



---

<b>Document title</b>	Information on airborne input data availability
<b>Code</b>	3-5
<b>Category</b>	INF
<b>Agenda Item</b>	3 – Thematic session on hazardous substances
<b>Submission date</b>	30.9.2015
<b>Submitted by</b>	EMEP
<b>Reference</b>	

---

### Background

According to the Protocol to the Convention on Long-range Transboundary Air Pollution on persistent organic pollutants, the list of the POPs under consideration includes a number of compounds from the list of priority pollutants of the BSAP. Some of these compounds are also included into the set of HELCOM indicators of the ecosystem health of the Baltic Sea. The updated version of the contract between HELCOM and EMEP contains Annex 2 where compounds included into both the Baltic Sea Action Plan and to the Protocol to the Convention on Long-range Transboundary Air Pollution. Inclusion of some of the compounds to the Protocol to CLRTAP is currently under consideration.

This document contains information by EMEP on the availability of information on POPs, listed in Annex 2 of the Contract between the HELCOM and EMEP/MSC-E, for the evaluation of atmospheric input to the Baltic Sea (Attachment 1). The document also integrates evaluation of atmospheric input of HMs and monitored POPs to the Baltic Sea for the period 1990-2013 (Attachment 2).

### Action required

The Meeting is invited to consider and decide on a set of pollutants, which airborne inputs have to be assessed in order to complement the holistic assessment of the health of the Baltic Sea with data on environmental pressure. The Meeting is also invited to decide on the periodicity of reporting data on different pollutants by EMEP.

---

## Attachment 1

### **Availability of information on POPs, listed in the Annex 2 of the Contract between the HELCOM and EMEP/MSC-E, for the evaluation of atmospheric input to the Baltic Sea**

The information on emissions and deposition of selected POPs, which can be presented by EMEP, has been discussed at previous meetings of the HELCOM LOAD group (HELCOM LOAD 4, LOAD 7).

In particular, it was noted that EMEP could provide data on emissions and estimates of atmospheric load to the Baltic Sea for selected PAH and PCB congeners in a similar way as for heavy metals and PCDD/Fs (Minutes of HELCOM MONAS 15/2011, paragraph 9.3).

PBDE and HBCDD are currently under consideration for the inclusion to the CLRTAP Protocol on POPs. Therefore there is no regular evaluation of their emissions and long-range transport under EMEP currently. At the same time, pilot evaluation of pollution levels for the Baltic Sea region can be performed using available information. It should be noted that this work requires further cooperation with national experts with regard to refinement of available data on their emissions and observed levels of pollution and construction of gridded emission data for modelling.

Updated outline of possible deliverables on selected POPs which can be used to characterize atmospheric input to the Baltic Sea is given below.

**Polychlorinated dibenzo(p)dioxins and dibenzofurans (PCDD/Fs):** Evaluation of pollution by dioxins and furans is performed for 17 toxic PCDD/F congeners. Necessary information on their physical-chemical properties is available for use in modelling. Data on PCDD/F emissions are regularly collected and reported to the UN ECE by EMEP countries (including all 9 HELCOM countries). Emission data are available for the period from 1990 to the latest reporting year. Regular measurements of PCDD/Fs at the EMEP monitoring sites are not currently performed. At the same time, it is possible to use available national measurements of the EMEP countries reported in literature and collected in the database of the UNEP Stockholm Convention<sup>1</sup>. Model assessment of temporal changes of atmospheric input to the Baltic Sea and contributions of EMEP countries to deposition is performed. Results of model simulations reasonably agree with measurements (Gusev et al., 2015).

**Polyaromatic hydrocarbons (PAHs):** Following the CLRTAP Protocol on POPs EMEP provides assessment of pollution levels for the following 4 PAHs: benzo[a]pyrene (B[a]P), benzo[b]fluoranthene (B[b]F), benzo[k]fluoranthene (B[k]F) and indeno[1,2,3-cd]pyrene (I[1,2,3-cd]P). For these 4 PAHs necessary information on physical-chemical properties is available. Data on PAH emissions are regularly collected and reported to the UN ECE by EMEP countries (including all 9 HELCOM countries). Emission data are available for the period from 1990 to the latest reporting year. Levels of PAHs are regularly measured by the EMEP monitoring network. Model assessment of pollution levels, trans-boundary transport, and temporal changes of pollution is carried out. Results of model simulations reasonably agree with measurements. The level of discrepancies is about a factor of two on average (Gusev et al., 2015). Based on this information EMEP can evaluate time-series of atmospheric deposition to the Baltic Sea and its sub-basins, for B[a]P, as an indicator PAH compound, and estimates of contribution of particular countries and source categories. In addition, analysis of sector-wise information on emission and deposition data is possible for selected years.

**Polychlorinated biphenyls (PCBs):** PCBs have been included in the list of pollutants for regular model assessment of pollution levels within the EMEP region since 2013. The information on

---

<sup>1</sup> Global Monitoring Plan (GMP) for Persistent Organic Pollutants (POPs) under the Stockholm Convention. GMP Data Warehouse – Data Visualization (<http://www.pops-gmp.org/visualization-2014/>).

physical-chemical properties required for modelling is available for several PCB congeners (e.g. for PCB-28, PCB-52, PCB-101, PCB-105, PCB-118, PCB-138, PCB-153 and PCB-180). The information on emissions of PCBs is regularly reported by the EMEP countries (including 8 HELCOM countries) as annual totals without splitting on the individual congeners. Emission data are available for the period from 1990 to the latest reporting year. Along with this there exist expert estimates of global emissions of PCB congeners worked out by Breivik et al. (2007). Levels of PCB concentrations in air and precipitation are annually measured by the EMEP monitoring network. Results of model simulations reasonably agree with observed levels of pollution (Gusev et al., 2015). Level of discrepancies between the modelled and observed air concentrations is about a factor of two on average. Using this information EMEP can provide model assessment of time-series of PCB deposition to the Baltic Sea and its sub-basins as well as estimates of contribution of particular countries (for individual PCB congeners e.g. for PCB-153).

**Polybrominated biphenyl ethers (PBDE):** At present PBDE is under consideration for the inclusion into the CLRTAP Protocol on POPs. Therefore EMEP has no regular reporting of PBDE emissions and evaluation of pollution levels. Besides, long-range transport and deposition of PBDE is not evaluated within EMEP on the regular basis. Nevertheless, evaluation of pollution levels within the Baltic Sea region could be carried out for BDE-47 and BDE-99 congeners using TNO inventory of PBDE emission in the European region (Denier van der Gon et al., 2005). The information on their physical-chemical properties for modelling purposes is available. Monitoring of air concentrations of particular BDE congeners is performed at the several EMEP monitoring sites. Thus, pilot study of atmospheric input of PBDE to the Baltic Sea and contribution of particular countries can be made in cooperation with the HELCOM countries and experts in order to refine information on emission data and national measurements.

**Hexabromocyclododecane (HBCD):** HBCD is considered as a candidate for the inclusion to the CLRTAP Protocol on POPs and assessment of pollution for this substance is not yet carried out within EMEP. In particular, EMEP has no regular reporting of information on emissions from countries for this chemical. At the same time, a number of studies of HBCD transport distance and persistence in the environment were carried out by MSC-E to provide preliminary estimates on its transport and fate. There is information on physical-chemical properties of this pollutant. Measurements of HBCD air concentrations are performed at the EMEP monitoring sites. Therefore, evaluation of HBCD long-range transport and deposition to the Baltic Sea region could be performed on pilot basis in cooperation with the HELCOM countries in order to construct gridded emission data based on national inventories of emissions and collect national measurements of HBCD for combined analysis of pollution using modelling results and measurements.

**Perfluorooctane sulfonate (PFOS):** PFOS is currently considered as a candidate for the inclusion to the CLRTAP Protocol on POPs and assessment of pollution for this substance is not yet carried out within EMEP. In particular, there is no regular reporting of information on emissions of PFOS and its precursors. Besides, data on their physical-chemical properties are subject of substantial uncertainties. At the same time, episodic measurements of air concentrations are performed at the EMEP monitoring sites. Thus, study of pollution of the Baltic Sea by PFOS and its precursors requires refinement of the information on physical-chemical properties and emissions to the environment in cooperation with the HELCOM countries and experts.

### *References*

Breivik K., Sweetman A., Pacyna J.M., Jones K.C. (2007). Towards a global historical emission inventory for selected PCB congeners - A mass balance approach-3. An update. *Science of the Total Environment*, vol. 377, pp. 296-307.

Denier van der Gon H.A.C., van het Bolscher M., Visschedijk A.J.H. and P.Y.J.Zandveld (2005). Study to the effectiveness of the UNECE Persistent Organic Pollutants Protocol and costs of possible additional measures. Phase I: Estimation of emission reduction resulting from the implementation of the POP Protocol. TNO-report B&O-A R 2005/194.

Gusev A., Shatalov V., O. Rozovskaya, W. Aas, P. Nizzetto (2015). Assessment of spatial and temporal trends of POP pollution on regional and global scale. EMEP Status Report 3/2015.

[http://www.msceast.org/reports/2\\_2015.pdf](http://www.msceast.org/reports/2_2015.pdf)

**Evaluation of atmospheric input of HMs and POPs to the Baltic Sea for the period 1990-2013.**

In accordance with the contract between HELCOM and EMEP MSC-E has performed evaluation of atmospheric input of lead, cadmium, mercury, and PCB-153 to the Baltic Sea for the period 1990-2013. Results of model assessment as well as data on emissions for these hazardous compounds are presented in the EMEP Centres Joint Report for HELCOM and in the indicator fact sheets on HM and PCB-153 emissions and depositions.

According to available information annual emissions of cadmium, lead, mercury, and PCB-153 of the HELCOM countries decreased from 1990 to 2013 by 65%, 88%, 65%, and 85%, respectively. Major changes of emissions took place in early 1990-s whereas after 2000 decrease of emissions was slower. From 2012 to 2013 annual emissions of PCB-153 and cadmium dropped by 7% and 1%. At the same time emissions of lead and mercury increased slightly by 1% and 0.2%. The largest contribution to total emission of the HELCOM countries was made by Poland, Germany, and Russia.

Levels of cadmium, lead, mercury, and PCB-153 annual deposition to the Baltic Sea declined from 1990 to 2013 by 68%, 81%, 29%, and 71%, respectively. Similar to the changes of emissions, higher reduction of deposition was seen in the early 1990-s. In comparison to the year 2012 annual deposition fluxes of considered hazardous substances in 2013 were lower by 21%, 1.2%, 15%, and 7%, respectively.

Anthropogenic emission sources of the HELCOM countries contributed to annual deposition over the Baltic Sea in 2013 about 27% for cadmium, 22% for lead, 12% for mercury, and 30% for PCB-153. Among the HELCOM countries the most significant contributions to HM deposition to the Baltic Sea in 2013 were made by Poland and Germany, while for PCB-153 by Germany and Sweden.

Along with anthropogenic emission sources of the HELCOM countries essential contribution to total annual deposition was made by other sources, in particular, natural emissions, re-suspension with dust, distant emissions, and re-emission (about 60-80%).

Comparison of modelling results with available measurements made in 2013 around the Baltic Sea indicated that modelled concentrations in air and precipitation were generally within a factor of two with observed concentrations of cadmium, lead, mercury, and PCB-153.