TOWARDS A BALTIC SEA UNAFFECTED BY HAZARDOUS SUBSTANCES

HELCOM Overview 2007

HELCOM Ministerial Meeting

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TOWARDS A BALTIC SEA UNDISTURBED BY HAZARDOUS SUBSTANCES

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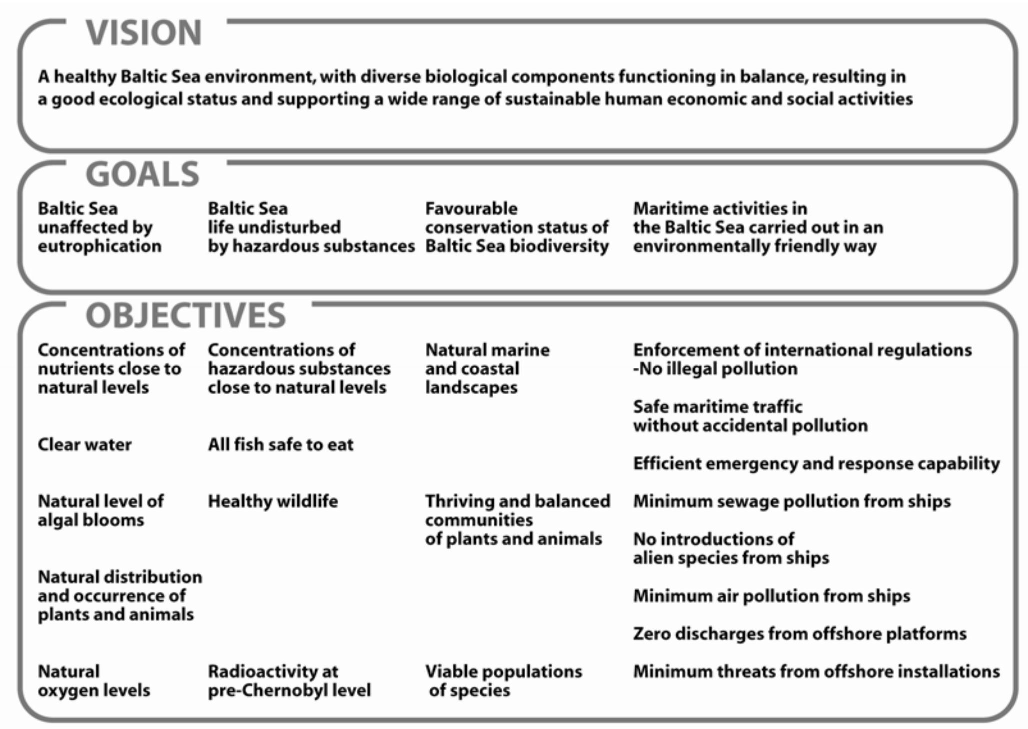
Note: This is a background document for the HELCOM Ministerial Meeting 2007 elaborated by the HELCOM Secretariat

PREFACE

The aim of this concise overview is not to provide a comprehensive assessment of the extent of the impacts of hazardous substance on Baltic Sea environment, but rather, is a first attempt to:

- show how ecological objectives can be used as basic tools when assessing the degree to which the Baltic Sea ecosystem is affected by hazardous substances, and
- outline the current state and trends in the marine environment, with respect to hazardous substances,
- present the development of actions for the hazardous substances of specific concern included in the HELCOM Baltic Sea Action Plan (BSAP).

For the implementation of the ecosystem approach, HELCOM has adopted a system of vision, strategic goals and ecological objectives. “Hazardous substances” is one of the four thematic areas covered by the HELCOM Baltic Sea Action Plan.



The HELCOM system of vision, strategic goals and ecological objectives

The specific **strategic goal** for hazardous substances is to have a “Baltic Sea life undisturbed by hazardous substances”. The **ecological objectives** related to this goal are reaching concentrations of hazardous substance close to natural levels, having all fish safe to eat, having healthy wildlife and reaching pre Chernobyl levels of radioactivity.

EXECUTIVE SUMMARY

Pollution caused by hazardous substances refers to the discharge to, and presence of, a number of different anthropogenic substances in the marine environment. These substances include those that do not occur naturally in the environment but also natural substances, whose concentrations exceed natural levels.

Hazardous substances have adverse effects on the ecosystem, such as:

- Impaired general health status of animals
- Impaired reproduction of animals, especially top predators
- Increased pollutant levels in fish for human food.

Although monitoring indicates that the loads of some hazardous substances have been reduced considerably over the past 20–30 years, problems still persist; and concentrations in the marine environment of some new substances have even increased.

Goal and objectives for hazardous substances in the HELCOM Baltic Sea Action Plan

The agreed goal of HELCOM on Hazardous substances *Baltic Sea undisturbed by hazardous substances* is described by four ecological objectives:

1. Concentrations of hazardous substances close to natural levels,
2. All fish safe to eat,
3. Healthy wildlife,
4. Radioactivity at pre-Chernobyl level.

In order to have operational ecological objectives, indicators have been identified. The agreed objectives will be monitored by the state of the environment (State and Impact).

Further actions

The information available on inputs and sources for hazardous substances is much scarcer than that on nutrients and does not allow for a comprehensive assessment of the situation in the Baltic Sea at present.

As a basis for the HELCOM Baltic Sea Action Plan, HELCOM has evaluated all available information on certain hazardous substances with the aim to assess their impacts on the Baltic Sea environment. The activity has focused on nine organic hazardous substances and two heavy metals that have been selected by HELCOM as being of specific concern to the Baltic Sea marine environment. These substances have also been included in the HELCOM Baltic Sea Action Plan, acknowledging the possible revision of the list and the actions in the future when more information is available.

HELCOM has collected information on the use of the selected substances in different sectors from available national registers and other sources. Furthermore, information has been collected on their occurrence in discharges/emissions and in the Baltic marine environment and on possible actions needed to reduce chemical loads to the Baltic Sea. This information is to be used when taking actions to restrict and substitute the use of the selected substances in important sectors within an agreed timetable in the whole catchment area of the Baltic.

The Contracting States should also develop national programmes addressing hazardous substances, taking into account the need for further identification of sources and elimination or restrictions of uses of the selected hazardous substances as well as the need for development of guidelines and capacity building for authorities and industries. There is also a need to further increase public awareness with regard to hazardous substances, e.g. in the field of environmentally friendly practices for the use of small-scale combustion appliances, with a view to limiting emissions of dioxins.

Additional information will be collected in a screening study focusing on the occurrence of the selected hazardous substances in the Baltic marine environment and there are plans to further screen the sources of these substances in the Baltic Sea countries.

Based on the outcome from available reports, and the work still to be carried out, the most relevant hazardous substances of specific concern, their main uses and most significant sources have been identified. This information will be the basis for developing input, e.g. a joint position by the HELCOM countries, to international, regional or national actions, including:

- the development of EU BAT Reference Documents (BREFs) in order to enhance implementation of BAT with regard to hazardous substances, with special focus on main uses or on uses having high emission factor to the environment;
- the updating of the EU Water Framework Directive list of priority substances and substances to be evaluated under REACH;
- placing of plant protection and biocides products on the market, if e.g. levels of these substances in the Baltic marine environment are so high that they may cause adverse effects on marine organisms;
- promotion of, and support to, the identification of new candidate substances and their inclusion in the Stockholm Convention on Persistent Organic Pollutants and the Protocol on Persistent Organic Pollutants to the UNECE Convention On Long Range Transboundary Air Pollution.

HELCOM assessments show that a significant share of both airborne and waterborne inputs of hazardous substances to the Baltic Sea originate in non-HELCOM countries. This means that it is of utmost importance that the results of HELCOM assessments are taken into account in other *fora* as well.

BALTIC SEA UNDISTURBED BY HAZARDOUS SUBSTANCES

Pollution caused by hazardous substances refers to the discharge to, and presence of, a number of different anthropogenic substances in the marine environment. These substances include those that do not occur naturally in the environment but also natural substances, whose concentrations exceed natural levels.

Although monitoring indicates that the loads of some hazardous substances to the Baltic Sea have reduced considerably over the past 20–30 years, problems still persist; and concentrations in the marine environment of some new substances have also increased (e.g. perfluorinated substances).

Once released into the Baltic Sea, hazardous substances can remain in the marine environment for very long periods and can accumulate in the marine food web up to levels which are toxic to marine organism. Levels of some hazardous substances in the Baltic Sea exceed concentrations in e.g. the North East Atlantic by more than 20 times. Hazardous substances cause adverse effects on the ecosystem, such as

- Impaired general health status of animals
- Impaired reproduction of animals, especially top predators
- Increased pollutant levels in fish for human food.

Some fish species caught in some parts of the Baltic Sea are not suitable for human consumption as they contain concentrations of hazardous substances exceeding requirement levels. Certain contaminants may be hazardous because of their effects on hormone and immune systems, as well as their toxicity, persistence and bio-accumulating properties. Especially substances which are persistent and bio-accumulative may cause potential hazard to humans.

Within HELCOM, substances are defined as hazardous if they are toxic, persistent and bio-accumulative (PBT-substances), or very persistent and very bio-accumulative (vPvB). Moreover, substances which affect hormonal and immune systems are also considered hazardous substances and are of equal concern.

Goal and objectives for hazardous substances in the HELCOM Baltic Sea Action Plan

The agreed goal of HELCOM on Hazardous substances *Baltic Sea undisturbed by hazardous substances* is described by four ecological objectives:

1. Concentrations of hazardous substances close to natural levels,
2. All fish safe to eat,
3. Healthy wildlife,
4. Radioactivity at pre-Chernobyl level.

In order to have operational ecological objectives, indicators have been identified. The agreed objectives will be monitored by the state of the environment (State and Impact). The indicators are represented by concentrations of selected heavy metals, organic substances and radioactive substances in different environmental compartments such as in sediment and fish, as well as health aspects of white-tailed eagle and seals.

Target levels for the indicators reflect undisturbed, i.e. good ecological, status. Existing target values, developed e.g. within the EU Water Framework Directive and European Environment Agency work, are used as much as possible and existing methodologies should be used when developing new targets.

Concentrations of hazardous substances close to natural levels

Despite reductions in inputs, concentrations of heavy metals (mercury, cadmium and lead) in the water of the Baltic Sea are still up to 5 times higher than in the Northern Atlantic (Pohl & Hennings 2007). Also, the levels of some organic pollutants are much higher in Baltic marine environment.

On the other hand, the levels of HCH-isomers in both sea water and biota (marine organisms) in the Baltic marine environment have decreased considerably since the mid-1980s. Additionally, DDT and HCB levels in biota have decreased considerably since the early 1970s and end of 1980s, respectively (HELCOM 2002 & 2003).

Temporal trend analyses (ICES 2007) covering the years 1980-2005, and altogether five Swedish coastal areas from Kattegat to Bothnian Bay and five Finnish coastal areas from Gulf of Finland to Bothnian Bay, found three significant downwards trends for mercury in herring muscle in Swedish and Finnish parts of Bothnian Sea and in Gulf of Finland. A significant upward trend for mercury was found for one site in the Kattegat. For other sites significant trends were not found (Figure 1).

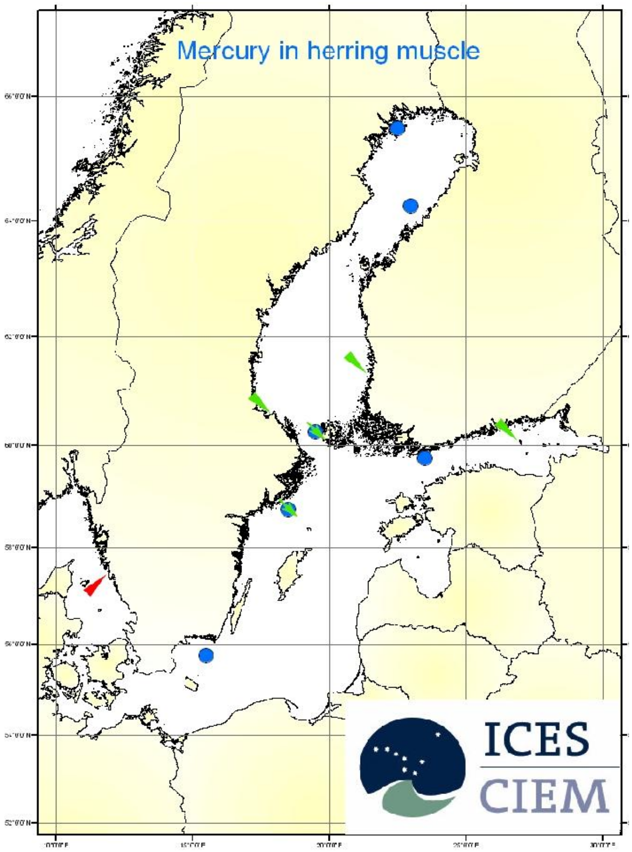


Figure 1. *Temporal trends of mercury in herring muscle. Green arrows indicate a significant downwards trend. Blue dots indicate no significant trend (ICES 2007).*

Another temporal trend analysis (Bignert et al. 2007a), covering the years 1981-2006, and altogether five Swedish coastal areas from Kattegat to Bothnian Bay, showed that cadmium levels in herring liver are decreasing in Swedish coastal areas (Bothnian Sea and western Baltic Proper) where increasing concentration trends were observed during 1980s (Figure 2). However, the recent levels are not significantly lower compared to the concentrations measured at the beginning of the 1980s, despite measures taken to reduce cadmium discharges to the environment. Additionally, cadmium levels in cod liver in the south east of Gotland and Kattegat have decreased significantly during 1981-2006.

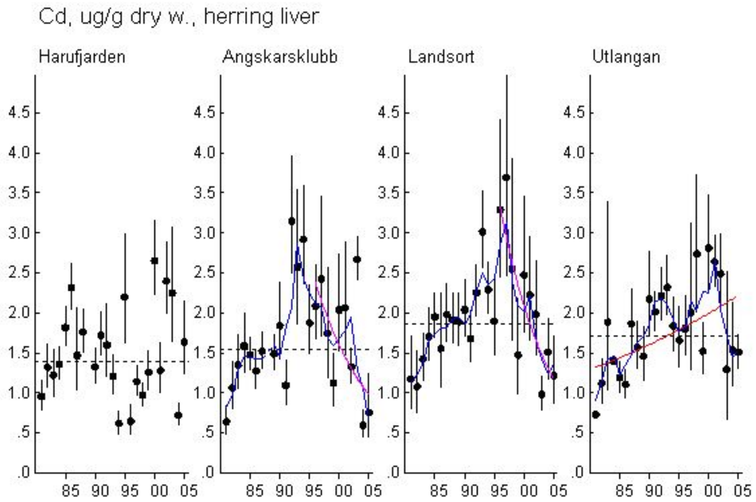


Figure 2. *Temporal trends of cadmium level (μg/g dw) in herring liver in Swedish coastal area during 1981-2006 (Bignert et al. 2007a)*.

Among the positive trends concerning hazardous substances is the clear decrease in lead levels in biota (e.g. herring and perch liver) in most Baltic Sea areas (HELCOM 2002, Bignert et al. 2007b, ICES 2007).

TBT levels are still so high that they have potential biological effects in all parts of the Baltic marine environment, especially in coastal areas (HELCOM in prep.). For many endocrine disrupting substances and other organic contaminants, a comprehensive assessment of their levels or effects is not possible due to the lack of eco-toxicological data (i.e. what is the harmful contaminant level in organisms) and monitoring data (i.e. which contaminant levels occur in the Baltic marine environment and in effluents from e.g. landfills and sewage treatment plants).

The concentrations levels of dioxins (TCDD-equivalents) in guillemot eggs show an overall significant decreasing trend since the late 1960s. However, the concentrations have not continued to decrease significantly during the last 15 years (Figure 3). Additionally, no significant changes can be seen for dioxin-levels in herring muscle during 1990-2005. The declining trends prior to the early 1990s are most likely due to measures taken to reduce emissions between 1969 and 1985. After that, the decline ceased, contrary to e.g. PCBs (Bignert et al. 2007c).

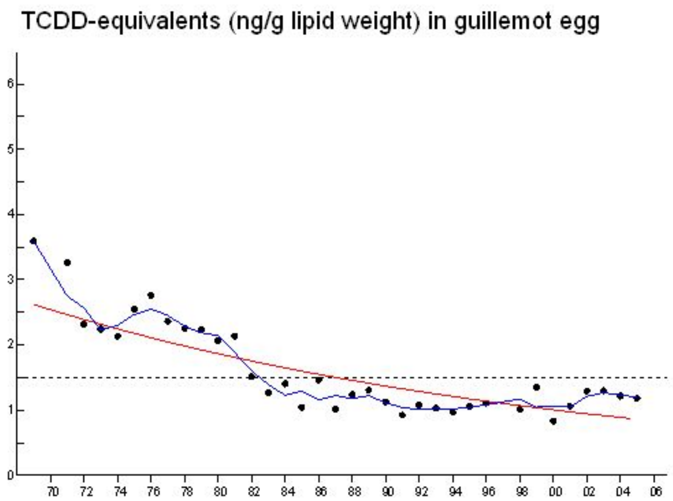


Figure 3. *Temporal trends of TCDD-equivalent concentration (ng/g lipid weight) in guillemot egg during 1969-2005 (Bignert et al. 2007c).*

The level of HBCDD, which is a commonly used flame retardant in different plastics and textiles, in Guillemot egg shows a significant increase of about 3% per year (Figure 4). No trend can be seen for HBCDD in herring muscle during the monitored time period, 1999-2005.

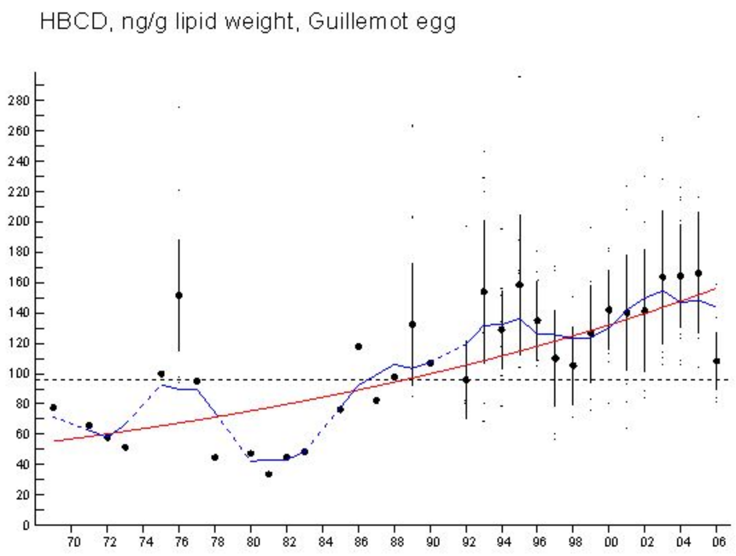


Figure 4. *Temporal trends of HBCDD concentration (ng/g lipid weight) in guillemot egg (1969-2005) (Bignert et al. 2007d).*

Sediments often act as an ultimate sink for many heavy metals (e.g. mercury, Figure 5) and hydrophobic organic substances (e.g. PCBs, Figure 6). Nevertheless, the changes in oxic/anoxic conditions may remobilise some heavy metals from sediments to water. Under anoxic conditions, for instance mercury and cadmium concentrations in water (e.g. in the central Baltic Sea, Figure 7) decrease due to the formation of rather insoluble sulphides, which settle down to the sediments (HELCOM 2002, Pohl & Hennings 2007).

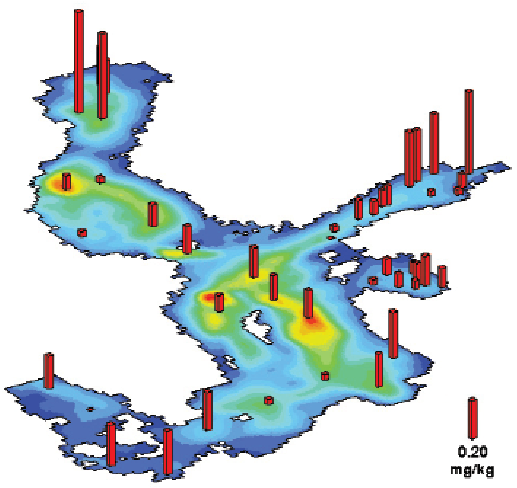


Figure 5. *Mercury levels (mg/kg dw) in surface sediment in the Baltic Sea (HELCOM 2002).*

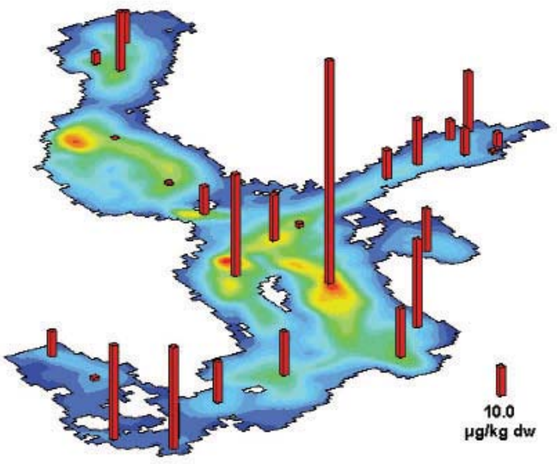


Figure 6. *PCB (∑7PCB congeners) levels (range 3.5-55 µg/kg dw) in surface sediment (0-1 cm) in the Baltic Sea (Perttilä et al. 2003).*

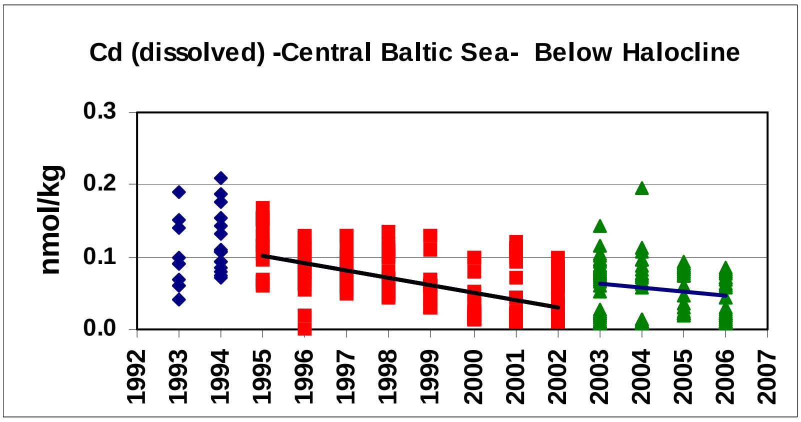


Figure 7. *Trend for dissolved cadmium in water below the halocline in the central Baltic Sea during 1993 – 2006 (Pohl and Henning, 2007)*.

Indicators with targets

As a huge number of different hazardous substances are affecting the Baltic Sea, and as all of them cannot be monitored, some representative substances have to be selected for which target values are defined. Traditionally, HELCOM has assessed heavy metals (e.g. mercury, cadmium and lead) and some historic organic pollutants such as DDT and PCB.

The partition of hazardous substances among the different compartments of the marine environment (water, sediment, and biota) varies depending on the physico-chemical properties of each substance (e.g. water solubility, adsorption, and bioaccumulation). Although different compounds are measured in different environmental compartments, the assessment should consider the whole marine environment as thoroughly as possible.

For many of the HELCOM priority substances, which are defined as so called PBT substances (Persistent, Bioaccumulative, Toxic), biota is considered to be the most relevant matrix. For other types of substances (e.g. endocrine disrupters), biological effect monitoring can be considered to be more practical and of more importance. For substances which are not PBT substances, but give reason for concern due to their widespread and extensive use, monitoring of concentrations in water is regarded a more valid strategy. In conclusion, the selection of representative substances and the most relevant matrices to monitor in the Baltic Sea is based on the substance properties, the extent of use and potential effects of the substance.

HELCOM has, as a start, selected nine organic substances or substance groups (Table 1) and surveyed the use and occurrence of these substances in different effluents (from e.g. sewage treatment plants and landfills) and in the Baltic marine environment (HELCOM in prep.).

For most of the selected substances, available information is quite scarce. Nevertheless, the preliminary results of the HELCOM survey indicate that some of the substances need more attention than others.

The findings of this HELCOM assessment imply that the occurrence of organotin compounds is widespread and a continuous threat to the Baltic marine environment, in particular near harbours and shipyards. The elevated levels occur also near sea routes and at the disposal sites for dredged material. Despite the legislative measures taken, the current levels of the most toxic triorganotin compounds, TBT and TPhT, pose a risk to the marine environment and especially to organisms at the lower trophy levels of the food web, such as sediment-dwelling organisms (HELCOM in prep.).

Additionally, the findings in the HELCOM survey indicate that the PFOS pose a to the Baltic Sea top predators, such as seals and predatory birds, via secondary poisoning (HELCOM in prep.). Dioxin levels in fish (especially in salmon and herring) exceed the EU food safety limits in some Baltic Sea areas, particularly in the northern Baltic Sea (see chapter “All fish safe to eat”). As a consequence, the substances and matrixes presented in Table 2 have been chosen as initial indicators for the ecological objective “Concentrations close to natural levels”.

Table 1. Substances or substance groups of specific concern in the Baltic Sea.
1. Dioxins (PCDD), furans (PCDF) & dioxin-like polychlorinated biphenyls
2a. Tributyltin compounds (TBT)
2b. Triphenyltin compounds (TPhT)
3a. Pentabromodiphenyl ether (pentaBDE)
3b. Octabromodiphenyl ether (octaBDE)
3c. Decabromodiphenyl ether (decaBDE)
4a. Perfluorooctane sulfonate (PFOS)
4b. Perfluorooctanoic acid (PFOA)
5. Hexabromocyclododecane (HBCDD)
6a. Nonylphenols (NP)
6b. Nonylphenol ethoxylates (NPE)
7a. Octylphenols (OP)
7b. Octylphenol ethoxylates (OPE)
8a. Short-chain chlorinated paraffins (SCCP or chloroalkanes, C_{10-13})
8b. Medium-chain chlorinated paraffins (MCCP or chloroalkanes, C_{14-17})
9. Endosulfan
10. Mercury (Hg)
11. Cadmium (Cd)

Concerning penta-, octa- and decaBDE, HBCDD, PFOA, NP/NPE, OP/OPE, SCCP/MCCP and endosulfan, more information on their occurrence in the Baltic marine environment and in discharges (e.g. from sewage treatment plants and landfills) and air emissions from HELCOM countries is very much needed. Additionally, the effects of some of the above mentioned substances on the Baltic marine environment are difficult to estimate due to the lack of eco-toxicological information (i.e. the harmless limit concentration has not been comprehensively assessed).

Three kinds of target levels have been defined for the ecological objective “Concentrations close to natural levels”:

- The primary target is a decreasing trend in concentration (concerns all substances);
- The intermediate target levels are relevant at least for certain substances. EU maximum levels in muscle meat of fish (referring to human health, Table 3) are used as intermediate target levels for mercury, cadmium as well as dioxins, furans and dioxin-like PCBs;
- The ultimate target level is to reach near background concentrations for naturally occurring substances (mercury, cadmium as well as dioxins and furans, dioxin-like PCBs) and to reach close to zero concentrations for man-made synthetic substances (TBT and PFOS). The ultimate target levels reflect undisturbed, i.e. good ecological status.

The following tables give a general overview of how the favourable status of the Baltic Sea with regards to hazardous substances has been assessed in this document.

The status is categorised using flounder smileys.

 indicates a favourable status or a positive trend

 an unfavourable status or a negative trend

 is neutral or no trend

 refers to big gaps in information

Table 2. Initial indicators for the ecological objective "Concentrations of hazardous substances close to natural levels"

Indicator substance and matrix	Target	Status
Cadmium * in fish (herring or flounder or perch) liver as indicator for different sub-regions of Baltic Sea and * in bivalve (blue mussel or Baltic clam) soft tissue as indicator for different sub-regions of Baltic Sea	Primary target of decreasing concentration trend Ultimate target level to reach near background concentrations	
Mercury * in fish (herring or flounder or perch) muscle as indicators for different sub-regions of Baltic Sea and * in bivalve (blue mussel or Baltic clam) soft tissue as indicators for different sub-regions of Baltic Sea	Primary target of decreasing concentration trend Intermediate target level for fish in **Table 3** Ultimate target level to reach near background concentrations	
Dioxins, furans, dioxin-like PCBs * in fish (herring or salmon or perch) muscle for different sub-regions of Baltic Sea	Primary target of decreasing concentration trend Intermediate target level for fish in **Table 3** Ultimate target level to reach close to zero concentrations	
TBT * in sediment or biota (fish or mussel) or imposex (i.e., biological effects monitoring) for different sub-regions of Baltic Sea	Primary target decreasing concentration trend and/or decreasing effects Ultimate target level to reach close to zero concentration and/or no effect level.	
PFOS * in sediment or fish (species optional) liver for different sub-regions of Baltic Sea	Primary target of decreasing concentration trend Ultimate target level to reach close to zero concentrations	

Progress towards targets for "Concentrations close to natural levels"

- Decreasing trends, or no trends at all, for mercury in herring in Swedish and Finnish coastal waters
- Decreasing trends for cadmium levels in herring and cod in some Swedish coastal areas during very recent years. However, the recent levels are not significantly lower compared with the beginning of the 1980s
- TBT levels are still so high that they have potential biological effects all around the Baltic Sea, especially in the coastal areas
- For many organic contaminants, a full assessment of their levels and effects in Baltic marine environment is not possible due to the lack of monitoring and eco-toxicological data

All fish safe to eat

Of the life living in and around the Baltic Sea, people have a special relation to fish. Although birds such as eider duck (*Somateria mollissima*) are hunted for food, the most common Baltic Sea biota ending up at the dinner table are different fish species. Recent news about the alarmingly high levels of various hazardous substances such as tributyl tin (TBT) and dioxins in fish has made the polluted state of the Baltic Sea very concrete for many people. Therefore, the HELCOM Baltic Sea Action Plan has identified "All fish safe to eat" as one of the objectives for hazardous substances.

Concentrations of dioxins in marine ecosystems declined in the 1980s but this decrease levelled off in the 1990s. Dioxin levels in fatty Baltic fish (e.g. herring and salmon) still show high levels of contamination (Figure 8, HELCOM 2004).

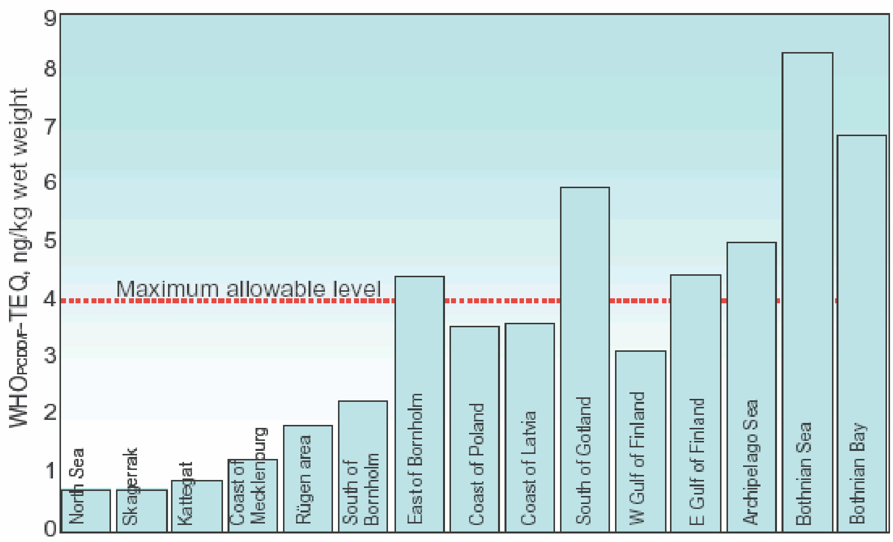


***Figure 8.** The dioxin content in herring muscle at different fishing grounds (HELCOM 2004).*

The polychlorinated biphenyl (PCB) levels in herring muscle in Swedish coastal areas from Kattegat to Bothnian Bay have decreased significantly during the time period 1978/80-2005. The levels are still significantly higher in the Baltic Proper and in the southern Bothnian Sea compared to the Kattegat and the Skagerrak (Figure 9). Two cod liver time-series (1980-2004/05) from southeast of Gotland in the Baltic Proper and Kattegat also show significant decreasing trends of PCB (Bignert et al. 2007c)[1]. A Recent study (MacKenzie et al. 2004) shows that the standing stock of the most abundant fish species in the Baltic Sea was a sink for 260 kg of PCBs in the late 1980s to early 1990s, and that fisheries removed 31 kg of PCB per year which ended up in the consumers. Fishery removed as much, or even more, PCB as other factors (e.g. degradation in the water).

[1] Note that these PCB congeners are not exactly the same as the dioxin-like PCB congeners

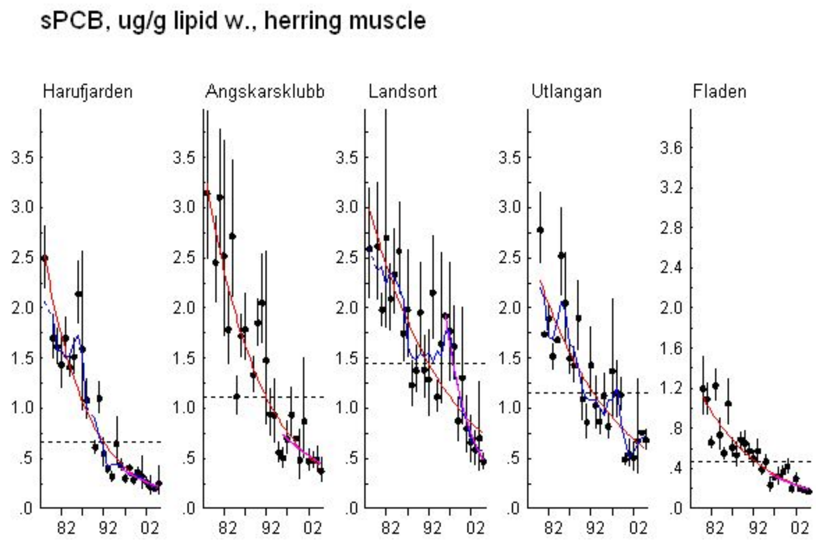


Figure 9. *Temporal trends of sPCB concentration (μg/g lipid w.) in herring muscle in Swedish coastal area during 1981-2005 (Bignert et al. 2007c).*

Indicators with targets

The EU has adopted regulations concerning limit values on maximum levels for certain hazardous substances in foodstuff, including fish. The World Health Organization has also developed recommendations on daily intake of some hazardous substances from fish. In addition, some Contracting Parties recommend limitations in consumption of Baltic herring and salmon for children and women of childbearing age due to dioxins, furan and PCB contamination.

As a pragmatic approach, the EU maximum levels of mercury, cadmium as well as dioxins and dioxin-like PCBs in muscle meat of fish are used as intermediate target levels for fish in the Baltic Sea (Table 3). It is recognised that some wildlife species could be more susceptible to hazardous substances in fish compared to human. It should be noted that the stricter target levels for these substances have been presented in the ecological objective “Concentrations of hazardous substances close to natural levels”; namely the ultimate target to reach near background concentrations in some fish species (Table 2).

Table 3. Intermediate target levels / maximum allowable concentrations of mercury (Hg), cadmium (Cd), dioxins and sum of dioxins & dioxin-like PCBs in fish muscle meant for foodstuff as regulated by EC 1881/2006

Substance	Maximum levels in muscle meat of fish (µg / kg WW fish (EC 466/2001). Note that exceptions (in parenthesis) listed include only eel and pike, other species named in the regulation but less common in the Baltic are excluded.
Hg	500 (1 000 in pike *Esox lucius,* eel *Anquilla anguilla*)
Cd	50 (100 in eel *Anquilla anguilla*)
Dioxins (WHO-PCDD/F-TEQ)	$4 * 10^{-3}$
Dioxins + dioxin-like PCBs (WHO-PCDD/F-PCB-TEQ)	$8 * 10^{-3}$ ($12 * 10^{-3}$ in eel *Anquilla anguilla*)

Progress towards targets for "All fish safe to eat"

- Dioxin levels in fish (specially in salmon and herring) exceed the EU food safety limits in some Baltic Sea areas, particularly further north
- PCB levels in herring in Swedish coastal areas have decreased significantly during 1978/80-2005. The levels are still clearly higher in the Baltic Proper and in the southern Bothnian Sea compared to the Kattegat and the Skagerrak

Healthy wildlife

It is important to take both concentrations and biological effects of hazardous substances into account in the objectives as a large number of hazardous substances have been released to the Baltic Sea, often in low concentrations. Such substances may be possible to observe if special concern for the substance is raised, e.g. human health risks. In other cases, the only way to detect the impact of previously unknown substances, and especially substance mixtures, is through applying biological effects monitoring methods, just like the observations in seal and predatory bird reproductive health indicating pollution by PCBs and DDT during the 1970s. Specific methods to detect biological effects (such as molecular biomarkers) caused by unknown and known substances are presently on the way to reaching maturity.

In addition to being harmful to humans, the hazardous substances found in Baltic Sea animals (as well as plants) cause various health problems to some organisms, even at low dosages. Such sub-lethal poisonings endanger the reproduction and viability of many Baltic species.

The monitoring of biological effects of hazardous substances provides information on their adverse effects on marine organisms *in situ*. These effects are visible both as direct physical changes in some animals in the form of sterility and failed breeding among birds, but also as physiological changes measurable as biomarkers and other eco-toxicological tools. Detection of biological effects is of strategic importance to the overall monitoring of hazardous substances since many methods reveal the potential presence of substances (or substance groups) that are not feasible to be measured on a regular basis due to their huge number and technical difficulties in analysis.

Generally, the reproductive success of top predators is an indicator of detrimental effects of accumulating hazardous substances. The shell thickness of common guillemot (*Uria aalge*) eggs from Stora Karlsö in the Central Baltic Proper has been monitored in Sweden since the end of the 1960s (Figure 10). During the 1990s the thickness of guillemot eggshells in the area returned to the dimensions recorded prior to the 1940s. The thin eggshells observed during the 1960s were attributable to the severe DDT pollution during that period. Similar effects of, and recovery from, DDT and other substances have been observed in Swedish time series of white-tailed eagle (*Haliaeetus albicilla*) brood size and nesting success (HELCOM 2002)

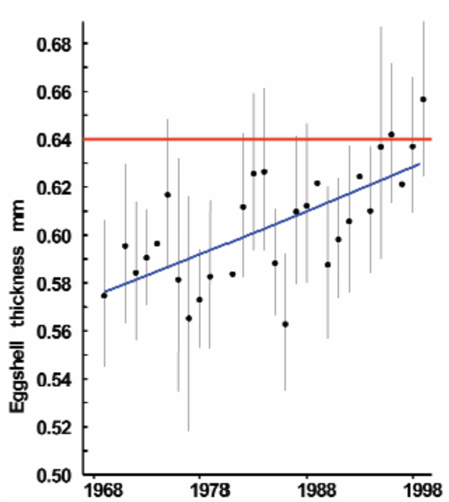


Figure 10. *Temporal trends in the thickness of common guillemot (Uria aalge) eggshells collected in Stora Karlsö in the central Baltic Proper. The solid red line indicates the thickness prior to 1940 (HELCOM 2002).*

The pregnancy rate among female grey seals in the Baltic Sea has increased very significantly in recent years, reflecting the fact that uterine damage is now rare. Intestinal ulcers, on the other hand, are still common, even in young individuals (Figure 11).

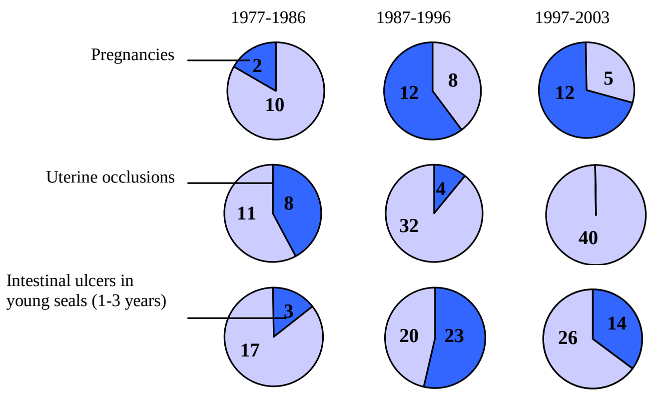


***Figure 11.** Health status of the grey seals in the Baltic Sea. Numbers in the pie charts are the numbers of seals examined (data from Museum of Natural History, Stockholm, Sweden, Bernes 2005).*

The most sensitive reaction of mammals to TBT is linked to effects on the immune system. It is supposed that TBT could increase the susceptibility of mammals to diseases such as microbial infection. It is possible that TBT acts in a synergistic way with other immune toxicants such as PCBs. The mass die-outs among the Baltic seals, caused mainly by morbilli virus infections, may possibly be attributed to chemical pollutants such as organochlorines, heavy metals and TBT (Ciesielski et al. 2004). Additionally, harbour porpoises from the German area of the North Sea and the Baltic Sea exhibit a higher incidence of bacterial infections compared to whales in less polluted arctic waters. Beineke et al. (2005) found that thymic atrophy and splenic depletion were significantly correlated to increased PCB and polybrominated diphenyl ether (PBDE) levels. This supports the hypothesis of contaminant-induced immunosuppression, possibly contributing to disease susceptibility in harbour porpoises. The potential adverse effects of contaminants such as PCBs and heavy metals on the immune system and the health status of marine mammals are still discussed controversially.

Indicators with targets

Research on health effects caused by hazardous substances is ongoing on different species around the Baltic. However, the data is mostly scarce and limited to a few regions, which at this stage does not seem to allow for developing common target levels for the different regions. Most information on long time-series concerns predatory birds, such as the white-tailed eagle as well as seals. Therefore, the following initial indicator topics have been chosen for healthy wildlife (Table 4). Target levels for the different sub-regions are to be defined.

Table 4. The initial indicators for the ecological objective “Healthy wildlife”

Indicator	Target	Status
Predatory bird health: White tailed sea eagle (and/or osprey) for different sub-regions of Baltic Sea * Proportion of successfully reproducing pairs * Mean brood size	targets need to be defined	

Fish health: * Fish Disease Index	target need to be defined	
Seal health: Grey seal for entire Baltic and ringed seal for northern Baltic, (harbour porpoise proposed to the consideration of Seal Group) - rate of pregnancy (CA) - rate of fecundity (CL) - occurrence of uterine pathology (occlusion, stenosis, "myoma") - occurrence of intestinal ulcers in 1-3 year old seals	- normal pregnancy rate (to be defined)	 Grey seal  Ringed seal
	- normal fecundity rate (to be defined)	 Grey seal  Ringed seal
	- normal level of uterine pathology (to be defined)	
	- normal occurrence of intestinal ulcers in 1-3 year old seals	

Progress towards targets for "Healthy wildlife"

- The pregnancy rate among female grey seals has increased very significantly in recent years, reflecting the fact that uterine damage is now rare. Intestinal ulcers, on the other hand, are still common, even in young individuals
- There is a need to further develop the indicators and targets for Healthy wildlife

Radioactivity at pre-Chernobyl levels

The levels of anthropogenic radionuclides are higher in the Baltic Sea than in other water bodies around the world. Compared to the North East Atlantic and the North Sea, the concentrations of caesium-137 in the Baltic Sea are 40 and 10 times higher, respectively. This is due to atmospheric nuclear testing in the 1960s and the Chernobyl accident in 1986. Also discharges of radionuclides into the Irish Sea from Sellafield are traceable in the Baltic Sea. Liquid discharges from nuclear power plants in the Baltic Sea are estimated to be low.

HELCOM has since 1984 collected monitoring data on radioactivity in the Baltic Sea. These data cover both radioactivities in the Baltic marine environment and in discharges from nuclear installations (nuclear power plants and nuclear research facilities) within the catchment area of the Contracting Parties to HELCOM.

Indicators and targets

HELCOM will in the future continue to monitor and follow closely both the radioactivity concentrations in the marine environment as well as the level of radioactivity in the discharges from Baltic nuclear installations. The results from the monitoring are also used to assess potential health risks to humans due to radioactive exposure.

The following initial indicators have been chosen for radioactivity (Table 5).

Table 5. The initial indicators for the ecological objective "Radioactivity at pre-Chernobyl levels". Target values have been calculated on the basis of average concentrations during the years 1984-85, which refer to the pre-Chernobyl time period (HELCOM MORS 2006).

Indicator substance and matrix	Target	Status
Cs-137 * in herring muscle as indicator for whole Baltic Sea * in plaice and flounder muscle for Southern Baltic Sea (southwards from Gotland)	- Primary target of decreasing concentration trend - Ultimate target level to reach pre-Chernobyl level which is 2.5 Bq/kg wet weight for herring muscle and 2.9 Bq/kg wet weight for plaice and flounder muscle	
Cs-137 * in sea water [1] for whole Baltic Sea	- Primary target of decreasing concentration trend - Ultimate target level to reach pre-Chernobyl level of 14.6 Bq/m3	
Cs-137 * in sediment for whole Baltic Sea	- Primary target of decreasing concentration trend - Ultimate target level to reach pre-Chernobyl level 1 640 Bq/m2	

[1] sampling depth 0-10 m

Together with the information that HELCOM holds, and regular updates on sources, emissions and inputs of radioactive material, as well as their impacts in the marine ecosystem, the ecological objectives and the associated indicators provide the basis for HELCOM's sound management decisions.

Progress towards targets for radioactive substances

- Overall, the levels of radioactivity in the Baltic Sea water and biota have shown declining trends since the Chernobyl accident in 1986 (cf. Figure 12)
- The amount of caesium-137 in Baltic Sea sediments, however, has remained largely unchanged, with highest concentrations in the Bothnian Sea and the Gulf of Finland

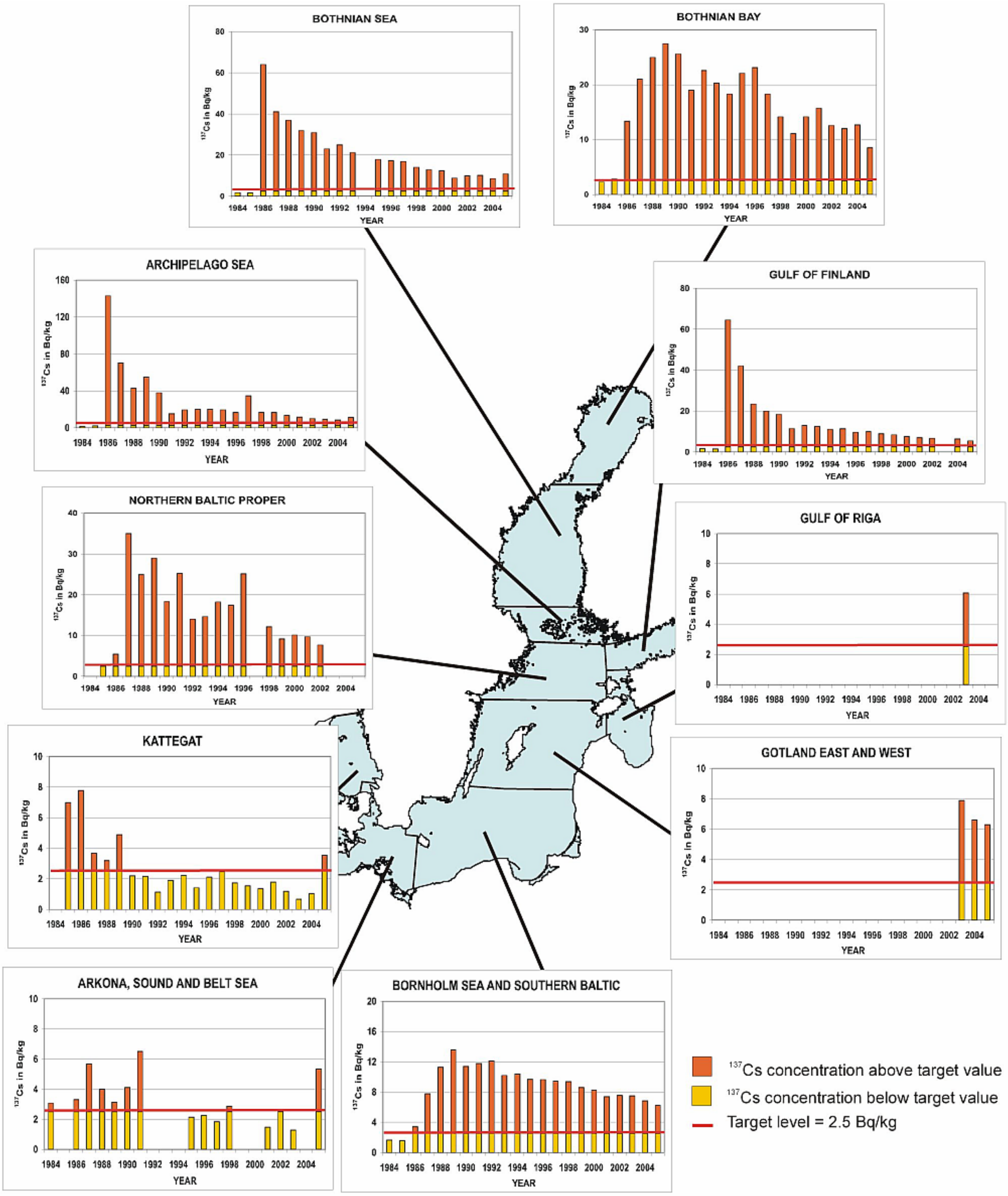


Figure 12. *^{137}Cs concentrations (in Bq/kg) in herring muscle in 1984-2005, as annual mean values by basin. Target values have been calculated as averages of pre-Chernobyl (1984-1985) concentrations. Note: variable scales in the graphs (HELCOM MORS 2007).*

INPUTS AND SOURCES

HELCOM monitoring programmes provide regular information on the water- and airborne inputs and sources to the Baltic Sea as well as trends of selected heavy metals and some organic pollutants. Data on sources and inputs of hazardous substances is scarce compared to information on nutrients.

The loads of some hazardous substances to the Baltic Sea have been reduced considerably over the past 20-30 years. In particular, discharges of heavy metals have decreased although no similar general trend has been observed for heavy metal levels in marine biota since 1990.

For mercury, lead and cadmium, waterborne inputs to the Baltic Sea, via rivers or as direct discharges, are the main source. The remaining share is mainly from atmospheric deposition.

Dioxins are not intentionally produced, but are formed as by-products or impurities of several different industrial processes as well as from most combustion processes, such as chemical, paper and metal industries, incineration of municipal and hazardous waste and small scale burning. Fossil energy production, traffic, and other sources both in Central Europe and in the countries around the Baltic Sea also contribute to their presence. Natural events or processes such as forest or steppe fires and volcanic eruptions can also cause dioxin emissions. Thus, dioxins enter the Baltic Sea as atmospheric fallout when transported from land-based sources and via a multitude of waterways. Knowledge about dioxin air emissions has improved to the point where there are relatively accurate measurements or estimations available from some countries. However, it seems that the information concerning dioxin concentrations in waste waters or wastes are not at the same level (HELCOM 2004).

Sources and pathways of hazardous substances to the Baltic Sea

The main pathways of hazardous substances to the marine environment are industrial wastewater, municipal wastewater - discharged directly to the Baltic or transported via rivers – and/or atmospheric deposition, depending on substance. The main source or pathway to the Baltic marine environment of TBT and TPhT is the anti-fouling use in ship hulls and subsequent direct release to sea water. On the other hand, the main pathways of pentaBDE, octaBDE and decaBDE, HBCDD, PFOS, PFOA, SCCP and MCCP to the Baltic Sea are via rivers receiving municipal and industrial waste water, direct municipal and industrial waste water discharges and via the atmosphere. The main pathways of NP, NPE, OP and OPE are via rivers receiving municipal and industrial waste water and via direct municipal and industrial waste water discharges. The main pathways of endosulfan are via rivers receiving leaching waters from agricultural land and via atmosphere due to the application of agricultural pesticides containing endosulfan. Discharges from landfills and via storm water can be significant for some of the substances mentioned above. Significant pollution sources of selected organic substances, which have been found based on preliminary assessment results, are presented in more detail in Annex 1. More information on uses and sources has been presented in Annex 2.

Quantitative information of emissions, discharges and deposition of some heavy metals, lindane and dioxins are presented in the following chapters. This information is not, however, available for other organic substances presented in Table 1 (HELCOM in prep.). According to a HELCOM evaluation (HELCOM 2001), it can be assumed that 50% of the discharge reduction target has been largely achieved for 46 hazardous substances prioritised by HELCOM.

Emissions to air and atmospheric depositions

Heavy metals

The HELCOM monitoring programme annually compiles data on the amount of selected waterborne and airborne pollutants entering the Baltic Sea. Data on cadmium, lead and mercury loads are presented in this chapter. In 2005, total annual emissions to the air by the HELCOM countries amounted to 112 tonnes of cadmium, 41 tonnes of mercury, and 1,103 tonnes of lead (Gusev, 2007a).

Depositions of cadmium and lead show a decrease from south to north, due to the distance from the main emission sources. The total atmospheric depositions of heavy metals into the Baltic Sea during 2005 were 5.3 tonnes of cadmium, 3 tonnes of mercury, and ca. 251 tonnes of lead. The highest levels of heavy metal deposition were experienced in the Belt Sea and Kattegat sub-basins (Gusev, 2007b).

Anthropogenic emission sources, such as industries, energy production and waste incineration, of heavy metals in the HELCOM countries accounted for about 30-50% of the total atmospheric deposition into the Baltic Sea in 2003. Natural and distant sources from outside the Baltic Sea catchment area also contributed significantly. HELCOM assessments also show that the contribution from HELCOM Contracting Parties to the deposition to the Baltic Sea has decreased since 1995, especially with regard to cadmium and lead.

In 2005, HELCOM countries were the source of 39% of airborne cadmium being deposited onto the Baltic Sea and three non-HELCOM countries (United Kingdom, France, and Slovak Republic) were among the top ten contributors (Figure 13). Ten percent of airborne cadmium deposited on the Baltic Sea originated from other European countries and 51% from other sources (re-emission, natural and global sources). The most significant contributions to total annual cadmium depositions to the Baltic Sea in 2005 were from Poland, Russia and Finland (EMEP, 2007).

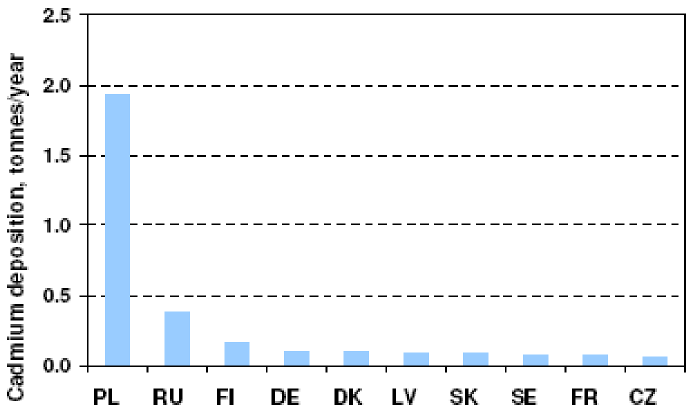


Figure 13. *Ten European countries with the highest calculated contribution to the annual deposition of cadmium to the Baltic Sea for 2005 (units: tonnes/year). (EMEP, 2007).*

As regards the atmospheric deposition of lead to the Baltic Sea in 2005, HELCOM countries were the source of 16% of the total deposited lead and three non-HELCOM countries (Belgium, United Kingdom and France) were among the top ten contributors. Five percent of airborne lead deposited on the Baltic Sea originated from other European countries and 79% from other sources (re-emission, natural and global sources). The most significant contributors to total annual lead depositions over the Baltic Sea in 2005 were Poland, Germany, and Estonia (EMEP, 2007).

For mercury, HELCOM countries were the source of 22% of airborne mercury deposited onto the Baltic Sea in 2005 and three non-HELCOM countries (United Kingdom, France, and Czech Republic) were among the top ten contributors (Figure 14). Eight percent of airborne mercury deposited on the Baltic Sea originated from other European countries and 70% from other sources (re-emission, natural and global sources).The most significant contributions to total annual mercury depositions over the Baltic Sea in 2005 were from Poland, Denmark, and the United Kingdom (EMEP, 2007).

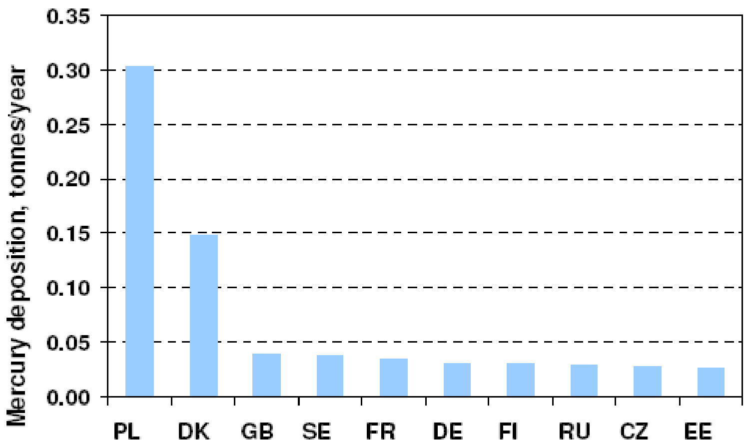


Figure 14. *Ten countries with the highest contribution to annual deposition of mercury to the Baltic Sea in 2005 (units: tonnes/year). (EMEP, 2007).*

Dioxins and furans

According to the European Dioxin Inventory report, the major industrial sources presented in Table 6 account for about 62% of total dioxin air emissions in Europe. The most important direct source of dioxins to the marine environment is the dry deposition of airborne particle-bound dioxins (HELCOM 2004, OSPAR 2005).

Table 6. The sources of dioxin emissions to air according to the European Dioxin Inventory (HELCOM 2004)

Major industrial air emission sources (62%)	-incinerators for municipal waste -iron ore sinter plants -incinerators for clinical waste -facilities of the non-ferrous metal industry
Other industrial sources and mainly non-industrial sources (38%)	-domestic heating facilities (particularly wood combustion) - accidental fires - traffic (mainly if petrol is used)

Gusev (2007c) found that in 2005, among the HELCOM countries, the largest contributions to total annual PCDD/F emission came from Russia (55%), followed by Poland (31%) and Germany (5%).The highest fractions of emissions deposited to the Baltic Sea belong to Poland (20%), Sweden (12%), and Finland (11%) and the highest levels of PCDD/Fs depositions over the Baltic Sea can be noted for its southern-western part (the Belt Sea).

Waterborne input

The reported riverine loads, including direct discharges from coastal areas, to the Baltic Sea in 2005 amounted to 13.6 tonnes of mercury, 472.5 tonnes of lead and 54.5 tonnes of cadmium. The riverine inputs of heavy metals are for cadmium and lead highest in the Gulf of Finland, while mercury inputs are highest in the Baltic Proper. A few large rivers account for very large proportions of the total riverine heavy metal loads.

Heavy metals and some hazardous substances end up in water from various different sources, such as industrial activities, urban waste waters, agriculture and waste management.

To a large extent, in the past, dioxin and furan pollution in waterways could be attributed to certain chemical and forest industries where chlorine was used in large quantities for pulp bleaching until the early 1990s. This has now stopped in most countries, but chlorine gas is still used in some Russian pulp and paper mills. Additionally, historical production and use of chlorophenols have been significant sources for dioxins and furans. Historical dioxin pollution is still relevant e.g. via continuous transport of dioxin-contaminated sediments from rivers to the Baltic Sea, such as is the case with river Kymijoki loading the Gulf of Finland. Other water pollution sources of dioxins and furans are e.g. municipal waste waters and residues (solid waste). Wastewater from households and smaller enterprises contain traces of dioxins, the major part of which ends up in sludge produced by sewage treatment plants. Dioxins and furans also eventually end up in residues from air pollution control systems. Residues are mainly disposed of in landfills, from where dioxins and furans may be released via landfill effluents to the aquatic environment (HELCOM 2004, OSPAR 2005, Verta et al. 2007).

Transboundary pollution

Transboundary pollution loads of heavy metals from Belarus, the Czech Republic and Ukraine are significant. Although the exact loads of heavy metals originating from upstream countries in the Baltic Sea catchment have not been accurately measured or assessed, a HELCOM project evaluated the proportion of transboundary pollution in 2000 (HELCOM 2005). The project findings suggest that the proportions of the total pollution loads entering the Baltic Sea that originate from these upstream countries are in the range of 5-15% for selected heavy metals such as mercury, cadmium and lead. The significance of this transboundary pollution is naturally higher in certain sub-catchments than in the Baltic Sea overall.

Long-term trends in emissions and inputs

Heavy metals

Annual emissions of heavy metals from HELCOM countries to air have decreased during the period from 1990 to 2005 by 45% for cadmium, 46% for mercury, and 86% for lead (cf. Figure 15). The reductions in heavy metal emissions to the air are largely due to the increased use of lead-free fuels, the wider use of cleaner production technologies, the substitution of different production inputs as well as the economic decline and industrial restructuring that occurred in Poland, Estonia, Latvia, Lithuania, and Russia in the early 1990s (Gusev 2007a).

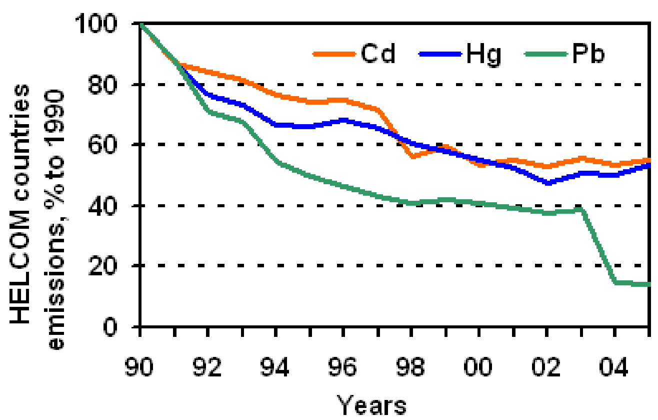


Figure 15. *Total annual emissions of cadmium (Cd), mercury (Hg), and lead (Pb) to air from HELCOM countries in period 1990-2005 (% of 1990) (Gusev 2007a).*

The annual atmospheric deposition of heavy metals are affected by meteorological conditions, therefore decreases in emissions do not always lead to corresponding reductions in atmospheric deposition rates. Annual deposition rates of heavy metals have decreased substantially since 1990 in the Baltic Sea as a whole with reductions of 43% for cadmium, 33% for mercury, and 65% for lead, respectively. On the level of individual sub-basins the most significant drop in cadmium and lead depositions can be noted for the Gulf of Finland (64% and 73%, respectively). The largest decrease in mercury depositions (51%) was observed for the Kattegat (Gusev 2007b).

Since the mid-1990s riverine heavy metal loads (notably cadmium and lead) have decreased in several countries (HELCOM PLC 2005).

Dioxins and furans

In 2005, the total annual PCDD/F emissions of HELCOM countries amounted to 1.4 kg TEQ, which is 24% lower than emissions in 1990 (Figure 16). The largest contributions to the total annual PCDD/F emission of HELCOM countries came from Russia (55%), followed by Poland (31%) and Germany (5%). The most significant drop of PCDD/F emissions can be noted for Denmark (62%), Estonia (42%), and Sweden (35%). Some decrease of emission can also be noted for Germany (27%), Russia (25%), Poland (21%), and Finland (13%). For some of the HELCOM countries, the level of PCDD/F emissions in 2005 was higher than emission of 1990. In particular, Latvia and Lithuania for reported higher values of emissions for 2005 in comparison with the emissions for 1990 (Gusev 2007c).

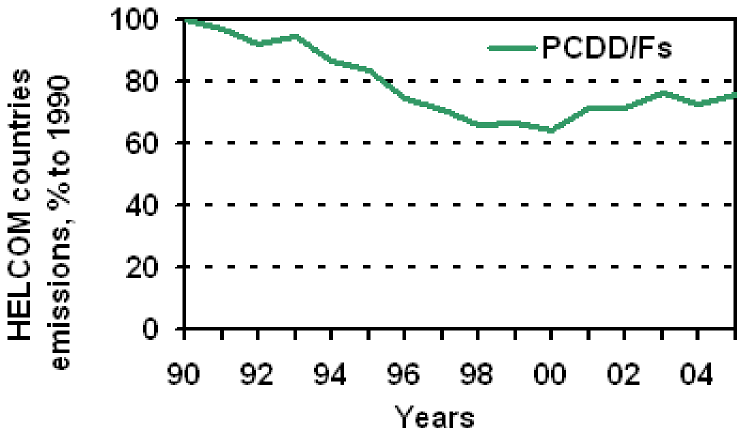


Figure 16. *Emissions of PCDD/Fs to air from HELCOM countries in period 1990-2004 (% of 1990) (Gusev 2006c).*

Total annual atmospheric depositions of PCDD/Fs to the surface of the Baltic Sea have decreased by 50% during the period 1990-2005 (Figure 17). On the level of sub-basins, the most significant drop in PCDD/F depositions was noted for the Belt Sea (66%) and the Kattegat (65%). For other sub-basins the decrease of depositions varied from 28% to 49% (Gusev 2006d).

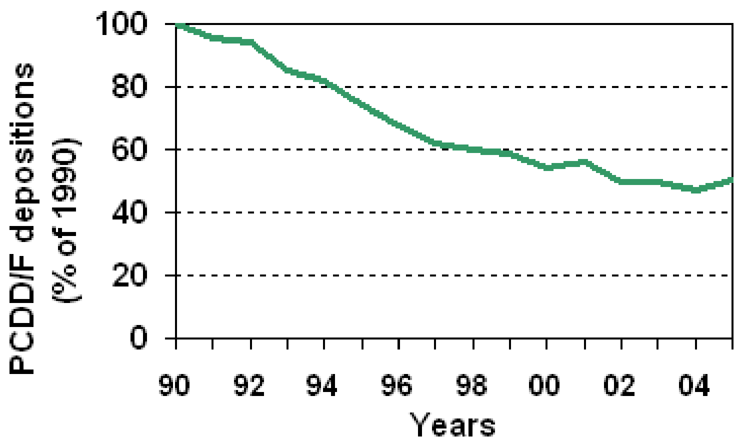


Figure 17. *Computed atmospheric depositions of PCDD/Fs to the Baltic Sea in 1990-2005 (% of 1990) (Gusev 2007d).*

On the sub-basin level the most significant drop in PCDD/Fs deposition has been in the Belt Sea (40%) and the Gulf of Riga (39%). The highest levels of PCDD/Fs depositions over the Baltic Sea can be noted for the Belt Sea and the lowest deposition fluxes were obtained for the Gulf of Bothnia (Figure 18). Among the HELCOM countries the most significant contributions to deposition over the Baltic Sea belong to Germany, Poland and Russia (Gusev 2007d).

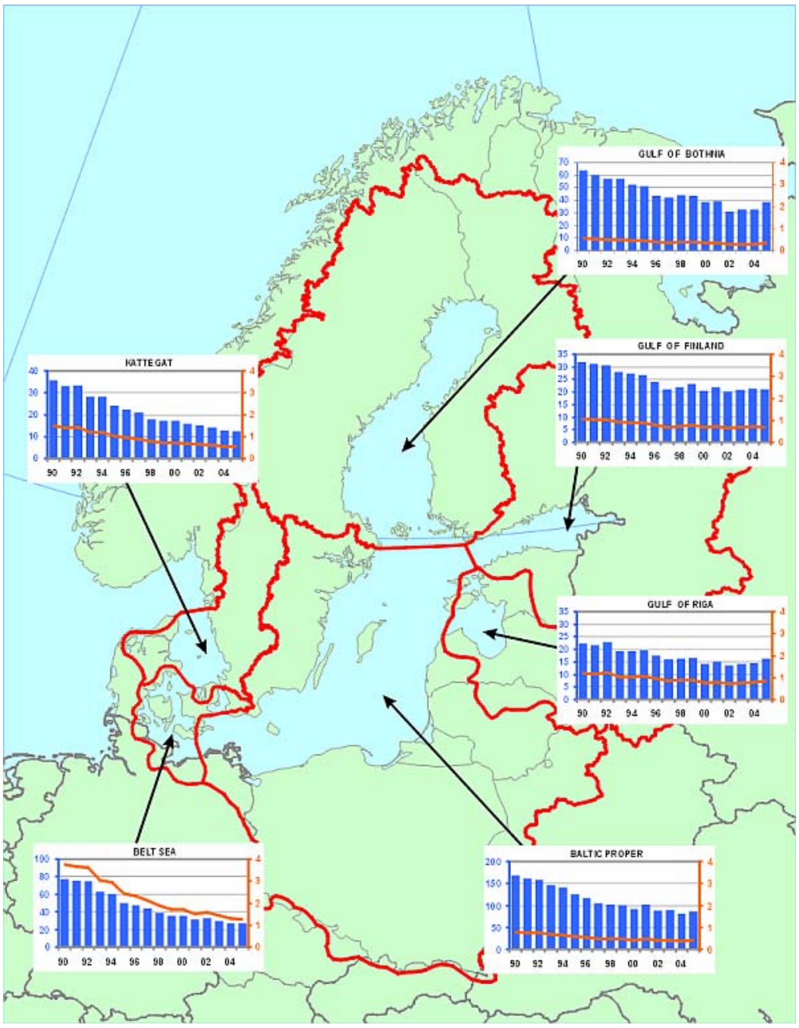


Figure 18: *Time-series of computed total annual atmospheric deposition of PCDD/Fs to six sub-basins of the Baltic Sea in 1990-2005 in tons/year as bars (left axis) and total deposition fluxes in mg TEQ/km2/year as lines (right axis). Note that different scales are used for total depositions in g TEQ/year and the same scales for total deposition fluxes (Gusev 2007d).*

Radioactive substances

In 2006, the total discharges of caesium-137, strontium-90 and cobalt-60 into the Baltic Sea were 2.5, 24 and 5.1 GBq, respectively. In general, there has been a clear decreasing trend in the discharges of caesium-137, strontium-90 and cobalt-60 from local nuclear power plants into the Baltic Sea during the last decade.

The local discharges are of minor importance as sources of radioactivity in the Baltic Sea. The most important sources with respect to the present total inventory of artificial radionuclides in the Baltic Sea have been the fallout from the Chernobyl accident in 1986, the fallout from atmospheric nuclear weapons tests in the 1950s and 1960s, and the discharges from nuclear reprocessing plants in the Western Europe. A small share of the discharges from the reprocessing plants has been transported into the Baltic Sea among the sea currents through the Danish Straits. These three sources represent 82, 14 and 4% of the total input of caesium-137 into the Baltic Sea, respectively, while the share of the local discharges has been only 0.03%. With respect to strontium-90, the share of the local discharges has been 0.1% (Vartti 2007).

Further actions

As a result of the EU enlargement and the development of new EU measures, there is a reduced need for corresponding HELCOM measures. There remain, nevertheless, continuing needs for identifying the specific problems in the Baltic marine environment and reviewing whether measures by the various organisations (global organisations, EU, HELCOM or national) adequately cover the general obligations of the Helsinki Convention and the HELCOM Objective with regard to the cessation target for emissions and discharges of hazardous substances by 2020 in the whole Baltic catchment area. Particular care should be taken that the interests of all HELCOM Contracting Parties are taken into account. This might generate the need for HELCOM to adopt its own Baltic specific measures.

The basic steps for taking action in HELCOM are:

- Identification of threats;
- Identification of fields of action and the need for measures;
- Screening the coverage / implementation efficiency of existing international and national provisions, and
- Deciding whether to develop new measures at international, regional or national level.

The information available on inputs and sources for hazardous substances is much scarcer than that on nutrients and does not allow for a comprehensive assessment of the situation in the Baltic at present.

There is a clear need to efficiently implement already existing regulations concerning hazardous substances, such as implementation of BAT and substitution of hazardous substances in production processes. One particular field with direct impact on the marine environment, where implementation of existing HELCOM regulations should be further improved, seems to be dredging and the disposal of dredged spoils. The HELCOM survey shows that TBT concentrations are high in sediments in some areas indicating that disposal of contaminated material from those areas should be managed in an appropriate way.

As a basis for the HELCOM Baltic Sea Action Plan, HELCOM has evaluated all available information on certain hazardous substances with the aim to assess their impacts on the Baltic Sea environment. The activity has focused on nine organic hazardous substances and two heavy metals that have been selected by HELCOM as being of specific concern to the Baltic Sea marine environment. These substances have also been included in the HELCOM Baltic Sea Action Plan, acknowledging the possible revision of the list and the actions in the future when more information is available.

HELCOM has collected information on the use of the selected substances in different sectors from available national registers and other sources. Furthermore, information has been collected on their occurrence in discharges/emissions and in the Baltic marine environment and on possible actions needed to reduce chemical loads to the Baltic Sea. This information is to be used when taking actions to restrict and substitute the use of the selected substances in important sectors within an agreed timetable in the whole catchment area of the Baltic Sea (see possible actions in Annex 2).

The Contracting States should also develop national programmes addressing hazardous substances taking into account the need for further identification of sources and elimination or restrictions of uses of the selected hazardous substances as well as the need for development of guidelines and capacity building for authorities and industries with regard to identification of hazardous substances and the application of BAT. There is also a need to further increase public awareness with regard to hazardous substances, e.g. in the field of environmentally friendly practices for the use of small-scale combustion appliances with a view to limiting emissions of dioxins.

Additional information will be collected in a screening study focusing on the occurrence of the selected hazardous substances in the Baltic marine environment and there are plans to further screen the sources of these substances in the Baltic Sea countries.

Based on the outcome of available reports, and the work still to be carried out, the most relevant hazardous substances of specific concern, their main uses and most significant sources have been identified. This information will be the basis for developing input, e.g. a joint position by the HELCOM countries, to international, regional or national actions, including:

- the development of EU BAT Reference Documents (BREFs) in order to enhance implementation of BAT with regard to hazardous substances, with special focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment);
- the updating of the EU Water Framework Directive list of priority substances and substances to be evaluated under REACH ;
- placing of plant protection and biocides products on the market, if e.g. levels of these substances in the Baltic marine environment are so high that they may cause adverse effects on marine organisms are possible;
- promotion of, and support to, the identification of new candidate substances and their inclusion to the Stockholm Convention on Persistent Organic Pollutants and the Protocol on Persistent Organic Pollutants to the UNECE Convention On Long Range Transboundary Air Pollution.

HELCOM assessments show that a significant share of both the airborne and waterborne inputs of hazardous substances to the Baltic Sea originate in non-HELCOM countries. This means that it is of utmost importance that the results of HELCOM assessments are taken into account in other *fora* as well.

Other actions needed:

- Introduction of the whole effluent assessment approach
- Development of biological effects monitoring
- Development of requirements concerning Import/export of hazardous substances.

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ANNEX 1

Estimated significant sources of 8 organic substances (Table 1, HELCOM in prep.). All possible sources are listed in Annex 2. It should be noted that all below mentioned sectors (i.e. sources to environment) may not be relevant in all HELCOM countries and these should be identified within national programs under the HELCOM Baltic Sea Action Plan. The industrial sector or professional use has been identified as a significant source if the emission factor is relatively high or if it has been identified as risk use in national risk assessments or if based on expert judgment. The significance of other activities (e.g. sewage treatment plants, STPs) has been evaluated on the basis of measured effluent concentrations.

Table 1. Estimated significant sources of 8 organic substances

Substance	Sources to aquatic environment	Sources to atmosphere
TBT	* anti-fouling use in sea ship hulls (the most significant source for Baltic Sea!) * waste treatment; storm water from waste sorting sites * landfills	considered not important
TPhT	* anti-fouling use in sea ship hulls (the most significant source for Baltic Sea!)	considered not important
pentaBDE	* waste treatment; storm water from waste sorting sites * landfills * STPs * industrial waste water from textile industry & pentaBDE production	* waste treatment * losses from products during service-life
octaBDE	* waste treatment; storm water from waste sorting sites * industrial waste water from textile industry & octaBDE production	* waste treatment * losses from products during service-life
decaBDE	* industrial waste water from polymer and textile industry * waste treatment; storm water from waste sorting sites	* losses from products during service-life * waste treatment
HBCDD	* industrial waste water from textile industry and laundries * landfills * waste treatment, storm water from waste sorting sites	* production of HBCDD
PFOS & PFOS related substances	* landfills * STPs * industrial waste water from metal plating factories, semiconductor and photographic industry, manufacture (and use) of fire fighting foams, paper and packaging protection industry	* semiconductor industry
PFOA	* use of PFOA related substances * landfills * STPs * fluoropolymer production	* use of PFOA related substances * fluoropolymer production

NP	* use of NPE-based products, see NPE sources * STPs * landfills * storm water from waste sorting sites and residential area	not considered important
NPE	* industrial waste water from NPE production, pulp and paper industry, paint industry, production (also use) of detergents and cleaning agents, metal working industry, textile and leather industry, photographic industry and civil and mechanical engineering industry * air transport (anti-icing use) * agriculture * STPs * landfills * storm water from waste sorting sites & residential area	not considered important
OP	* use of OPE-based products, see OPE sources * industrial waste water possibly [1] * STPs * landfills * waste treatment; storm water from waste sorting sites	not considered important
OPE	* industrial waste water possibly [1] * STPs * landfills * storm water from waste sorting sites and residential area	not considered important
SCCP	* industrial waste water from metal cutting and leather industry and manufacture of fat liquoring products used in textile industry	* industrial waste water from metal cutting industry
MCCP	* industrial waste water from metal cutting and leather industry	* industrial waste water from plastics and rubber industry
endosulfan	* agricultural pesticide use	* agricultural pesticide use

[1] An assessment is not possible due to lack of information on emission factors

ANNEX 2

The uses, existing requirements and possible actions to reduce the chemical burden to the Baltic Sea caused by the selected 11 hazardous substances / substance groups of concern to the Baltic Sea.

Substance	Existing requirements	Potential uses in HELCOM area (if e.g. landfills have been identified as a significant sources, this has been noted in "Possible action" column)	Background material	Possible action
Organic substances				
1. Dioxins (PCDD), Furans (PCDF) and Dioxin-like Polychlorinated Biphenyls Chosen as indicator for ecological objectives 1 and 2	- Stockholm Convention on persistent organic pollutants (POPs) - United Nations Economic Commission for Europe (UNECE) Protocol to the Convention on Long-Range Transboundary Air Pollution - EU requirements (e.g. POP regulation 850/2004/EC, Dioxin strategy), see: http://ec.europa.eu/environment/pops/index_en.htm - HELCOM recommendations 27/1 Incineration of waste, 25/2 BAT in industry, 24/4 Iron and steel industry, 25/1 PCBs and PCTs, 19/5 Strategy, 14/3 Glass industry, 13/2 Industrial connections to municipal sewerage systems	Main sources to air in EU-25 (http://ec.europa.eu/environment/dioxin/sources.htm): - Residential combustion - Open burning of waste (backyard burning) - Wood preservation - Iron and steel industry - Power production, non-ferrous metals, chemical industry	EU accession country report and other, HELCOM[1a,b] OSPAR[1c]	- HELCOM recommendation on BEP for small scale combustion to be adopted within BSAP - BAT for bigger sources - Implementation of National Implementation Plan (NIP) and National Action Plan (NAP) under Stockholm convention on POPs

2a. Tributyltin compounds (TBT) Chosen as indicator for objective 1	- Anti-fouling Convention (IMO): application of TBT banned since 2003, and coating of TBT required from 2008 (Convention will enter into force in September 2008) 2002/62/EC: prohibiting, the marketing and use of organostannic compounds in anti-fouling systems for all ships, irrespective of their length. Regulation 782/2003: Antifouling use of organic tin compounds in all vessels banned in 2003. Old paint should be removed or permanently covered in 2008 at the latest. From 1 January 2008, ships bearing an active TBT coating on their hulls will no longer be allowed in Community ports. - 98/8/EC: Biocide use of all organic tin compounds banned since autumn 2006 - 2455/2001/EC: identified as priority hazardous substance under Water Framework Directive - HELCOM Recommendations 20/4 Antifouling paints & 19/5 Strategy	- Use as anti-fouling agent (main use and the most significant source) - Use as biocide - Use as pesticide - Use as marking agent in manufacture of aircraft - Use as fungicide in “regular” (non-anti-fouling) paints - Mono- and dibutyltin, which are used as stabilizers in e.g. PVC, polyurethane, polyester, can include TBT as impurity	OSPAR[2a] Finnish report[2b]	- Ratification and implementation of IMO Convention on the Control of harmful Anti-Fouling Systems (AFS Convention). This proposal has been included to declaration text of Maritime segment under BSAP. As a one important detail and action is the preparation and implementation of Best Management Practises concerning removal of TBT anti-fouling paints in shipyards. Work is currently on-going within IMO working group. Secondly, enforcement of the AFS Convention, once it has entered into force, including development of appropriate measures for survey, certification and inspection of ships. - Introduction of wide network of boat hull washing sites in coastal area in order to reduce the use of anti-fouling agents (e.g. copper) and raising the environmental awareness with regard to washing of boat / ship hulls instead of using anti-fouling agents - Enhancement of implementation for HELCOM regulations / recommendations with regard to dredging and disposal of dredged material in order to minimise the resuspension of hazardous substances (e.g. TBT, TPhT, PAHs, PCBs and heavy metals) from bottom sediments. Dredging should be performed as little as possible and in an environmentally friendly way - Restoration of contaminated areas - Control / treatment of landfill effluents - Proper handling of waste and treatment of storm water originating from waste sorting sites
2b. Triphenyltin compounds (TPhT)	- 91/414/EC: Pesticide use banned in 2002 - 2002/62/EC: prohibiting,	- Use as anti-fouling agent (main use and the most significant source)	OSPAR[2a] Finnish report[2b]	- Ratification and implementation of AFS Convention. See more details in TBT chapter - Introduction of wide network of boat hull washing sites in coastal

	the marketing and use of organostannic compounds in anti-fouling systems for all ships, irrespective of their length in EU - 98/8/EC: Biocide use of all organic tin compounds banned since autumn 2006 - HELCOM Rec. 20/4 Antifouling paints & 19/5 Strategy	- Use as biocide - Use as pesticide (fungicide)		area in order to reduce the use of anti-fouling agents. See more details in TBT chapter - Enhancement of implementation for HELCOM regulations / recommendations with regard to dredging and disposal of dredged material in order to minimise the resuspension of hazardous substances (e.g. TPhT) from bottom sediments. See more details in TBT chapter
3a. Pentabromo-diphenyl ether (pentaBDE)	- 2003/11/EC and 2004/98/EC: Total ban since August 2004, prohibiting the placing on the market and the use of pentaBDE and octaBDE and the placing on the market of articles containing one or both of these substances. - 2002/95/EC (RoHS Directive): from July 2006 new electrical and electronic equipment placed on the market are no longer allowed to contain PentaBDE - 2002/96/EC (WEEE Directive): have to set up collection scheme, proper treatment, recovery and disposal of waste electrical and electronic equipment (to be implemented by 13th August 2004) - 2455/2001/EC: identified as priority hazardous substance under Water Framework Directive - HELCOM Rec. 19/5 Strategy	No information on use in Russia, but is possibly used (see uses below, including production and manufacture stages) Use in EU banned (see left column) but inflow to EU market is occurring via importing finished articles presented below - Use as flame retardant in plastic used in electrical equipment such as computers (e.g. in electronic circuits) - Use as flame retardant in different textiles used in special work wear (designed e.g. to protect humans) and special carpets - Use as flame retardant in different products made of flexible polyurethane foam such as in furniture, mattresses, parts of cars and packing material (main use) - Use in resin used as raw material for above	OSPAR[3a] EU RAR[3b] Swedish report[3f]	- Enhancement of plastics recycling - Review of environmental permits for industrial activities; special attention should be paid on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment) - Substitution with less hazardous substances; requires the compilation of information on substitutes - Promote restrictions and bans on use with special focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment) - Demands on industry using this substance and connected to sewers (e.g. enhanced waste water pre-treatment) with special focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to waste water) - Develop environmental product labelling (EU flower, Nordic swan, German blue angel) to take into account this substance - Overall improvement of waste water treatment in municipal waste water treatment plants, single family homes and small businesses - Control / treatment of landfill effluents - Proper handling of waste and when necessary treatment of storm water originating from waste sorting sites

	- Stockholm Convention on POPs: Chemical for preparation of risk management evaluations	mentioned plastic polymers		
3b. Octabromodi-phenyl ether (octaBDE)	- 2003/11/EC: Total ban since August 2004 - 2002/95/EC (RoHS Directive): see pentaBDE - 2002/96/EC (WEEE Directive): see pentaBDE - 2455/2001/EC: identified as priority substance under Water Framework Directive - HELCOM Rec. 19/5 Strategy - Stockholm convention on POPs: Chemical for preparation of risk profile	No information on use in Russia, but is possibly used (see uses below, including production and manufacture stages) Use in EU banned (see left column) but inflow to EU market is occurring via importing finished articles presented below - Use as flame retardant in insulated wires and cables used in different electronic equipment such as computers - Use as flame retardant in different plastic products made of polymers such as ABS and HIPS (main use) - Use as flame retardant in different textiles made of polymers PBT, polyamide (e.g. nylon), PE-LD and polycarbonate polymers - Use in resin used as raw material for above mentioned plastic polymers	OSPAR[3a] EU RAR[3c]	- Enhancement of plastics recycling (see pentaBDE) - Review of environmental permits for industrial activities; special attention should be paid on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment) - Substitution with less hazardous substances; requires the compilation of information on substitutes - Promote restrictions and bans on use with special focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment) - Demands on industry using this substance and connected to sewers (e.g. enhanced waste water pre-treatment) with special focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to waste water) - Develop environmental product labelling (EU flower, Nordic swan, German blue angel) to take into account this substance
3c. Decabromodi-phenyl ether (decaBDE)	- 2002/96/EC (WEEE Directive): see pentaBDE - 2455/2001/EC: identified as priority substance under Water Framework Directive - HELCOM Rec. 19/5 Strategy - The EU risk assessment concluded that "more data is	No information on use in Russia, but is possibly used (see uses below, including production and manufacture stages) Not produced in EU but is used (see below). Inflow to EU market is occurring also via importing finished	OSPAR[3a] EU RAR[3d,e]	- Enhancement of plastics recycling (see pentaBDE) - Review of environmental permits for industrial activities; special attention should be paid on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment) - Substitution with less hazardous substances; requires the compilation of information on substitutes - Promote restrictions and bans on use with special

	needed" for some aspects of the toxicity and environmental fate of decaBDE	articles presented below - Both use and occurrence in imported products as flame retardant in different plastic products made of HIPS used e.g. in shell structures of TVs and monitors and in wires and cables of electrical equipment - Use in textiles such as in curtains, upholstery fabrics and carpets containing polypropylene - Use in resins as raw material for above mentioned plastic polymers		focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment) → possible joint position on restriction/ban in EU - Demands on industry using this substance and connected to sewers (e.g. enhanced waste water pre-treatment) with special focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to waste water) - Develop environmental product labelling (EU flower, Nordic swan, German blue angel) to take into account this substance
4a. Perfluoro-octane sulfonate (PFOS) Chosen as indicator for objective 1	- 2006/122/EC: Restrictions on the marketing and use; PFOS partly banned as a substance or constituent of preparations at concentration ≥0.005% by mass and in semi-finished products or articles ≥0.1% by mass from 27th June 2008 . Uses in the EU are restricted to: * Photoresists or anti reflective coatings for photolithography processes * Photographic coatings applied to films, papers or printing plates * Mist suppressants for non-decorative hard chromium (VI) plating and wetting agents for use in controlled electroplating system	Below the main uses according to Danish report[17], other minor uses exist, but not shown - Use as surface-active agent in waxes and floor polishes - Use as dirt rejecter, friction control agent, surfactant and antistatic agent in photographic industry in manufacturing of photo film, paper and plates and developing photos (main use & high emission factor to waste water) - Use in semiconductor industry in photo-acid generators, antireflective coatings, etch mixtures and photo-resists (high emission factor to waste water) - Use as surface-active	NCM[4a] OSPAR[4b] Swedish report[8] Danish report[17]	- Review of environmental permits for industrial activities; special attention should be paid on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment) - Substitution with less hazardous substances; requires the compilation of information on substitutes - Promote restrictions and bans on use with special focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment) → e.g. joint position to ban use in sectors not yet covered - Demands on industry using this substance and connected to sewers (e.g. enhanced waste water pre-treatment) with special focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to waste water) - Develop environmental product labelling (EU flower, Nordic swan, German blue angel) to take into account this substance - Overall improvement of waste water treatment in

	* Hydraulic fluids for aviation * Fire fighting foams Note! Fire-fighting foams that have been placed on the market before 27 December 2006 can be used until 27 June 2011. - Mostly substituted by voluntary agreement in USA, Canada and Europe. Restrictions on remaining (few) uses under discussion - Stockholm convention on POPs: Chemical for preparation of risk management evaluations	agent in metal surface treatment in chromium bath used in e.g. chromium plating (main use & high emission factor to waste water). Important applications / final products are e.g. aircraft and vehicles - Use in fire-fighting foams (high emission factor to waste water) - Use as surfactant in industrial and household cleaning products - Use as flame retardant, corrosion inhibitor and surface-active agent in hydraulic fluids of both civil and military airplanes - Use as water and oil repellent in surface treatment (impregnation) of textiles and leather - Use as water and grease repellent in surface treatment (impregnation) of paper and cardboard (high emission factor to waste water)		municipal waste water treatment plants, single family homes and small businesses - Control / treatment of landfill effluents
4b. Perfluoro-octanoic acid (PFOA)	Four of several PFOA precursor substances banned in Canada	- Use as fluxing agent in plumbing with leaded soldering tin - As impurity in polytetrafluoroethylene (PTFE) fluoroplastic coatings (in primer and topcoat) applied in many sorts of products. PFOA is used as processing aid in manufacture of fluoropolymers such as	NCM[4a] OSPAR[4b] Danish report[17]	- Review of environmental permits for industrial activities; special attention should be paid on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment) - Substitution with less hazardous substances both in industrial processes and industrial / consumer products; requires the compilation of information on substitutes - Promote restrictions and bans on use with special focus on uses having high emissions / discharges to

		PTFE - Normally, PFOA is not intentionally part of the final products (unlike PFOS), but there are residual contents in e. g. fluorpolymer. PFOA can be formed through the transformation or metabolism of PFOA related substances such as telomere alcohols.		environment (if this information not available, on main uses or on uses having high emission factor to environment) → e.g. joint position on ban - Demands on industry using this substance and connected to sewers (e.g. enhanced waste water pre-treatment) with special focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to waste water) - Develop environmental product labelling (EU flower, Nordic swan, German blue angel) to take into account this substance - Overall improvement of waste water treatment in municipal waste water treatment plants, single family homes and small businesses - Control / treatment of landfill effluents
5.Hexabromo cyclododecan e (HBCDD)	- EU risk assessment has concluded the existence of risks for both health and the environment. Risk reduction measures discussed in EU, regarding health issues and environmental risks - HELCOM Rec. 19/5 Strategy	- Use as flame retardant in four principal product types: 1. Expandable Polystyrene (EPS, main use), which (as foam containing HBCDD) is further used in the building and construction industry in end products such as insulation panels / boards in the construction sector, automobile cushions for children, rigid packaging material for fragile equipment, packaging material such as ”chips” and shaped EPS-boards 2. Extruded Polystyrene (XPS, main use), which is further used e.g. in rigid insulation panels/boards in the construction sector, insulation material protecting against frost damage on road and railway embankments and	OSPAR[3a] Swedish reports[3f,8] EU RAR[16]	- Review of environmental permits for industrial activities; special attention should be paid on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment) - Substitution with less hazardous substances; requires the compilation of information on substitutes - Promote restrictions and bans on use with special focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment) → possible joint position on restriction/ban in EU - Demands on industry using this substance and connected to sewers (e.g. enhanced waste water pre-treatment) with special focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to waste water) - Develop environmental product labelling (EU flower, Nordic swan, German blue angel) to take into account this substance - Control / treatment of landfill effluents

		sandwich construction in e.g. caravans and lorry platforms 3. High Impact Polystyrene (HIPS), which is further used in electrical and electronic appliances such as audio visual equipment cabinets (video and stereo equipment), distribution boxes for electrical lines in the construction sector and refrigerator lining 4. Polymer dispersion for textile finishing (coating, significant source); textiles can be used for e.g. flat and pile upholstered furniture (residential and commercial furniture), upholstery seatings in transportation, draperies, and wall coverings, bed mattress ticking, interior textiles e.g. roller blinds, automobile interior textiles and car cushions		*The EU rapporteur is proposing the following risk reduction measures:* to impose restrictions on the marketing and use of HBCDD in i.e. textiles, HIPS, EPS and XPS under the Limitations directive (76/769/EEC) to impose compulsory marking of exempted uses of HBCDD in EPS and XPS products under the Limitations Directive to classify used material and products containing HBCDD as hazardous waste under the hazardous waste directive to include HBCDD as a priority hazardous substance in Annex X of the Water framework directive
6a. Nonylphenols (NP)	- 2003/53/EC: Restrictions on the marketing and use; NP and NPE banned at conc. >0.1 % since 1st January 2005 in: * industrial and institutional cleaning * domestic cleaning * textiles and leather processing * emulsifier in agricultural teat dips * metal working	- Use as raw material for production of NPE - Use as stabiliser and emulsifying agent in paints, varnishes and coatings - Use as adhesive or binding agent, process regulator, stabiliser and hardener for epoxy resin in manufacture of plastic products such as in construction materials and as soldering agent in insulated wires and cables	HELCOM[5a] OSPAR[5b] EU RAR[5c,d] Swedish report[8,11,18]	- Review of environmental permits for industrial activities; special attention should be paid on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment) - Substitution with less hazardous substances; requires the compilation of information on substitutes - Promote restrictions and bans on use with special focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment) → possible joint position on restriction/ban in EU in sectors not yet covered - Demands on industry using this substance and

	* manufacturing of pulp and paper * cosmetic products * other personal care products * co-formulants in pesticides and biocides - 2455/2001/EC: identified as priority hazardous substance under Water Framework Directive - HELCOM Rec. 19/5 Strategy, 23/12 Textile, 23/7 Metal plating			connected to sewers (e.g. enhanced waste water pre-treatment) with special focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to waste water) - Develop environmental product labelling (EU flower, Nordic swan, German blue angel) to take into account this substance - Overall improvement of waste water treatment in municipal waste water treatment plants, single family homes and small businesses - Control / treatment of landfill effluents - Treatment of storm water originating from waste sorting sites and residential area - See more possible actions on NPE (see below), which degrades to NP
6b. Nonylphenol ethoxylates (NPE) NPE degrades to NP	- 2003/53/EC: Restrictions on the marketing and use; NP and NPE, see NP - HELCOM Rec. 19/5, 23/12 Textile, 23/7 Metal plating	- Use as stabiliser and emulsifying agent in paints, varnishes and coatings (main use and risk use) - Use as solvent for pesticide applied in agriculture and horticulture (high emission factor to waste water) - Use as aid agent in pre-treatment of wooden fibre mass and removal of lignin in manufacture of pulp (high emission factor to waste water) - Use as stabiliser and developer agent in developing photos (high emission factor to waste water) - Use in metal working fluids in treatment and coating of metal (high emission factor to waste water)	HELCOM[5a] OSPAR[5b] EU RAR[5c,d] Swedish reports[8,11,18]	- Review of environmental permits for industrial activities; special attention should be paid on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment) - Substitution with less hazardous substances; requires the compilation of information on substitutes - Promote restrictions and bans on use with special focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment) → possible joint position on restriction/ban in EU in sectors not yet covered - Demands on industry using this substance and connected to sewers (e.g. enhanced waste water pre-treatment) with special focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to waste water) - Develop environmental product labelling (EU flower, Nordic swan, German blue angel) to take into account this substance - Increased attention to the content of NPE in imported product, e.g. imported textiles has recently

		- Use as surface-active agent in manufacture of pharmaceuticals - Use as cleaning agent in cleaning preparations applied by industry and households (main use and high emission factor to waste water) - Use as soldering agent in manufacture of electronic valves and tubes and other electronic components - Use as laboratory chemical - Use as anti-icing agent in aircrafts (high emission factor to waste water) - Use in liquids designed for technical testing on damages / cracks in different objects - Use in cosmetics - Use as surface-active agent in veterinary medicines - Use in treatment of textiles (e.g. washing of wool, pre-treatment of fibres and smoothing of ink / colour) (main use and high emission factor to waste water) - Use as degreasing agent in treatment of animal hides (main use and high emission factor to waste water) - Use in concrete in order to increase its porosity (high		been shown to contain NPE in higher concentrations - Overall improvement of waste water treatment in municipal waste water treatment plants, single family homes and small businesses - Control / treatment of landfill effluents - Treatment of storm water originating from waste sorting sites and residential area

		emission factor to waste water)		
7a. Octyl-phenols (OP)	- 2455/2001/EC: identified as priority substance under Water Framework Directive - Some OSPAR requirements	- Use as adhesive during vulcanisation in manufacture of car tyres - Use in paper coating - Use in insulation of electronic coils in manufacture of electric motors, generators and transformers - <u>As impurity</u> in nonylphenol at concentration of 1-10%	OSPAR[9]	- Review of environmental permits for industrial activities; special attention should be paid on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment) - Substitution with less hazardous substances; requires the compilation of information on substitutes - Promote restrictions and bans on use with special focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment) → possible joint position on restriction/ban in EU in sectors not yet covered - Demands on industry using this substance and connected to sewers (e.g. enhanced waste water pre-treatment) with special focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to waste water) - Develop environmental product labelling (EU flower, Nordic swan, German blue angel) to take into account this substance - Overall improvement of waste water treatment in municipal waste water treatment plants, single family homes and small businesses - Control / treatment of landfill effluents - Treatment of storm water originating from waste sorting sites
7b. Octyl-phenol ethoxylates (OPE) OPE degrades to OP	- 2004/648/EC: indirectly banned as detergent - HELCOM Rec. 23/12	- Use as stabiliser and developer in developing photos - Use as surface-active agent in cleaning preparations used e.g. in service of motor vehicles, compressors and other industrial cleaning - Use as adhesive and glue	OSPAR[9]	- Review of environmental permits for industrial activities; special attention should be paid on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment) - Substitution with less hazardous substances; requires the compilation of information on substitutes - Promote restrictions and bans on use with special focus on uses having high emissions / discharges to environment (if this information not available, on main

		in manufacture of plastic products - Use in water based metal working fluids in treatment and coating of metal - Use as emulsifier and dispersant for pesticide applied in agriculture and horticulture - Use in treatment of textiles and leather finishing - Use as emulsifier in manufacture of styrene-butadiene polymers - Use as emulsifier and dispersant in water based paints, printing inks and paints intended to surfaces exposed to sea water - Use in pharmaceuticals		uses or on uses having high emission factor to environment) → possible joint position on restriction/ban in EU in sectors not yet covered - Demands on industry using this substance and connected to sewers (e.g. enhanced waste water pre-treatment) with special focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to waste water) - Develop environmental product labelling (EU flower, Nordic swan, German blue angel) to take into account this substance - Overall improvement of waste water treatment in municipal waste water treatment plants, single family homes and small businesses - Control / treatment of landfill effluents - Treatment of storm water originating from waste sorting sites
8a. Short-chain chlorinated paraffins (SCCP or chloroalkanes C_{10-13})	- 2002/45/EC: Limitations on marketing and use; banned at metal working fluids and leather finishing at conc. > 1% - 2455/2001/EC: identified as priority hazardous substance under Water Framework Directive - HELCOM Rec. 19/5 Strategy, 17/8, 17/9, 16/4 Pulp industry, 16/7 Leather industry - Stockholm convention on POPs: Chemical for preparation of risk profile	- Use in manufacture of textiles and wearing apparels in order to achieve clothes (designed e.g. to sailing and industrial work) of high flame resistant, water-proof and anti-fungal properties - Use as greasing agent in leather finishing, further use in manufacture of leather products - Use in metal working fluids (both water and oil based) in treatment and coating of metal - Use as lubricants in compressed air tools in garages and in different industrial sectors	HELCOM[6a] EU RAR[6b] OSPAR[6c] Swedish reports[11,12] German report[10]	- Review of environmental permits for industrial activities; special attention should be paid on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment) - Substitution with less hazardous substances; requires the compilation of information on substitutes - Promote restrictions and bans on use with special focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment) → possible joint position on restriction/ban in EU in sectors not yet covered - Demands on industry using this substance and connected to sewers (e.g. enhanced waste water pre-treatment) with special focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to waste water) - Develop environmental product labelling (EU flower,

		- Use as plasticiser and flame retardant in paints (used e.g. in road marking and as primer for surfaces exposed to sea water), varnishes and coatings - Use as plasticiser and flame retardant in rubber products such as gaskets, sealants and in glues which have been used e.g. in construction sector and car industry - MCCP can contain up 1% SCCP as impurity		Nordic swan, German blue angel) to take into account this substance
8b. Medium-chain chlorinated paraffins (MCCP or chloroalkanes C_{14-17})	No regulations yet	- Use as substitute for SCCP - Use as greasing agent in leather finishing - Use in metal working fluids (both water and oil based) in treatment and coating of metals - Use as plasticiser and flame retardant in paints (used e.g. in road marking and as primer for surfaces exposed to sea water), varnishes and coatings - Use as plasticiser and flame retardant in rubber products such as gaskets and in glues which have been used e.g. in construction sector and car industry - Use in some carbon copy paper types - Use as plasticiser and flame retardant in PVC	EU RAR[6d] German report[10] Swedish report[12]	- Review of environmental permits for industrial activities; special attention should be paid on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment) - Substitution with less hazardous substances; requires the compilation of information on substitutes - Promote restrictions and bans on use with special focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to environment) → possible joint position on restriction/ban in EU - Demands on industry using this substance and connected to sewers (e.g. enhanced waste water pre-treatment) with special focus on uses having high emissions / discharges to environment (if this information not available, on main uses or on uses having high emission factor to waste water) - Develop environmental product labelling (EU flower, Nordic swan, German blue angel) to take into account this substance

		plastic and further use in manufacture of plastic products		
9. Endosulfan	- 864/2005/EC: banned in EU (withdrawal of authorisation) in plant protection product since 2005, authorisation in Poland shall expire not later than 31.12.07 - 2455/2001/EC: identified as priority hazardous substance under Water Framework Directive	- Agricultural pesticide (main use) - Possibly use as a wood impregnation agent e.g. in Russia	OSPAR[7] German report[10]	- Joint position for POP under Stockholm convention - Substitution with less hazardous substances both in industrial processes (wood impregnation) and specially as agricultural pesticide (main use): requires the compilation of information on possible substitutes - Promote restrictions and bans on use as wood impregnation agent and specially as agricultural pesticide - Demands on wood impregnation industry using this substance and connected to sewers (e.g. enhanced waste water pre-treatment)
Heavy metals				
10. Mercury (Hg) Chosen as indicator for objective 1 and objective 2	- EU strategy and several other requirements for product control and production. There is an agreement on a ban on mercury in fever thermometers and measuring instruments for consumers use – see http://www.ec.europa.eu/enterprise/chemicals/legislation/markrestr/preparation_en.htm - There is also a draft EU regulation on the banning of exports and the safe storage of metallic mercury, see: http://ec.europa.eu/environment/chemicals/mercury/ - There is also EC rules on	- Dentistry (dental amalgams) - Batteries - Measuring and control instruments (e.g. thermometers) - Lamps - Electronics - Laboratory chemical - pharmaceuticals - Gold and silver recovery - Chlorine-alkali industry - Coating on paper or film in photographic applications - Fossil fuel combustion in power plants - Crematoria - Production of zinc and copper (Hg in raw material)	HELCOM[13a] OSPAR[13b] EU fact sheet under WFD[13c] See further information "EU source screening under WFD" (e.g. classification of sources)[13d]	- Joint position for more stringent measures - Ban of export - Ban in various measuring equipment and products where alternative solutions exist (requires the compilation of information on substitutes) - Reduction of mercury content in lamps - BAT for power plants - Work for restrictions on the use of amalgam in dentistry; either ban or obligation to use mercury precipitator in dental operations - HELCOM Recommendation on crematoria to be adopted in HELCOM 29/2008 Meeting

	the content of mercury in batteries and waste collection of batteries see: http://ec.europa.eu/environment/waste/batteries/index.htm - 2002/95/EC (RoHS Directive) from July 2006 also prohibits new electrical and electronic equipment placed on the market to contain mercury with the exception of fluorescent lamps where maximum contents are specified for various types of lamps. - 2455/2001/EC: identified as priority hazardous substance under Water Framework Directive - HELCOM recommendations 6/4 Dentistry, 24/4 Iron and steel industry, 14/5 Batteries, 27/11 Incineration of waste, 17/6 Fertilisers, 18/2 Offshore activities, 23/4 Light sources and electrical equipment, 23/6 Chlor-alkali industry, 23/7 Metal surface treatment, 23/11 Chemical industry & 23/12 Textile industry	- Non-antifouling paints (use possible in HELCOM area) - Cosmetics (banned in EU, but use possible in Russia) - Pesticide (banned in EU, but use possible in Russia) - Marine antifouling paints (banned in EU, but use possible in Russia) - Wood preservation (banned in EU, but use possible in Russia) - Textile treatment (banned in EU, but use possible in Russia)		
11. Cadmium (Cd) Chosen as indicator for objective 1 and objective 2	- 2002/95/EC (RoHS Directive) from July 2006 prohibits new electrical and electronic equipment placed on the market to contain cadmium with some exceptions - There is also EC rules on	- Stabiliser for PVC - Pigment in plastics, glasses, ceramics, paints, papers and inks - Electrode material in nickel-cadmium batteries - Synthesis of other	HELCOM[14a] OSPAR[14b] EU fact sheet under WFD[14c] See further information "EU source screening	- Introduction of restrictions on the content of cadmium in fertilizers, - Implementation of BAT in relevant industrial sectors - Control / treatment of landfill effluents - Proper handling of hazardous waste and treatment of induced storm water - Control / treatment of urban run off / storm water

	the content of cadmium in batteries and waste collection of batteries see: http://ec.europa.eu/environment/waste/batteries/index.htm - 2455/2001/EC: identified as priority hazardous substance under Water Framework Directive - HELCOM recommendations 24/4 Iron and steel industry, 14/5 Batteries, 27/11 Incineration of waste, 17/6 Fertilisers, 18/2 Offshore activities, 23/7 Metal surface treatment, 23/11 Chemical industry & 23/12 Textile industry	inorganic cadmium compounds - Metal industry and metal ore roasting or sintering installations - Production of ferrous and non-ferrous metals (zinc mining, lead and zinc refining, cadmium) - Plating of metals i.e. protection of iron against corrosion - Component for various alloys - Solar cells - Fossil fuel combustion in power plants (as impurity) - Fertilizer (as impurity)	under WFD (e.g. classification of sources)[14d]	

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