.	Unit (dry matter, DM)	River Narva monitoring station no. 32		River Kohtla, flowing into River Purtse		River Pühajõgi monitoring station no. 33 (in the mouth)		River Kunda monitoring station no. 36 (in the mouth)	
			I round	II round	I round	II round	I round	II round	I round	II round
Polybrominated biphenyls, diphenylethers and polybrominated organic compounds										
Decabromodiphenylether, PBDE-209	1163-19-5	µg/kg	<100	–	–	–	–	–	–	–
Heptabromodiphenylether, PBDE-183	207122-16-5	µg/kg	<20	–	–	–	–	–	–	–
Heptabromodiphenylether,PBDE-190	189084-68-2	µg/kg	<100	–	–	–	–	–	–	–
Hexabromobiphenyl, PBB-153	59080-40-9	µg/kg	<10	–	–	–	–	–	–	–
Hexabromodiphenylether, PBDE-138	182677-30-1	µg/kg	<5	–	–	–	–	–	–	–
Hexabromodiphenylether, PBDE-153	68631-49-2	µg/kg	<20	–	–	–	–	–	–	–
Hexabromodiphenylether, PBDE-154	207122-15-4	µg/kg	<5	–	–	–	–	–	–	–
Octabromodiphenylether, PBDE-203	32536-52-0	µg/kg	<5	–	–	–	–	–	–	–
Pentabromobiphenyl, PBB-101	67888-96-4	µg/kg	<5	–	–	–	–	–	–	–
Pentabromodiphenylether, PBDE-100	189084-66-0	µg/kg	<5	–	–	–	–	–	–	–
Pentabromodiphenylether, PBDE-99	60348-60-9	µg/kg	<5	–	–	–	–	–	–	–
Octabromodiphenylethers (the sum)		µg/kg	<50	–	–	–	–	–	–	–
Octabromodiphenylethers (the sum)		µg/kg	<5	–	–	–	–	–	–	–
Tetrabromobiphenyl, PBB-52	59080-37-4	µg/kg	<5	–	–	–	–	–	–	–
Tetrabromodiphenylether, PBDE-47	5436-43-1	µg/kg	<5	–	–	–	–	–	–	–
Tribromodiphenylether, PBDE-28	---	µg/kg	<5	–	–	–	–	–	–	–
3,3',5,5'-tetrabromobisphenol A (TBBPA)	79-94-7	µg/kg	<5	–	–	–	–	–	–	–
Bromocyclene		µg/kg	<5	–	–	–	–	–	–	–
Hexabromobenzene	87-82-1	µg/kg	<5	–	–	–	–	–	–	–
Hexabromocyclodecane	25637-99-4	µg/kg	<200	–	–	–	–	–	–	–
Short- and medium-chain chlorinated paraffins										
C14-17 chloroalkanes (MCCP)		µg/kg	<300	–	–	–	–	–	–	–
C10-13 chloroalkanes (SCCP)	**85535-84-8**	µg/kg	<300	–	–	–	–	–	–	–
Other substances										
Cyanides	57-12-5	mg/kg	< 0,5	–	–	–	–	–	–	–

River Mustajõgi monitoring station no. 60		River Jägala monitoring station no. 42 (in the mouth, in Linnamäe)		River Keila monitoring station no. 47		River Vääna monitoring station no. 45 (in the mouth)”		River Vasalemma (the mouth of the river)		River Kasari monitoring station no. 49		River Pärnu monitoring station no. 52	
I round	II round	I round	II round	I round	II round	I round	II round	I round	II round	I round	II round	I round	II round
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Annex 4. Chemical analysis results for sediment and sewage sludge: Lakes

Substance/ Group of Substances	CAS no.	Unit (dry matter, DM)	Monitoring point of Lake Peipus no. 17		Monitoring point of Lake Peipus no. 38	
			I round	II round	I round	II round
Heavy metals						
Lead and its compounds	7439-92-1	mg/kg	<2	5,47	<2	–
Nickel and its compounds	7440-02-0	mg/kg	2,37	12,2	<1	–
Mercury and its compounds	7439-97-6	mg/kg	< 0,02	0,05	< 0,02	–
Cadmium and its compounds	7440-43-9	mg/kg	<1	1,7	<1	–
Zink and its compounds	7440-66-6	mg/kg	14,5	49,1	3,26	–
Chromium	7440-47-3	mg/kg	3,71	17,8	1,21	–
Copper and its compounds	7440-50-8	mg/kg	6,29	9,86	6,52	–
Arsenic and its compounds	7440-38-2	mg/kg	<2,5	<2,5	<2,5	–
Phenols, alkylphenols and their ethoxylates						
4-t- octylphenol-monoethoxylate	–	μg/kg	<10	–	<10	–
4-t- octylphenol-diethoxylate	–	μg/kg	<10	–	<10	–
4-t- octylphenol-triethylethoxylate	–	μg/kg	<10	–	<10	–
4-t- octylphenol-tetraethylethoxylate	–	μg/kg	<10	–	<10	–
4-t- octylphenol-pentaethylethoxylate	–	μg/kg	<10	–	<10	–
4-t- octylphenol-hexaethylethoxylate	–	μg/kg	<10	–	<10	–
Isononylphenol-monoethoxylate	–	μg/kg	<100	–	<100	–
Isononylphenol-diethoxylate	–	μg/kg	<100	–	<100	–
Isononylphenol-triethoxylate	–	μg/kg	<100	–	<100	–
Isononylphenol-tetraethoxylate	–	μg/kg	<100	–	<100	–
Isononylphenol-pentaethoxylate	–	μg/kg	<100	–	<100	–
Isononylphenol-hexaethoxylate	–	μg/kg	<100	–	<100	–
4-octylphenol	1806-26-4	μg/kg	<10	–	<10	–
4-tert-octylphenol	140-66-9	μg/kg	<10	–	<10	–
4-nonylphenol	104-40-5	μg/kg	<10	–	<10	–
Isononylphenol	11066-49-2	μg/kg	<100	–	<100	–
4-tert-butylphenol	98-54-4	μg/kg	<10	–	<10	–
4-tert-pentylphenol	80-46-6	μg/kg	<10	–	<10	–
Pentachlorophenol	87-86-5	μg/kg	< 1	–	< 1	–
Resorcin	108-46-3	mg/kg	< 0,5	–	< 0,5	–
2,5-dimethylresorcin	488-87-9	mg/kg	1,17	–	0,72	–
5-methylresorcin	504-15-4	mg/kg	< 0,5	–	< 0,5	–
Phenol	108-95-2	mg/kg	0,2	–	0,16	–
2,3-dimethylphenol	526-75-0	mg/kg	< 0,1	–	< 0,1	–
2,6-dimethylphenol	576-26-1	mg/kg	< 0,1	–	< 0,1	–

Substance/ Group of Substances	CAS no.	Unit (dry matter, DM)	Monitoring point of Lake Peipus no. 17		Monitoring point of Lake Peipus no. 38	
			I round	II round	I round	II round
3,4-dimethylphenol	95-65-8	mg/kg	< 0,1	–	< 0,1	–
3,5-dimethylphenol	108-68-9	mg/kg	< 0,1	–	< 0,1	–
o-cresol	95-48-7	mg/kg	< 0,1	–	< 0,1	–
p- and m-cresol (the sum)	106-44-5, 108-39-4	mg/kg	< 0,1	–	< 0,1	–
Polyaromatic hydrocarbons						
Anthracene	120-12-7	µg/kg	<10	–	<10	–
Benzo(a)pyrene	50-32-8	µg/kg	<10	–	<10	–
Benzo(b)fluoranthene	205-99-2	µg/kg	<10	–	<10	–
Benzo(k)fluoranthene	207-08-9	µg/kg	<10	–	<10	–
Fluoranthene	206-44-0	µg/kg	<10	–	<10	–
Naphtalene	91-20-3	µg/kg	<10	–	<10	–
Benzo[g,h,i]perylene	191-24-2	µg/kg	<2,0	–	<2,0	–
Indeno[1,2,3-cd]pyrene	193-39-5	µg/kg	<2,0	–	<2,0	–
Sum Benzo[g,h,i]perylene/Indeno[1,2,3-cd]pyrene		µg/kg	<2,0	–	<2,0	–
Organotin compounds						
Monobutyltin	78763-54-9	µg/kg	<1,0	–	<1,0	–
Dibutyltin	1002-53-5	µg/kg	<1,0	–	<1,0	–
Tributyltin	3664-73-3	µg/kg	<0,2	–	<0,2	–
Tetrabutyltin	1461-25-2	µg/kg	<1,0	–	<1,0	–
Monooctyltin	---	µg/kg	<1,0	–	<1,0	–
Dioctyltin	94410-05-6	µg/kg	<1,0	–	<1,0	–
Tricyclohexyltin	6056-50-4	µg/kg	<1,0	–	<1,0	–
Monophenyltin	2406-68-0	µg/kg	<1,0	–	<1,0	–
Diphenyltin	6381-06-2	µg/kg	<1,0	–	<1,0	–
Triphenyltin	668-34-8	µg/kg	<1,0	–	<1,0	–
Phthalates						
Dimethylphthalate	113-11-3	µg/kg	<50	–	<50	–
Diethylphthalate	84-66-2	µg/kg	<50	–	<50	–
Benzylbenzonate	120-51-4	µg/kg	<50	–	<50	–
Diisobutylphthalate	84-69-5	µg/kg	<50	–	<50	–
Dibutylphthalate	84-74-2	µg/kg	<50	–	<50	–
Dimetoxyethylphthalate	117-82-8	µg/kg	<50	–	<50	–
Diisohexylphthalate	---	µg/kg	<50	–	<50	–
Di-2-ethoxyethylphthalate	605-54-9	µg/kg	<50	–	<50	–
Dipentylphthalate	131-18-0	µg/kg	<50	–	<50	–
Benzylbutylphthalate	85-68-7	µg/kg	<50	–	<50	–
Hexyl-2-etylhexylphthalate	---	µg/kg	<50	–	<50	–
Dibutoxyethylphthalate	117-83-9	µg/kg	<50	–	<50	–
Dicyclohexylphthalate	84-61-7	µg/kg	<50	–	<50	–

Substance/ Group of Substances	CAS no.	Unit (dry matter, DM)	Monitoring point of Lake Peipus no. 17		Monitoring point of Lake Peipus no. 38	
			I round	II round	I round	II round
Di(2-ethylhexyl)phthalate (DEHP)	117-81-7	µg/kg	<50	-	<50	-
Diisononylphthalate	28553-12-0	µg/kg	<50	-	<50	-
Di-n-octylphthalate	117-84-0	µg/kg	<50	-	<50	-
Diisodecylphthalate	26761-40-0	µg/kg	<1000	-	<1000	-
Polybrominated biphenyls, diphenylethers and polybrominated organic compounds						
Decabromodiphenylether, PBDE-209	1163-19-5	µg/kg	<100	-	<100	-
Heptabromodiphenylether, PBDE-183	207122-16-5	µg/kg	<20	-	<20	-
Heptabromodiphenylether, PBDE-190	189084-68-2	µg/kg	<100	-	<100	-
Hexabromobiphenyl, PBB-153	59080-40-9	µg/kg	<10	-	<10	-
Hexabromodiphenylether, PBDE-138	182677-30-1	µg/kg	<5	-	<5	-
Hexabromodiphenylether, PBDE-153	68631-49-2	µg/kg	<20	-	<20	-
Hexabromodiphenylether, PBDE-154	207122-15-4	µg/kg	<5	-	<5	-
Octabromodiphenylether, PBDE-203	32536-52-0	µg/kg	<5	-	<5	-
Pentabromobiphenyl, PBB-101	67888-96-4	µg/kg	<5	-	<5	-
Pentabromodiphenylether, PBDE-100	189084-66-0	µg/kg	<5	-	<5	-
Pentabromodiphenylether, PBDE-99	60348-60-9	µg/kg	<5	-	<5	-
Octabromodiphenylethers (the sum)		µg/kg	<50	-	<50	-
Octabromodiphenylethers (the sum)		µg/kg	<5	-	<5	-
Tetrabromobiphenyl, PBB-52	59080-37-4	µg/kg	<5	-	<5	-
Tetrabromodiphenylether, PBDE-47	5436-43-1	µg/kg	<5	-	<5	-
Tribromodiphenylether, PBDE-28	---	µg/kg	<5	-	<5	-
3,3',5,5'-tetrabromobisphenol A (TBBPA)	79-94-7	µg/kg	<5	-	<5	-
Bromocyclene	1715-40-8	µg/kg	<5	-	<5	-
Hexabromobenzene	87-82-1	µg/kg	<5	-	<5	-
Hexabromocyclodecane	25637-99-4	µg/kg	<200	-	<200	-
Short- and medium-chain chlorinated paraffins						
C10-13 chloroalkanes (SCCP)	85535-84-8	µg/kg	<300	-	<300	-
C14-17 chloroalkanes (MCCP)	85535-85-9	µg/kg	<300	-	<300	-
Other substances						
Cyanides	57-12-5	mg/kg	< 0,5	-	< 0,5	-

Annex 4. Chemical analysis results for sediment and sewage sludge: Coastal regions

Substance/ Group of Substances	CAS no.	Unit (dry matter, DM)	Coast of Sillamäe, Sillamäe bay		BLRT Grupp AS, Tallinn bay Baltic Premator dock no. 2 outlet		BLRT Grupp AS, Baltic Premator 50 m from dock no 2 outlet	
			I round	II round	I round	II round	I round	II round
Heavy metals								
Lead and its compounds	7439-92-1	mg/kg	8,82	-	-	-	-	-
Nickel and its compounds	7440-02-0	mg/kg	4,91	-	-	-	-	-
Mercury and its compounds	7439-97-6	mg/kg	< 0,02	-	-	-	-	-
Cadmium and its compounds	7440-43-9	mg/kg	<1	-	-	-	-	-
Zink and its compounds	7440-66-6	mg/kg	57,3	-	-	-	-	-
Chromium	7440-47-3	mg/kg	3,95	-	-	-	-	-
Copper and its compounds	7440-50-8	mg/kg	20	-	-	-	-	-
Arsenic and its compounds	7440-38-2	mg/kg	9,36	-	-	-	-	-
Phenols, alkylphenols and their ethoxylates								
4-t- octylphenol-monoethoxylate		µg/kg	<10	-	-	-	-	-
4-t- octylphenol-diethoxylate		µg/kg	<10	-	-	-	-	-
4-t- octylphenol-triethylethoxylate		µg/kg	<10	-	-	-	-	-
4-t- octylphenol-tetraethylethoxylate	---	µg/kg	<10	-	-	-	-	-
4-t- octylphenol-pentaethylethoxylate	---	µg/kg	<10	-	-	-	-	-
4-t- octylphenol-hexaethylethoxylate	---	µg/kg	<10	-	-	-	-	-
Isononylphenol-monoethoxylate	---	µg/kg	<100	-	-	-	-	-
Isononylphenol-diethoxylate	---	µg/kg	<100	-	-	-	-	-
Isononylphenol-triethoxylate	---	µg/kg	<100	-	-	-	-	-
Isononylphenol-tetraethoxylate	---	µg/kg	<100	-	-	-	-	-
Isononylphenol-pentaethoxylate	---	µg/kg	<100	-	-	-	-	-
Isononylphenol-hexaethoxylate	---	µg/kg	<100	-	-	-	-	-
4-octylphenol	1806-26-4	µg/kg	<10	-	-	-	-	-
4-tert-octylphenol	140-66-9	µg/kg	<10	-	-	-	-	-
4-nonylphenol	104-40-5	µg/kg	<10	-	-	-	-	-
Isononylphenol	11066-49-2	µg/kg	<100	-	-	-	-	-
4-tert-butylphenol	98-54-4	µg/kg	<10	-	-	-	-	-
4-tert-pentylphenol	80-46-6	µg/kg	<10	-	-	-	-	-
Pentachlorophenol	87-86-5	µg/kg	< 1	-	-	-	-	-
Resorcin	108-46-3	mg/kg	< 0,5	-	-	-	-	-
2,5-dimethylresorcin	488-87-9	mg/kg	0,79	-	-	-	-	-
5-methylresorcin	504-15-4	mg/kg	< 0,5	-	-	-	-	-
Phenol	108-95-2	mg/kg	< 0,1	-	-	-	-	-
2,3-dimethylphenol	526-75-0	mg/kg	< 0,1	-	-	-	-	-

Substance/ Group of Substances	CAS no.	Unit (dry matter, DM)	Coast of Sillamäe, Sillamäe bay		BLRT Grupp AS, Tallinn bay Baltic Premator dock no. 2 outlet		BLRT Grupp AS, Baltic Premator 50 m from dock no 2 outlet	
			I round	II round	I round	II round	I round	II round
2,6-dimethylphenol	576-26-1	mg/kg	< 0,1	–	–	–	–	–
3,4-dimethylphenol	95-65-8	mg/kg	< 0,1	–	–	–	–	–
3,5-dimethylphenol	108-68-9	mg/kg	< 0,1	–	–	–	–	–
o-cresol	95-48-7	mg/kg	< 0,1	–	–	–	–	–
p- and m-cresol (the sum)	106-44-5, 108-39-4	mg/kg	< 0,1	–	–	–	–	–
Polyaromatic hydrocarbons								
Anthracene	120-12-7	µg/kg	<10	–	–	–	–	–
Benzo(a)pyrene	50-32-8	µg/kg	<10	–	–	–	–	–
Benzo(b)fluoranthene	205-99-2	µg/kg	<10	–	–	–	–	–
Benzo(k)fluoranthene	207-08-9	µg/kg	<10	–	–	–	–	–
Benzo[g,h,i]perylene	191-24-2	µg/kg	<2,0	–	–	–	–	–
Indeno[1,2,3-cd]pyrene	193-39-5	µg/kg	<2,0	–	–	–	–	–
Fluoranthene	206-44-0	µg/kg	<10	–	–	–	–	–
Naphtalene	91-20-3	µg/kg	<10	–	–	–	–	–
Benzo[g,h,i]perylene/Indeno[1,2,3-cd] pyrene		µg/kg	<2,0	–	–	–	–	–
Organotin compounds								
Monobutyltin	78763-54-9	µg/kg	<1,0	–	–	152	–	45
Dibutyltin	1002-53-5	µg/kg	<1,0	–	–	1510	–	322
Tributyltin	3664-73-3	µg/kg	<0,2	–	–	22500	–	4490
Tetrabutyltin	1461-25-2	µg/kg	<1,0	–	–	27	–	4
Monooctyltin	---	µg/kg	<1,0	–	–	<1,0	–	<1,0
Dioctyltin	94410-05-6	µg/kg	<1,0	–	–	<1,0	–	<1,0
Tricyclohexyltin	6056-50-4	µg/kg	<1,0	–	–	<1,0	–	<1,0
Monophenyltin	2406-68-0	µg/kg	<1,0	–	–	59	–	8,6
Diphenyltin	6381-06-2	µg/kg	<1,0	–	–	34	–	4,1
Triphenyltin	668-34-8	µg/kg	<1,0	–	–	15	–	<1,0
Phthalates								
Dimethylphthalate	113-11-3	µg/kg	<50	–	–	–	–	–
Diethylphthalate	84-66-2	µg/kg	<50	–	–	–	–	–
Benzylbenzonate	120-51-4	µg/kg	<50	–	–	–	–	–
Diisobutylphthalate	84-69-5	µg/kg	<50	–	–	–	–	–
Dibutylphthalate	84-74-2	µg/kg	<50	–	–	–	–	–
Dimetoxyethylphthalate	117-82-8	µg/kg	<50	–	–	–	–	–
Diisohexylphthalate	---	µg/kg	<50	–	–	–	–	–
Di-2-ethoxyethylphthalate	605-54-9	µg/kg	<50	–	–	–	–	–
Dipentylphthalate	131-18-0	µg/kg	<50	–	–	–	–	–
Benzylbutylphthalate	85-68-7	µg/kg	<50	–	–	–	–	–
Hexyl-2-etylhexylphthalate	---	µg/kg	<50	–	–	–	–	–

Substance/ Group of Substances	CAS no.	Unit (dry matter, DM)	Coast of Sillamäe, Sillamäe bay		BLRT Grupp AS, Tallinn bay Baltic Premator dock no. 2 outlet		BLRT Grupp AS, Baltic Premator 50 m from dock no 2 outlet	
			I round	II round	I round	II round	I round	II round
Dibutoxyethylphthalate	117-83-9	µg/kg	<50	–	–	–	–	–
Dicyclohexylphthalate	84-61-7	µg/kg	<50	–	–	–	–	–
Di(2-ethylhexyl)phthalate (DEHP)	117-81-7	µg/kg	<50	–	–	–	–	–
Diisononylphthalate	28553-12-0	µg/kg	<50	–	–	–	–	–
Di-n-octylphthalate	117-84-0	µg/kg	<50	–	–	–	–	–
Diisodecylphthalate	26761-40-0	µg/kg	<1000	–	–	–	–	–
Polybrominated biphenyls, diphenylethers and polybrominated organic compounds								
Decabromodiphenylether, PBDE-209	1163-19-5	µg/kg	<100	–	–	–	–	–
Heptabromodiphenylether, PBDE-183	207122-16-5	µg/kg	<20	–	–	–	–	–
Heptabromodiphenylether, PBDE-190	189084-68-2	µg/kg	<100	–	–	–	–	–
Hexabromobiphenyl, PBB-153	59080-40-9	µg/kg	<10	–	–	–	–	–
Hexabromodiphenylether, PBDE-138	182677-30-1	µg/kg	<5	–	–	–	–	–
Hexabromodiphenylether, PBDE-153	68631-49-2	µg/kg	<20	–	–	–	–	–
Hexabromodiphenylether, PBDE-154	207122-15-4	µg/kg	<5	–	–	–	–	–
Octabromodiphenylether, PBDE-203	32536-52-0	µg/kg	<5	–	–	–	–	–
Pentabromobiphenyl, PBB-101	67888-96-4	µg/kg	<5	–	–	–	–	–
Pentabromodiphenylether, PBDE-100	189084-66-0	µg/kg	<5	–	–	–	–	–
Pentabromodiphenylether, PBDE-99	60348-60-9	µg/kg	<5	–	–	–	–	–
Octabromodiphenylethers (the sum)		µg/kg	<50	–	–	–	–	–
Octabromodiphenylethers (the sum)		µg/kg	<5	–	–	–	–	–
Tetrabromobiphenyl, PBB-52	59080-37-4	µg/kg	<5	–	–	–	–	–
Tetrabromodiphenylether, PBDE-47	5436-43-1	µg/kg	<5	–	–	–	–	–
Tribromodiphenylether, PBDE-28	---	µg/kg	<5	–	–	–	–	–
3,3',5,5'-tetrabromobisphenol A (TBBPA)		µg/kg	<5	–	–	–	–	–
Bromocyclene	1715-40-8	µg/kg	<5	–	–	–	–	–
Hexabromobenzene	87-82-1	µg/kg	<5	–	–	–	–	–
Hexabromocyclodecane	25637-99-4	µg/kg	<200	–	–	–	–	–
Hexabromobiphenyl, PBB-153	59080-40-9	µg/kg	<10					
Short- and medium-chain chlorinated paraffins								
C_{10-13} chloroalkanes (SCCP)	85535-84-8	µg/kg	<300	–	–	–	–	–
C_{14-17} chloroalkanes (MCCP)	85535-85-9	µg/kg	<300	–	–	–	–	–
Other substances								
Cyanides	57-12-5	mg/kg	< 0,5	–	–	–	–	–

Annex 4. Chemical analysis results for sediment and sewage sludge: Waste water treatment plants

Substance/ Group of Substances	CAS no.	Limit value*	Unit (dry matter, DM)	Outlet of Tallinn WWTP		Outlet of Kohtla-Järve WWTP		Outlet of Narva WWTP	
				I round	II round	I round	II round	I round	II round
Heavy metals									
Lead and its compounds	7439-92-1	750	mg/kg	22,6	29	11,3	13,9	39	29,1
Nickel and its compounds	7440-02-0	300	mg/kg	32,9	54	27,8	38,9	11,5	53,4
Mercury and its compounds	7439-97-6	16	mg/kg	0,66	0,56	0,54	0,26	0,47	0,19
Cadmium and its compounds	7440-43-9	20	mg/kg	1,79	2,1	1,03	1,46	1,73	5,74
Zink and its compounds	7440-66-6	2500	mg/kg	424	580	194	392	534	378
Chromium	7440-47-3	1000	mg/kg	89,2	94	30,4	39,6	31,8	1221
Copper and its compounds	7440-50-8	1000	mg/kg	242	217	231	79,2	435	341
Arsenic and its compounds	7440-38-2		mg/kg	<2,5	<2,5	9,26	7,08	<2,5	<2,5
Phenols, alkylphenols and their ethoxylates									
4-t- octylphenol-monoethoxylate	-		mg/kg	0,037	0,045	<0,001	-	<0,001	-
4-t- octylphenol-tetraethoxylate	-		mg/kg	<0,001	<0,001	<0,001	-	<0,001	-
Isononylphenol-monoethoxylate	27986-36-3		mg/kg	2,59	5,14	<0,1	-	<0,1	-
Isononylphenol-diethoxylate	20427-84-3		mg/kg	0,37	<0,1	<0,1	-	<0,1	-
4-octylphenol	1806-26-4		mg/kg	<0,001	<0,001	<0,001	-	<0,001	-
4-tert-octylphenol	140-66-9		mg/kg	0,28	0,44	<0,001	-	0,041	-
4-nonylphenol	104-40-5		mg/kg	<0,001	<0,001	<0,001	-	<0,001	-
Isononylphenol	25154-52-3		mg/kg	5,2	12	<0,1	-	0,64	-
4-tert-butylphenol	98-54-4		mg/kg	0,042	0,022	<0,001	-	<0,001	-
4-tert-pentylphenol	80-46-6		mg/kg	0,013	<0,001	<0,001	-	0,018	-
4-t- octylphenol-pentaethoxylate	-		mg/kg	<0,001	<0,001	<0,001	-	<0,001	-
4-t- octylphenol-hexaethoxylate	-		mg/kg	<0,001	<0,001	<0,001	-	<0,001	-
Isononylphenol-triethoxylate	-		mg/kg	<0,1	<0,1	<0,1	-	<0,1	-
Isononylphenol-tetraethoxylate	-		mg/kg	<0,1	<0,1	<0,1	-	<0,1	-
Isononylphenol-pentaethoxylate	-		mg/kg	<0,1	<0,1	<0,1	-	<0,1	-
Isononylphenol-hexaethoxylate	-		mg/kg	<0,1	<0,1	<0,1	-	<0,1	-
Pentachlorophenol	87-86-5		mg/kg	< 0,001	0,179	< 0,001	< 0,001	< 0,001	0,449
2,3-dimethylphenol	526-75-0		mg/kg	2,18	<0,1	-	<0,1	-	-
2,6-dimethylphenol	576-26-1		mg/kg	0,23	<0,1	-	<0,1	-	-
3,4-dimethylphenol	95-65-8		mg/kg	0,22	<0,1	-	<0,1	-	-
3,5-dimethylphenol	108-68-9		mg/kg	0,21	3,53	-	<0,1	-	-
Phenol	108-95-2		mg/kg	0,68	3,74	-	5,36	-	-
o-cresol	95-48-7		mg/kg	0,13	<0,1	-	<0,1	-	-
p- and m-cresol (the sum)	-		mg/kg	1,03	<0,1	-	466	-	-
Resorcin	108-46-3		mg/kg	4,6	<0,5	-	<0,5	-	-
2,5-dimethylresorcin	95-87-4		mg/kg	26,2	306	-	39	-	-

Outlet of Pärnu WWTP		Outlet of Kuressaare WWTP		Outlet of Haapsalu WWTP		Outlet of Keila WWTP		Outlet of Tartu WWTP	
I round	II round	I round	II round	I round	II round	I round	II round	I round	II round
19,9	30,1	20,6	15,4	12,4	11,5	11,8	10,2	12,9	23,4
16,5	29	8,06	10,4	10,5	15,6	46	11	164	14,7
0,63	1,01	0,39	0,43	0,26	0,44	0,28	0,45	0,44	0,6
1,2	1,57	<1	<1	2,7	<1	1,15	<1	<1	<1
745	706	454	411	437	413	615	520	525	547
36	59,3	18,8	24,4	20,7	23,3	1155	3902	37,6	37,7
441	237	499	231	246	73	64,5	133	154	163
	4,12	–	2,95	–	<2,5	<2,5	<2,5	–	3,39
–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–
< 0,001	0,0387	0,0195	–	0,0021	–	0,0068	0,599	–	–
–	1,09	–	–	–	–	–	32,9	–	–
–	<0,1	–	–	–	–	–	<0,1	–	–
–	0,43	–	–	–	–	–	<0,1	–	–
–	0,37	–	–	–	–	–	<0,1	–	–
–	1,08	–	–	–	–	–	19,3	–	–
–	0,19	–	–	–	–	–	<0,1	–	–
–	7,98	–	–	–	–	–	9,08	–	–
–	4,14	–	–	–	–	–	29,4	–	–
–	44,5	–	–	–	–	–	573	–	–

Substance/ Group of Substances	CAS no.	Limit value*	Unit (dry matter, DM)	Outlet of Tallinn WWTP		Outlet of Kohtla-Järve WWTP		Outlet of Narva WWTP	
				I round	II round	I round	II round	I round	II round
5-methylresorcin	504-15-4		mg/kg	0,57	<0,5	–	<0,5	–	–
Polyaromatic hydrocarbons									
Anthracene	120-12-7		mg/kg	0,179	–	0,024	–	–	–
Benzo(a)pyrene	50-32-8		mg/kg	0,308	–	0,126	–	0,184	–
Benzo(b)fluoranthene	205-99-2		mg/kg	0,297	–	0,059	–	0,137	–
Benzo(k)fluoranthene	207-08-9		mg/kg	0,242	–	0,027	–	0,087	–
Fluoranthene	206-44-0		mg/kg	<0,3	–	0,044	–	0,248	–
Benzo[g,h,i]perylene	191-24-2		mg/kg	1,302	–	0,165	–	0,326	–
Indeno[1,2,3-cd]pyrene	193-39-5		mg/kg	0,323	–	0,066	–	0,125	–
Benzo[g,h,i]perylene/Indeno[1,2,3-cd]pyrene (the sum)	–		mg/kg	1,625	–	0,231	–	0,451	–
Naphtalene	91-20-3		mg/kg	0,547	–	0,068	–	<0,01	–
Organotin compounds									
Monobutyltin	78763-54-9		mg/kg	0,191	0,068	0,033	0,04	0,152	0,017
Dibutyltin	1002-53-5		mg/kg	0,193	0,135	0,024	0,017	0,12	0,036
Tributyltin	688-73-3		mg/kg	0,016	0,031	<0,0002	<0,0002	0,0038	<0,0002
Tetrabutyltin	1461-25-2		mg/kg	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Monooctyltin	–		mg/kg	0,038	0,0089	0,0038	<0,01	0,039	<0,01
Dioctyltin	94410-05-6		mg/kg	0,023	0,011	<0,01	<0,01	0,056	<0,01
Tricyclohexyltin	6056-50-4		mg/kg	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Monophenyltin	2406-68-0		mg/kg	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Diphenyltin	6381-06-2		mg/kg	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Triphenyltin	668-34-8		mg/kg	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Phthalates									
Dimethylphthalate	113-11-3		mg/kg	<0,050	<0,050	<0,050	<0,050	<0,050	<0,050
Diethylphthalate	84-66-2		mg/kg	<0,050	<0,050	<0,050	0,23	<0,050	230
Benzylbenzonate	120-51-4		mg/kg	<0,050	<0,050	<0,050	<0,050	<0,050	<0,050
Diisobutylphthalate	84-69-5		mg/kg	0,11	0,11	<0,050	0,07	0,17	0,07
Dibutylphthalate	84-74-2		mg/kg	<0,050	<100	<0,050	0,28	1,2	0,28
Dimetoxyethylphthalate	117-82-8		mg/kg	<0,050	<0,050	<0,050	<0,050	<0,050	<0,050
Diisohexylphthalate	–		mg/kg	<0,050	<0,050	<0,050	<0,050	<0,050	<0,050
Di-2-ethoxyethylphthalate	605-54-9		mg/kg	<0,050	<0,050	<0,050	<0,050	<0,050	<0,050
Dipentylphthalate	131-18-0		mg/kg	<0,050	<0,050	<0,050	<0,050	<0,050	<0,050
Benzylbutylphthalate	85-68-7		mg/kg	<0,050	<0,050	<0,050	<0,050	0,33	<0,050
Hexyl-2-etylhexylphthalate	–		mg/kg	<0,050	<0,050	<0,050	<0,050	<0,050	<0,050
Dibutoxyethylphthalate	117-83-9		mg/kg	<0,050	<0,050	<0,050	<0,050	<0,050	<0,050
Dicyclohexylphthalate	84-61-7		mg/kg	<0,050	<0,050	<0,050	<0,050	<0,050	<0,050
Di(2-ethylhexyl)phthalate (DEHP)	117-81-7		mg/kg	45	39	22	19	33	19
Diisononylphthalate	28553-12-0		mg/kg	46	32	9,5	4,5	10	4,5
Di-n-octylphthalate	117-84-0		mg/kg	<0,050	<0,050	<0,050	<0,050	<0,050	<0,050

Outlet of Pärnu WWTP		Outlet of Kuressaare WWTP		Outlet of Haapsalu WWTP		Outlet of Keila WWTP		Outlet of Tartu WWTP	
I round	II round	I round	II round	I round	II round	I round	II round	I round	II round
–	<0,5	–	–	–	–	–	<0,5	–	–
0,065	–	0,041	–	–	–	0,051	–	0,39	–
0,294	–	0,1	–	0,127	–	0,227	–	0,153	–
0,246	–	0,086	–	0,102	–	0,157	–	0,172	–
0,157	–	0,059	–	0,068	–	0,125	–	0,116	–
0,405	–	0,33	–	0,233	–	0,385	–	0,507	–
0,536	–	0,22	–	0,225	–	0,472	–	0,582	–
0,229	–	0,093	–	0,092	–	0,146	–	0,184	–
0,765	–	0,313	–	0,317	–	0,618	–	0,766	–
0,026	–	<0,01	–	<0,01	–	0,014	–	<0,01	–
0,108	–	0,096	–	0,103	–	0,237	0,098	0,09	–
0,084	–	0,094	–	0,269	–	0,143	0,061	0,1	–
0,0081	–	0,0065	–	0,013	–	0,0079	0,0069	0,083	–
<0,01	–	<0,01	–	<0,01	–	<0,01	<0,01	<0,01	–
0,026	–	0,038	–	0,018	–	0,11	0,014	0,034	–
0,018	–	0,023	–	0,011	–	0,029	0,018	0,02	–
<0,01	–	<0,01	–	<0,01	–	<0,01	<0,01	<0,01	–
<0,01	–	<0,01	–	<0,01	–	<0,01	<0,01	<0,01	–
<0,01	–	<0,01	–	<0,01	–	<0,01	<0,01	<0,01	–
<0,01	–	<0,01	–	<0,01	–	<0,01	<0,01	<0,01	–
<0,050	–	<0,050	–	<0,050	–	<0,050	–	<0,050	–
<0,050	–	<0,050	–	0,07	–	<0,050	–	<0,050	–
<0,050	–	<0,050	–	<0,050	–	<0,050	–	<0,050	–
<0,050	–	<0,050	–	0,07	–	<0,050	–	<0,050	–
0,28	–	<0,050	–	0,43	–	<0,050	–	<0,050	–
<0,050	–	<0,050	–	<0,050	–	<0,050	–	<0,050	–
<0,050	–	<0,050	–	<0,050	–	<0,050	–	<0,050	–
<0,050	–	<0,050	–	<0,050	–	<0,050	–	<0,050	–
<0,050	–	<0,050	–	<0,050	–	<0,050	–	<0,050	–
<0,050	–	4	–	<0,050	–	<0,050	–	<0,050	–
<0,050	–	<0,050	–	<0,050	–	<0,050	–	<0,050	–
<0,050	–	<0,050	–	<0,050	–	<0,050	–	<0,050	–
<0,050	–	<0,050	–	<0,050	–	<0,050	–	<0,050	–
30	–	49	–	58	–	29	–	46	–
20	–	11	–	14	–	<0,050	–	34	–
<0,050	–	<0,050	–	<0,050	–	<0,050	–	<0,050	–
<1	–	<1	–	<1	–	<1	–	<1	–

Substance/ Group of Substances	CAS no.	Limit value*	Unit (dry matter, DM)	Outlet of Tallinn WWTP		Outlet of Kohtla-Järve WWTP		Outlet of Narva WWTP	
				I round	II round	I round	II round	I round	II round
Diisodecylphthalate	26761-40-0		mg/kg	<1	6	<1	<1	<1	<1
Polybrominated biphenyls, diphenylethers and polybrominated organic compounds									
Tribromodiphenylether, PBDE-28	-		mg/kg	<0,005	-	<0,005	-	<0,005	-
Tetrabromodiphenylether, PBDE-47	5436-43-1		mg/kg	<0,005	-	<0,005	-	<0,005	-
Pentabromodiphenylether, PBDE-99	60348-60-9		mg/kg	<0,005	-	<0,005	-	<0,005	-
Pentabromodiphenylether, PBDE-100	189084-66-0		mg/kg	<0,005	-	<0,005	-	<0,005	-
Hexabromodiphenylether, PBDE-138	182677-30-1		mg/kg	0,13	-	<0,005	-	<0,005	-
Hexabromodiphenylether, PBDE-153	68631-49-2		mg/kg	<0,02	-	<0,02	-	<0,02	-
Hexabromodiphenylether, PBDE-154	207122-15-4		mg/kg	<0,005	-	<0,005	-	<0,005	-
The sum of pentabromodiphenylethers	32534-81-9		mg/kg	<0,005	-	<0,005	-	<0,005	-
Heptabromodiphenylether, PBDE-183	207122-16-5		mg/kg	<0,02	-	<0,02	-	<0,02	-
Heptabromodiphenylether, PBDE-190	189084-68-2		mg/kg	<100	-	<100	-	<100	-
Octabromobiphenylether, PBDE-203	32536-52-0		mg/kg	<0,005	-	<0,005	-	<0,005	-
The sum of octabromodiphenylethers	-		mg/kg	<0,05	-	<0,05	-	<0,05	-
Decabromobiphenylether, PBDE-209	1163-19-5		mg/kg	<0,1	-	<0,1	-	<0,1	-
Tetrabromobiphenyl, PBB-52	59080-37-4		mg/kg	<0,005	-	<0,005	-	<0,005	-
Pentabromobiphenyl, PBB-101	67888-96-4		mg/kg	<0,005	-	<0,005	-	<0,005	-
Hexabromobiphenyl, PBB-153	59080-40-9		mg/kg	<0,01	-	<0,01	-	<0,01	-
3,5,3',5'-tetrabromobisphenol A (TBBPA)	79-74-7		mg/kg	<0,005	-	<0,005	-	<0,005	-
Bromocyclene	1715-40-8		mg/kg	<0,005	-	<0,005	-	<0,005	-
Hexabromobenzene	87-82-1		mg/kg	<0,005	-	<0,005	-	<0,005	-
Hexabromocyclodecane (HBCDD)	25637-99-4		mg/kg	<0,2	-	<0,2	-	<0,2	-
Short- and medium-chain chlorinated paraffins									
C_{10-13} chloroalkanes (SCCP)	85535-84-8		mg/kg	<0,3	-	<0,3	-	<0,3	-
C_{14-17} chloroalkanes (MCCP)	-		mg/kg	0,606	-	<0,3	-	<0,3	-

* the limit value according to the Minister of the Environment regulation of 30 December 2002 no. 78 "Requirements for using sewage sludge in agriculture, landscaping and recultivation"

Outlet of Pärnu WWTP		Outlet of Kuressaare WWTP		Outlet of Haapsalu WWTP		Outlet of Keila WWTP		Outlet of Tartu WWTP	
I round	II round	I round	II round	I round	II round	I round	II round	I round	II round
<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
0,009	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
0,053	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
0,014	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
<0,005	–	<0,005	–	<0,005	–	0,5	–	<0,005	–
<0,02	–	<0,02	–	<0,02	–	<0,02	–	<0,02	–
<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
0,089	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
<0,02	–	<0,02	–	<0,02	–	<0,02	–	<0,02	–
<100	–	<100	–	<100	–	<100	–	<100	–
<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
<0,05	–	<0,05	–	<0,05	–	<0,05	–	<0,05	–
0,85	–	<0,1	–	0,39	–	<0,1	–	0,1	–
<0,005	–	<0,005	–	<0,005	–	0,006	–	<0,005	–
<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
<0,01	–	<0,01	–	<0,01	–	<0,01	–	<0,01	–
<0,005	–	<0,005	–	<0,005	–	0,032	–	<0,005	–
<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
<0,005	–	<0,005	–	<0,005	–	<0,005	–	<0,005	–
<0,2	–	<0,2	–	<0,2	–	<0,2	–	<0,2	–
<0,3	–	<0,3	–	<0,3	–	<0,3	–	<0,3	–
<0,3	–	<0,3	–	<0,3	–	<0,3	–	<0,3	–

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ENVIRONMENTAL INVESTMENT CENTRE

LIETUVOS RESPUBLIKOS APLINKOS MINISTERIJA

MINISTRY OF THE ENVIRONMENT

2011