

## **Appendix H: Indicator Fact Sheet on PCDD/F depositions**

(copy from the HELCOM web pages:

[http://www.helcom.fi/environment2/ifs/ifs2006/en\\_GB/pcddfdepositions/](http://www.helcom.fi/environment2/ifs/ifs2006/en_GB/pcddfdepositions/))

## Dioxin and furan atmospheric depositions to the Baltic Sea

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### **1.1.1 Key message**

Total annual atmospheric depositions of PCDD/Fs to the Baltic Sea have decreased in period from 1990 to 2004 by 33%.

### **1.1.2 Results and Assessment**

Relevance of the indicator for describing the developments in the environment This indicator shows the levels and trends in PCDD/F atmospheric depositions to the Baltic Sea. The depositions of PCDD/Fs represent the pressure of emission sources on the Baltic Sea aquatic environment.

#### **1.1.2.1 Policy relevance and policy reference**

HELCOM adopted a Recommendation in May 2001 for the cessation of hazardous substance discharges/emissions by 2020, with the ultimate aim of achieving concentrations in the environment near to background values for naturally occurring substances and close to zero for man-made synthetic substances.

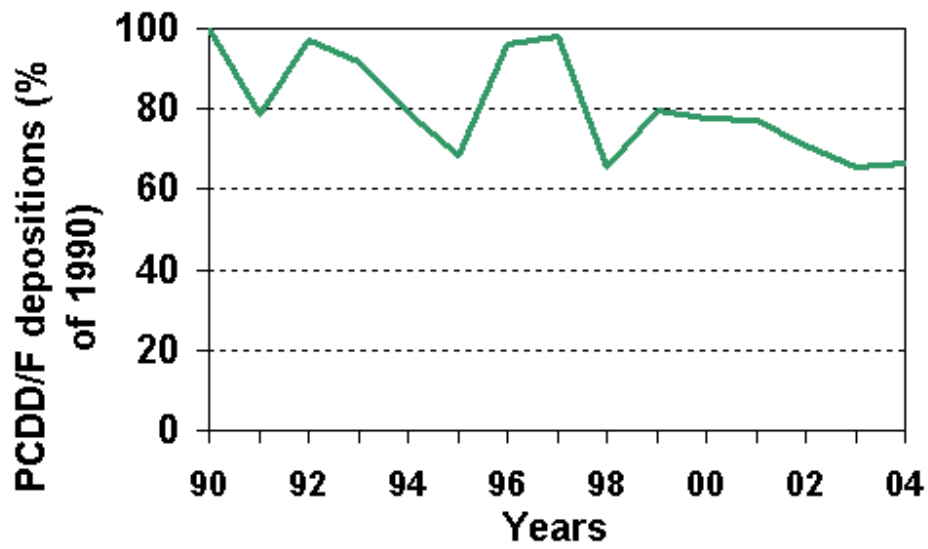
#### **1.1.2.2 Assessment**

Despite substantially increased dioxin and furan emissions from HELCOM countries as a whole, their total annual atmospheric depositions to the surface of the Baltic Sea have decreased in period 1990-2004 by 33% (Figure 1). The increase of dioxin and furan emission of HELCOM countries is connected with the incomplete sectoral emission data reported by Germany. However following the modelling results only several percents of emission from German source are deposited to the Baltic Sea. Therefore in combination with the contributions of other sources the influence of temporal variations of German emission is not rather essential for the total depositions over the Baltic Sea.

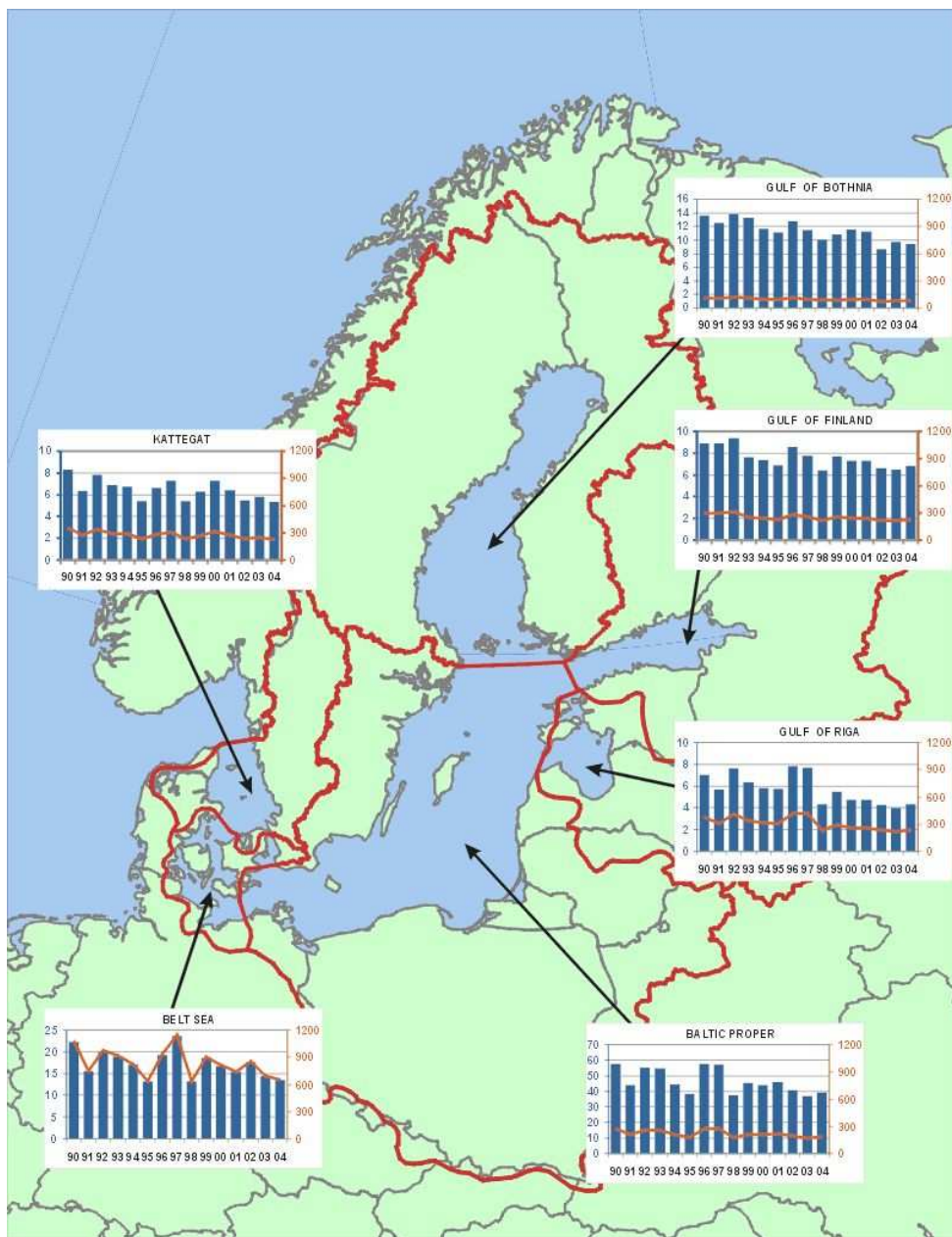
On the level of individual sub-basins the most significant drop in cadmium depositions can be noted for the Belt Sea (40%) and the Gulf of Riga (39%).

In spatial distribution of PCDD/Fs depositions on the Baltic Sea the highest levels can be noted for the southern-western part of the Baltic Sea (the Belt Sea). Significant levels of depositions can also be noted for the Kattegat and the Gulf of Riga. Lowest level of PCDD/F depositions can be noted for the Gulf of Bothnia.

Among the HELCOM countries the most significant contributions to depositions over the Baltic Sea belong to Germany, Poland, and Russia.



**Figure 1:** Computed total annual atmospheric depositions of PCDD/Fs to the Baltic Sea for the period 1990-2004, (% of 1990).



**Figure 2:** Time-series of computed total annual atmospheric deposition of PCDD/Fs to six sub-basins of the Baltic Sea for the period 1990-2004 in tonnes/year as bars (left axis) and total deposition fluxes in mg TEQ/km<sup>2</sup>/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. **Click image to enlarge!**

### 1.1.3 Data

**Table 1.** Computed total annual depositions of PCDD/Fs to six Baltic Sea sub-basins for period 1990-2004. Units: g TEQ/year

Sub-basin	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
GUB	14	12	14	13	12	11	13	11	10	11	11	11	9	10	9
GUF	57	44	55	55	44	38	57	57	37	45	44	45	40	37	39
GUR	9	9	9	8	7	7	9	8	6	8	7	7	7	6	7
BAP	7	6	8	6	6	6	8	8	4	5	5	5	4	4	4
BES	22	15	20	19	17	13	19	24	13	18	17	15	18	14	13
KAT	8	6	8	7	7	5	7	7	5	6	7	6	5	6	5
Baltic Sea	117	92	113	107	93	80	112	114	76	93	91	90	83	77	78

### 1.1.4 Metadata

Technical information:

1. Source:

EMEP/MSC-E

2. Description of data:

The atmospheric depositions of PCDD/Fs were obtained using the latest version of MSCE-POP model developed at EMEP/MSC-E (Gusev et al., 2005). The latest available official emission data for the HELCOM countries have been used in the model computations. Emissions of PCDD/Fs for each year of this period were officially reported to the UN ECE Secretariat by most of HELCOM countries. These data are available from EMEP emission database WEBDAB: <http://webdab.emep.int>. Some of the HELCOM countries submitted part of the data for this period. Denmark submitted data for 1998, 1999 and 2001-2003. Germany submitted data for the period 1990-2004. However the analysis of these data splitted by source sectors revealed some gaps in the reported information, in particular, emissions for the sector Petroleum refining (1A1b) were reported only for 2000-2004. Lithuania submitted data for 1997-2004. Russia did not report the information on emission for 2001, 2003, and 2004. Values of emission for missing years were obtained using interpolation or extrapolation.

3. Geographical coverage:

Atmospheric depositions of PCDD/Fs were obtained for the European region.

#### 4. Temporal coverage:

Timeseries of annual atmospheric depositions are available for the period 1990 – 2004.

#### 5. Methodology and frequency of data collection:

Atmospheric input and source allocation budgets of PCDD/Fs to the Baltic Sea and its catchment area were computed using the latest version of MSCE-POP model. MSCE-POP is the regional-scale model operating within the EMEP region. This is a three-dimensional Eulerian model which includes processes of emission, advection, turbulent diffusion, wet and dry depositions, degradation, gaseous exchange with underlying surface, and inflow of pollutant into the model domain. Horizontal grid of the model is defined using stereographic projection with spatial resolution 50 km at 60° latitude. The description of EMEP horizontal grid system can be found in the internet (<http://www.emep.int/grid/index.html>). Vertical structure of the model consists of 15 non-uniform layers defined in the terrain-following s-coordinates and covers almost the whole troposphere. Detailed description of the model can be found in EMEP reports (Gusev et al., 2005) and in the Internet on EMEP web page <http://www.emep.int> under the link to information on Persistent Organic Pollutants. Meteorological data used in the calculations for 1990-2004 were obtained using MM5 meteorological data preprocessor on the basis of the Re-analysis project data prepared by National Centers for Environmental Predictions together with National Center of the Atmospheric Research (NCEP/NCAR) in the USA (<http://wesley.ncep.noaa.gov/reanalysis.html>).

Calculations of atmospheric transport and depositions of PCDD/Fs are provided on the regular basis annually two years in arrears on the basis of emission data officially submitted by Parties to CLRTAP Convention.

#### Quality information:

##### 6. Strength and weakness:

**Strength:** annually updated information on atmospheric input of PCDD/Fs to the Baltic Sea and its sub-basins.

**Weakness:** uncertainties in officially submitted data on emissions of PCDD/Fs.

##### 7. Uncertainty:

The MSCE-POP model results were compared with measurements of EMEP monitoring network [Gusev et al., 2006, Shatalov et al., 2005]. The model was evaluated through the comparison with available measurements during EMEP TFMM meetings held in 2005. It was concluded that the MSCE-POP model is suitable for the evaluation of the long range transboundary transport and deposition of POPs in Europe.

8. Further work required:

Further work is required on reducing uncertainties in emission data and modeling approaches used in MSCE-POP model.

**1.1.5 References**

Gusev A., I. Ilyin, L.Mantseva, O.Rozovskaya, V. Shatalov, O. Travnikov [2006] Progress in further development of MSCE-HM and MSCE-POP models (implementation of the model review recommendations. EMEP/MSCE-E Technical Report 4/2006. ([http://www.msceast.org/reps/4\\_2006.zip](http://www.msceast.org/reps/4_2006.zip))

Gusev A., E. Mantseva, V. Shatalov, B.Strukov [2005] Regional multicompartiment model MSCE-POP EMEP/MSCE-E Technical Report 5/2005. ([http://www.msceast.org/events/review/pop\\_description.html](http://www.msceast.org/events/review/pop_description.html))

Shatalov V., Gusev A., Dutchak S., Holoubek I., Mantseva E., Rozovskaya O., Sweetman A., Strukov B. and N.Vulykh [2005] Modelling of POP Contamination in European Region: Evaluation of the Model Performance. Technical Report 7/2005. ([http://www.msceast.org/reps/7\\_2005.zip](http://www.msceast.org/reps/7_2005.zip))

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