Atmospheric emissions of heavy metals in the Baltic Sea region

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Key message

Annual atmospheric cadmium and mercury emissions of HELCOM countries have decreased by 39% and 48% during the period from 1990 to 2014.

Results and Assessment

Relevance of the indicator for describing the developments in the environment

This indicator shows the levels and trends in cadmium and mercury emissions from anthropogenic sources of HELCOM countries to the atmosphere. The emissions of heavy metals represent the pressure of emission sources on the atmosphere of the Baltic Sea region and subsequently on the Baltic Sea aquatic environment.

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.

On the European level the relevant policy to the control of emissions of heavy metals to the atmosphere is being taken in the framework of UN ECE Convention on Long-Range Transboundary Air Pollution (CLRTAP). The Executive Body of CLRTAP adopted the Protocol on Heavy Metals on 24 June 1998 in Aarhus (Denmark). It targets three particularly harmful metals: cadmium, lead and mercury. According to one of the basic obligations, Parties have to reduce their emissions for these three metals below their levels in 1990. The Protocol has been entered into force in 2003 and has been signed and/or ratified by 41 countries.

Assessment

Annual emissions of heavy metals from HELCOM countries have decreased during the period 1990-2014 by 39% for cadmium, and 48% for mercury (Figure 1). The most significant drop of cadmium emissions can be noted for Estonia (80%) and Sweden (75%). Cadmium emission of Latvia has increased by 27% since 1990. Mercury emission most significantly declined in Denmark (90%) and Lithuania (85%).

The reduction in heavy metal emission to the atmosphere is a consequence of increased use of cleaner production technologies as well as of economic contraction and industrial restructuring in Poland, Estonia, Latvia, Lithuania, and Russia in early 1990s.

In comparison to previously submitted emission data for the period 1990-2013, HM emission of the HELCOM countries presented in this report for years from 2007 are considerably higher. The increase of HM emissions takes place mostly due to the updated estimates of HM emissions of the Russian Federation, carried out by CEIP (Tista et al., 2016). In particular, estimates of national emission of Russia for the period 2007-2014 were complemented by the emissions from GNFR sector 'A_PublicPower', extrapolated from the years 2002 to 2006.

In 2014 total annual emissions of HELCOM countries amounted to 83 tonnes of cadmium, and 37 tonnes of mercury. Among the HELCOM countries the largest contributions to cadmium total emission belong to Russia (71%) and Poland (17%), and for mercury – to Russia (43%), Poland (26%) and Germany (25%).

Maps with time-series of annual total Cd and Hg emissions of HELCOM countries are shown in Figures 2-3. The diagrams also present the fractions of emissions deposited to the Baltic Sea. The largest fractions belong to Denmark and Sweden (about 20% for cadmium and 10% for mercury), and the lowest one to Russia (about 0.5%).

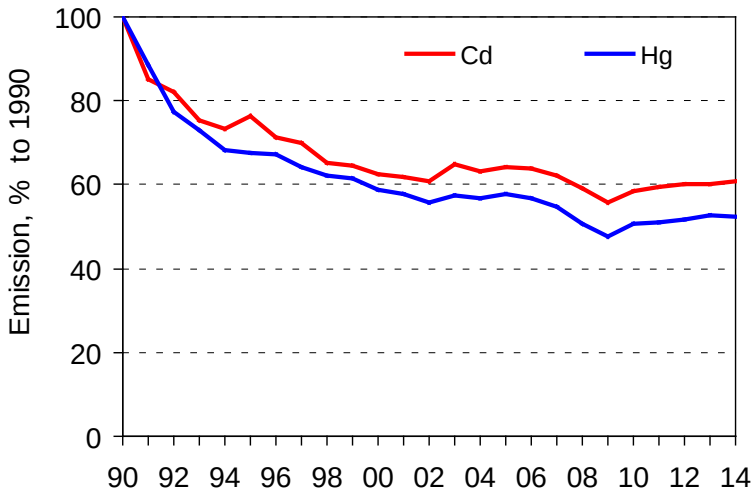

Figure 1. Changes of total annual emissions of cadmium and mercury to air from HELCOM countries in period 1990-2014 (% of 1990).

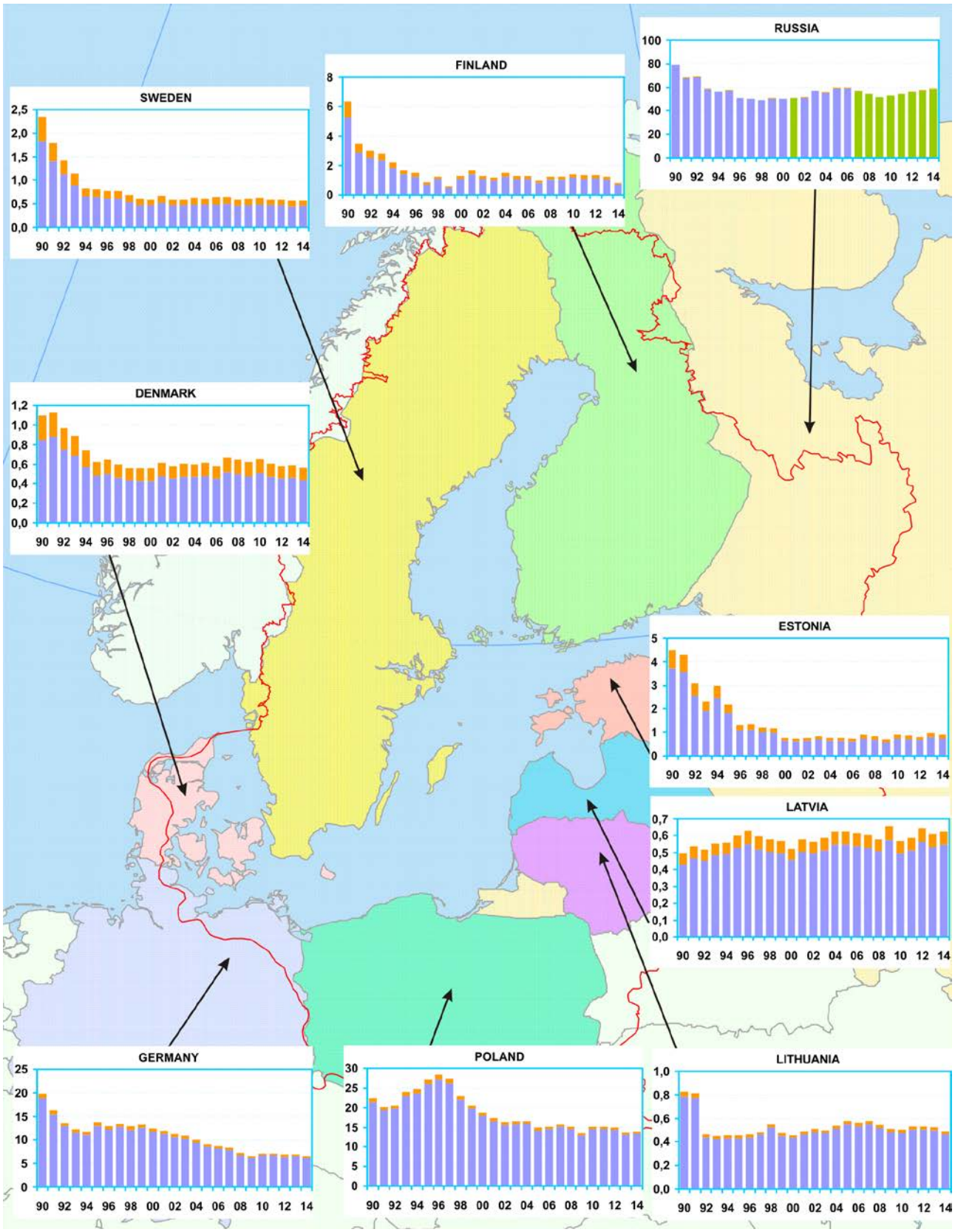

Figure 2: Map of **cadmium** emissions of HELCOM Contracting Parties (CP) to air as totals in tonnes/year for the period 1990-2014. Red sections of the bars identify the fraction of emission deposited to the Baltic Sea. *(The emission data of the CP refer to the total area of the CP except for Russian Federation, for which emissions from the territory of Russian Federation within the EMEP domain is used).*

Note: different scales have been used for different countries!

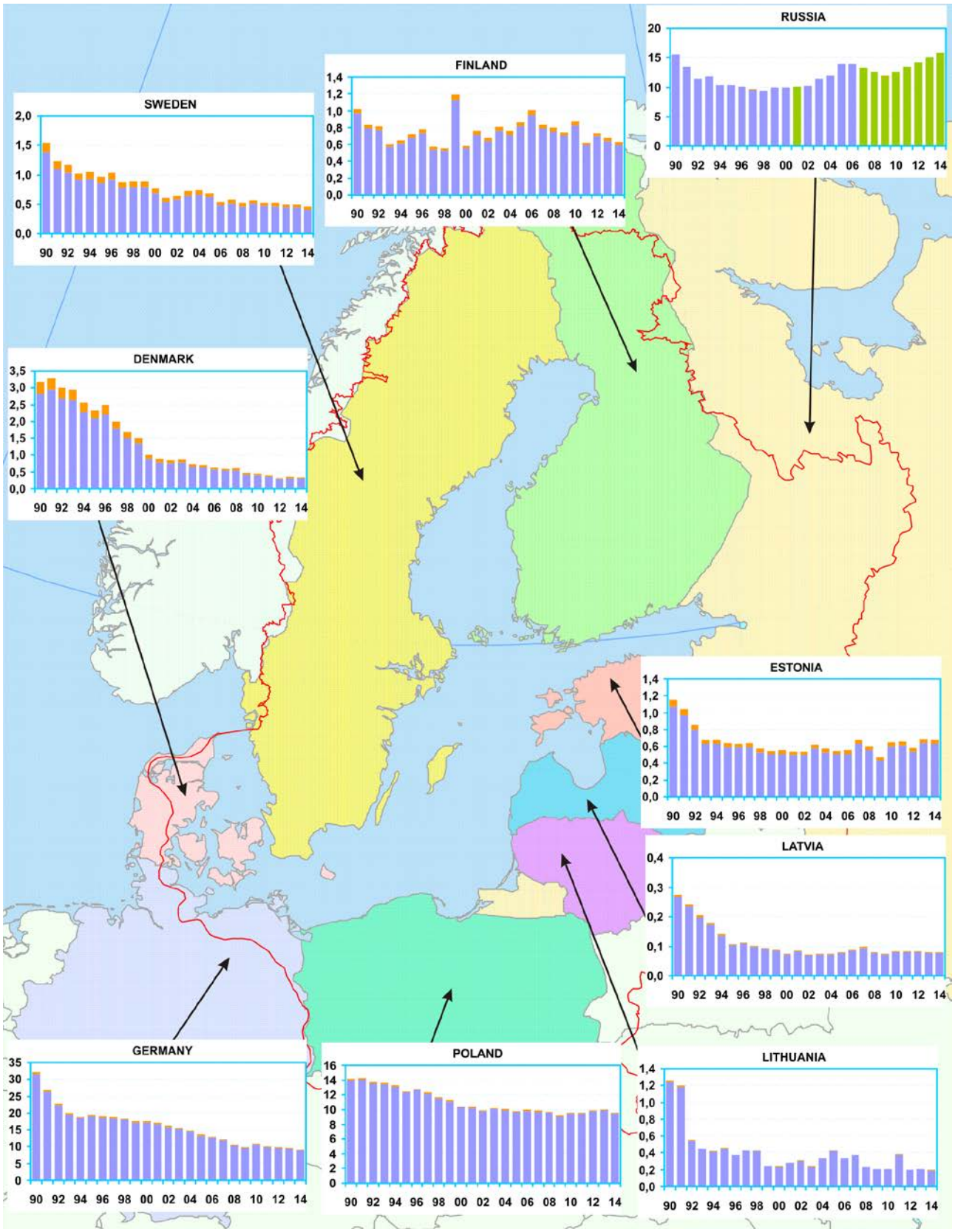

Figure 3: Map of **mercury** emissions of HELCOM Contracting Parties (CP) to air as totals in tonnes/year for the period 1990-2014. Red sections of the bars identify the fraction of emission deposited to the Baltic Sea. *(The emission data of the CP refer to the total area of the CP except for Russian Federation, for which emissions from the territory of Russian Federation within the EMEP domain is used).*

Note: different scales have been used for different countries!

Data

Numerical data on HM anthropogenic emissions of HELCOM countries are given in the following tables that can be found in the attached Microsoft Excel file (HM_emissions_data.xls).

Table 1. Cadmium emissions from anthropogenic sources of HELCOM countries from 1990 to 2014.

Table 2. Mercury emissions from anthropogenic sources of HELCOM countries from 1990 to 2014.

Metadata

Technical information:

1. Source:

   EMEP/MSC-E, EMEP/CEIP.

2. Description of data:

   Annual total emissions of all three metals were officially reported to the UN ECE Secretariat by HELCOM countries. These data are available from the EMEP Centre on Emission Inventories and Projections (CEIP) (http://www.ceip.at/).

3. Geographical coverage:

   EMEP region

4. Temporal coverage:

   Data on cadmium and mercury annual emission totals are available for the period 1990 – 2014 for all HELCOM countries but Russia. The Russian Federation did not submitted information for 2001, 2007, 2008, and 2010 - 2014. Values of HM emissions from Russia for 2006-2014 were estimated by CEIP (*Tista et al.*, 2016).

5. Methodology and frequency of data collection:

   National data on HM emissions are annually submitted by countries Parties to LRTAP Convention to the UN ECE Secretariat. The methodology is based on combination of measurements of releases to the atmosphere and estimation of emission based on activity data and emission factors. Submitted emission data are processed using quality assurance and quality control procedure and stored in the UN ECE/EMEP emission database at EMEP/CEIP Centre.

Quality information:

6. Strength and weakness:

   Strength: data on emissions are annually submitted, checked and stored in the database.

Weakness: gaps in time series of national emissions, uncertainties in national emissions, lack of gridded emissions, and incompleteness.

7. Uncertainty:

Among the HELCOM countries the level of uncertainty of official data on HM emission was reported by Finland, Denmark, Estonia, Latvia, Poland, and Sweden. From other EMEP countries the information on uncertainties of HM official emissions is available for Belarus, Belgium, France, Croatia, Cyprus, and the United Kingdom. The uncertainty of reported data on HM emissions expressed as percentage relative to mean value of emission is as follows:

Finland:	Cd	-30 +31%
	Hg	±21%
Denmark:	Cd	427%
	Hg	91%
Estonia:	Cd	130%
	Hg	138%
Latvia:	Cd	80%
	Hg	66%
Poland:	Cd	70%
	Hg	53%
Sweden:	Cd	35%
	Hg	56%
Belarus:	Cd	175%
	Hg	107%
Belgium:	Cd	231%
	Hg	145%
France:	Cd	28%
	Hg	20%
Croatia:	Cd	278%
	Hg	76%
Cyprus:	Cd	81%
	Hg	13%
UK:	Cd	-30% to >50%
	Hg	-30% to 50%

8. Further work required:

Further work of national experts on emissions of heavy metals is required to fill the gaps in the emission time-series and to reduce their uncertainties.

References

Tista M., Mareckova K. and R.Wankmueller [2016] Methodologies applied to the CEIP GNFR gap-filling 2016. Part I: Heavy Metals (Pb, Cd, Hg). Technical report CEIP 01/2016.