The specific conditions in the Baltic Sea Region to be taken into account when selecting and prioritising hazardous substances for priority action

Submitted by Finland and WWF[1]

The strategy to implement HELCOM objective with regard to hazardous substances (HELCOM Recommendation 19/5) gives guidance for selecting and prioritising hazardous substances for priority action. The strategy emphasises both the need to utilise the work done in other international fora and to take the specific conditions in the Baltic Sea area into consideration. The aim of this document is to describe the specific conditions of the Baltic Sea area and by that facilitate the future work on selecting and prioritising substances for priority action.

A considerable development of selection and prioritisation mechanisms has been conducted under the framework of OSPAR (DYNAMEC) and the EU (COMMPS). They were developed to select hazardous substances used in the Western European countries relevant for the protection of the marine environment of the North Eastern Atlantic and fresh waters respectively. Both natural and socio-economic conditions in the Baltic Sea area differ from that of OSPAR and the EU countries. However the selection criteria with regard to intrinsic properties both in DYNAMEC and COMMPS are not region-specific. Hence, they provide a good basis for priority setting under HELCOM as well. COMMPS uses monitoring data from West European freshwater for ranking. Both systems use IUCLID and the Nordic product Registers in ranking, DYNAMEC uses the Nordic product Registers and IUCLID as a criterion in the initial selection. Hence the exposure related data are specific for the EU region, not for Eastern Europe and the need for further adaptation of the selection and prioritisation mechanisms must be considered.

Annex 1 lists physical, chemical and biological features, which increase or may increase the vulnerability of the Baltic Sea ecosystem to anthropogenic chemicals compared to the marine or freshwater environments addressed within the OSPAR and EU framework. It should be noted that some of the characteristics included in the list (e.g. semi-enclosed sea, large catchment area) and their implications for hazardous substances are obvious facts, whereas the implications of some other features are less clear.

Annex 2 identifies socio-economic factors, which may contribute to market occurrence and use of hazardous substances that significantly differ from those on the EU market. It should be noted that knowledge on the chemicals market and stocks of outdated hazardous chemicals in the Baltic States, Poland and Russia is incomplete, thus some of the factors may be more of hypothetical nature.

Consequences of the nature conditions for the selection and priority setting of hazardous substances

- The physical conditions of the Baltic Sea are likely to retard the degradation of hazardous substances. Hence, more weight should be given to persistence in the selection of substances and the used cut-off values for persistence should be lower. An other feature giving emphasis on persistence are the hydro-

1 Finland was responsible for the preparation of Annex 1 concerning physical, chemical and biological features and WWF was responsible for Annex 2 concerning socio-economic factors.

geographical conditions which promote stocking up in time with regard to persistent and bioaccumulative substances
- There is lack of scientific knowledge on effects of hazardous substances (for instance, i) impacts of variable salinity on the toxicity of substances and ii) impacts of toxic effects on the whole ecosystem in the light of low biodiversity) in the Baltic Sea environment. This and the need to preserve the unique nature of the brackish water ecosystem in the Baltic Sea (rare compared to fresh and sea water ecosystems) stresses the importance of following the precautionary principle in the selection and priority setting.

Consequences of the socio-economic conditions for the selection and priority setting of hazardous substances

- The lack of knowledge on the type and amount of chemicals imported or produced in the southern and eastern part of the Baltic Sea area stresses the importance of carrying out market surveys in co-operation with chemicals trading companies and industry in the three Baltic States, Poland and Russia.
- The "Hazardous Substance Issue" as understood in the HELCOM context needs campaigning towards more awareness in the eastern and southern Baltic area. Since the available national data bases on market volumes, use patterns and environmental occurrence of these substances will only develop step by step, all current information depends on knowledge and awareness on company level. HELCOM priority setting among substances will hardly be possible without this knowledge.
- Hazardous waste collection and disposal should be given a particular weight within the implementation of HELCOM`s strategy with regard to hazardous substances. Discharges and losses of hazardous substances from the hazardous wastes management system should be paid full attention when selecting the substances.

Conclusions:

Selection and priority setting mechanisms as applied under OSPAR and EU WFD provide a good basis for the work in the HELCOM area but need to be modified to take into account natural and socio-economic conditions in the Baltic Sea Region.

In the selection of substances special attention should be given to persistency of the substances. The long-term effects or chronic toxicity should be stressed in the selection. Special attention should be given for substances that are found in the Baltic Sea.

To increase knowledge on substances and their use patterns in the Baltic Sea area and to facilitate the selection of new substances for priority action the following measures could be initiated:
- Awareness rising (by e.g., national workshops) on the aims and tools of the HELCOM strategy is needed to give basis for selection of substances. The project team and CEFIC should assist in organising workshops and other type of awareness rising in the South-Eastern Baltic area. In doing so other capacity building activities should be taken into account to avoid overlapping work.
- Market surveys related to i) the import of selected product groups[2], should be carried out in order to

2 Selection could be based on import statistics and the evaluation which product groups are dominated by imports from

facilitate priority setting, ii) the use of selected chemical products in certain industry[3] sectors and to iii) the use of chemicals initially selected in the OSPAR DYNAMEC procedure but excluded from priority setting as being already heavily regulated or phased on the EC market.

Need for further research is identified i.a. for following areas:

Although the precautionary principle constitutes the basis of any acceptable strategy for chemicals management it is important to identify the most important gaps of data and information and accordingly the needs for additional efforts. The following list of needs for further research must not be seen as a proposal to HELCOM concerning its own activities for data collection. The list of identified needs shall be seen and used as information also for other responsible stakeholders participating in providing an improved basis for an environmentally sound chemicals policy in the Baltic Sea catchment area.

- Effects of salinity and pH on degradation of organic compounds should be studied. The study could include freshwater, seawater and brackish water of variable salinity.
- Effects of temperature on degradation of organic compounds should be studied. The study should include also very low temperatures, i.e. 1-4 °C that are relevant during winter in the Baltic Sea
- Effects of light duration and intensity on photodegradation of organic compounds. The study could include degradation under ice.
- Hazardous substances are bound to anoxic sediments. Very little is known about the resuspension of hazardous substances into water when oxic conditions return. More research is needed in this field.
- Screening investigations of persistent substances that will likely enter to the Baltic Sea
- Do salinity, pH, temperature or other relevant abiotic factors in the Baltic Sea affect the bioavailability and bioaccumulation of different types of hazardous substances, i.e. metals, polar/non-polar organic substances, ionic/non-ionic substances?
- Effects of salinity on vulnerability of the Baltic Sea species. Different salinity, species and life-stages should be studied. The study should include species of marine and freshwater origin, as well as stenohaline and euryhaline species. Due to the potential slow degradation of substances in the Baltic Sea, the long-term studies focusing on growth, reproduction and survival should be investigated.
- Effects of low biodiversity on the vulnerability of the Baltic Sea ecosystem. Comparative studies between marine, brackish and freshwater environment, e.g. micro- or mesocosm studies.

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markets on which obligatory environmental classification rules are still inadequate.

3 Selection could be based on the economical relevance of certain industry sectors (textile and leather processing, pulp and paper, wood processing, manufacture of furniture, manufacture of food, metal processing) and the key chemicals in these sectors (e.g. institutional cleaners and textile processing detergents; dye stuffs; metal processing fluids;).

ANNEX 1

Feature	Consequence	Implication for exposure or effects of chemicals
Physical features		
Semi-enclosed sea	Slow exchange of water Minimal tides, low sediment circulation	Trapping of chemicals Stocking up of chemicals in anoxic, deep sediments, occurrence of stable hot spot areas (sedimentation areas).
Large, densely populated catchment area	High inflow of freshwater High atmospheric deposition of anthropogenic contaminants	High input of hazardous substances
Shallow compared to the Atlantic Sea	Small water volume compared to seas and hence smaller dilution of hazardous substances compared to seas	Higher concentration of chemicals
Low temperature	Slower hydrolysis and biodegradation of organic compounds	Higher concentrations of slowly degradable chemicals
Ice and snow cover (Furman et al. 1998)	Inhibition of photodegradation and volatilisation	Higher concentrations of photodegradable and volatile chemicals
Short day conditions in autumn and winter	Inhibition of photodegradation	Higher concentrations of photodegradable chemicals
Permanent stratification of water because of halocline Temporary stratification of water because of thermocline (Furman et al. 1998)	Inhibition of exchange of water and dissolved substances as well as particulate matter across halocline or thermocline	Concentrations of chemicals
Hydrodynamic fronts e.g. in the eastern Gulf of Finland	Selective sedimentation of metals (Harri Kankaanpää, FIMR)	Affects the proportions of chemicals present in the different compartments
Chemical features		
Brackish water, salinity range from 0 to 20‰ (Kautsky and Andersson 1997)	Salinity affects speciation of metals	Toxicity of metals is inversely related to the salinity (metals appear in more toxic forms in the low saline water compared to the seawater) (Reviewed by (Kautsky and Andersson 1997)
Low calcium concentration compared to oceans (Grasshoff and Voipio 1981)	Increased permeability of cell membranes	Increased uptake of metals compared to the seawater

Feature	Consequence	Implication for exposure or effects of chemicals
Anoxic and hypoxic sediments		Hazardous substances such as metals, PCB and PAH, are often bound in sediments under hypoxic or anoxic conditions. The improved oxygen conditions may temporary increase the mobilisation of some metals from sediments (Jonsson 1992, Sternbeck et al. 1999).
Biological features		
Short history of the Baltic Sea (The current salinity has existed about 3000 years)	Organisms are not fully adapted to live in the Baltic Sea → low biodiversity	One consequence of low biodiversity is that the Baltic Sea has only few key species, i.e. species that have an important ecological role in the ecosystem. If these species would decline, there are no other species taking over their functions. Bladder wrack (*Fucus vesiculosus*) and blue mussel (*Mytilus edulis*) can be regarded as key species in the Baltic Sea (Kautsky and Andersson 1997).
Species living in the Baltic Sea are originally marine or freshwater species and thus live close to their physiological tolerance limits regarding the ambient salinity		Hypothesis: Species living in the Baltic Sea are more vulnerable to chemicals compared to marine or freshwater species (Tedengren and Kautsky 1987, Tedengren et al. 1988) There are very little studies to verify whether brackish water species are more, less or equally sensitive to chemicals compared to marine and freshwater organisms. Different type of water may also affect the toxicity of chemicals.
High sedimentation rates compared to oceans (Harri Kankaanpää, FIMR)	Efficient input of particle-bound contaminants to sediments	Hypothesis I: Increased sedimentation reduces the bioavailability of pollutants and increases biodilution. Hypothesis II: The sediment may function as a source of hazardous substances, when the input to the sea stops. Due to equilibrium partitioning will substances end up in the water from the sediment, if the concentration in the water gets low enough.

Feature	Consequence	Implication for exposure or effects of chemicals
Cyanobacterial blooms produce liver toxins.		Hypothesis: Peak concentrations of natural toxins indirectly triggered through human activity (nutrient input => algae blooming) may interfere with toxokinetics of man made hazardous substances. Whether this is antagonistic or synergistic interference is not yet known. (Harri Kankaanpää, FIMR)

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ANNEX 2

Feature	Consequence	Implication for the selection and priority setting strategy
At present, data bases on market occurrence, volume and use pattern of chemical substances like IUCLID or the Nordic product registers are not available in the southern and eastern Baltic area.	The exposure driven priority setting like in the DYNAMEC and COMMPS procedure is not feasible. Also, in the initial selection only the registers for plant protection products can be used to determine whether or not a substance is market relevant.	The OSPAR and EU strategy to collect basic exposure information for priority setting is not applicable in the HELCOM area. Thus an appropriate strategy needs to be developed.
In the region there may be stored large stocks of outdated pesticides partly still not yet identified. The storage conditions need to be examined.	Leakage of hazardous substances not anymore marketed in the EU may be significantly higher compared to EU countries. "Re-utilisation" cannot totally be excluded because of the economic situation.	Current regional sources may contribute to the environmental occurrence of substances not on EU market anymore.
Hazardous waste storage, collection and disposal systems may contain previously used hazardous substances. There is a need to examine the role of hazardous waste management as a discharge source of hazardous substances.	Leakage of hazardous substances not anymore marketed in the EU may be significantly higher compared to EU countries.	
Production and import of chemicals in the Baltic Sea area may introduce "new" substances to the market or substances that have been phased out on the EU market.	The DYNAMEC and COMMPS mechanisms to identify substances of possible (or priority) concern may have missed these substances. This may apply in particular to several kinds of products based on coal chemistry.	Substances of priority concern regarding potential exposure in the HELCOM area may be different from those identified under OSPAR.
Compared to the EU and OSPAR area the market volume and uses of certain substances may much differ in the southern and eastern part of the HELCOM area.	The DYNAMEC and COMMPS mechanisms to identify substances of priority concern is not applicable for the Baltic area since it is to a large extent based on EU market volumes of substances.	
Classification of environmental properties of chemicals is not yet introduced in large parts of the chemicals market in the Baltic Sea area. The same applies to the measures following classification, e.g. obligation to provide SDSs.	Awareness and knowledge regarding persistence and bioaccumulation of chemicals need to be strengthened among trade, industry and state administration especially in the eastern and southern Baltic Region.	Increasing awareness and general knowledge in enterprises and state administration regarding the environmental properties of organic chemicals may be i) a precondition for the collection of data supporting selection and priority setting and ii) a substantial contribution to reducing environmental exposure.