Atmospheric emissions of Benzo(a)pyrene in the Baltic Sea region

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Key message

Annual emissions of benzo(a)pyrene in HELCOM countries have decreased by 51% 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 emissions of benzo(a)pyrene (B(a)P) from anthropogenic sources of HELCOM countries to the atmosphere. These emissions 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 B(a)P 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 Persistent Organic Pollutants on 24 June 1998 in Aarhus (Denmark). According to one of the basic obligations, Parties to the Convention shall reduce their emissions of B(a)P below their levels in 1990. The Protocol has been entered into force in 2003 and has been signed and/or ratified by 40 countries.

Assessment

Based on officially reported inventories of POP releases, annual emissions of B(a)P in HELCOM countries have decreased during the period from 1990 to 2014 by 51% (Figure 1). The most significant drop of B(a)P emissions (see Figure 2) is noted for Germany (82%), Latvia (46%), and Finland (38%). Other HELCOM countries are characterized by less significant changes of emissions from 2% to 36%. At the same time emissions of Denmark and Poland in 2014 were higher than emissions for 1990, by 24% and 20% respectively.

In 2014 total annual B(a)P emissions of HELCOM countries amounted to 108 t. Among the HELCOM countries the largest contributions to total annual B(a)P emissions of HELCOM countries belong to Poland (40%), Germany (23%), and Russia (21%).

Maps with time-series of annual total B(a)P emissions of HELCOM countries are shown in Figure 2. The diagrams on the map also show the fractions of emissions deposited to the Baltic Sea. The highest fractions belong to Denmark and Sweden (13% and 12%, respectively), and the lowest one to the Russian Federation (about 0.4%).

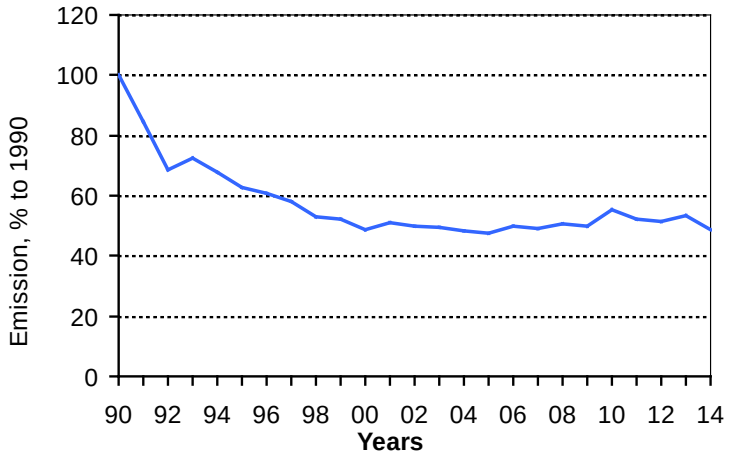

Figure 1. Changes of total annual emissions of B(a)P to air from HELCOM countries in period 1990-2014 (% of 1990).

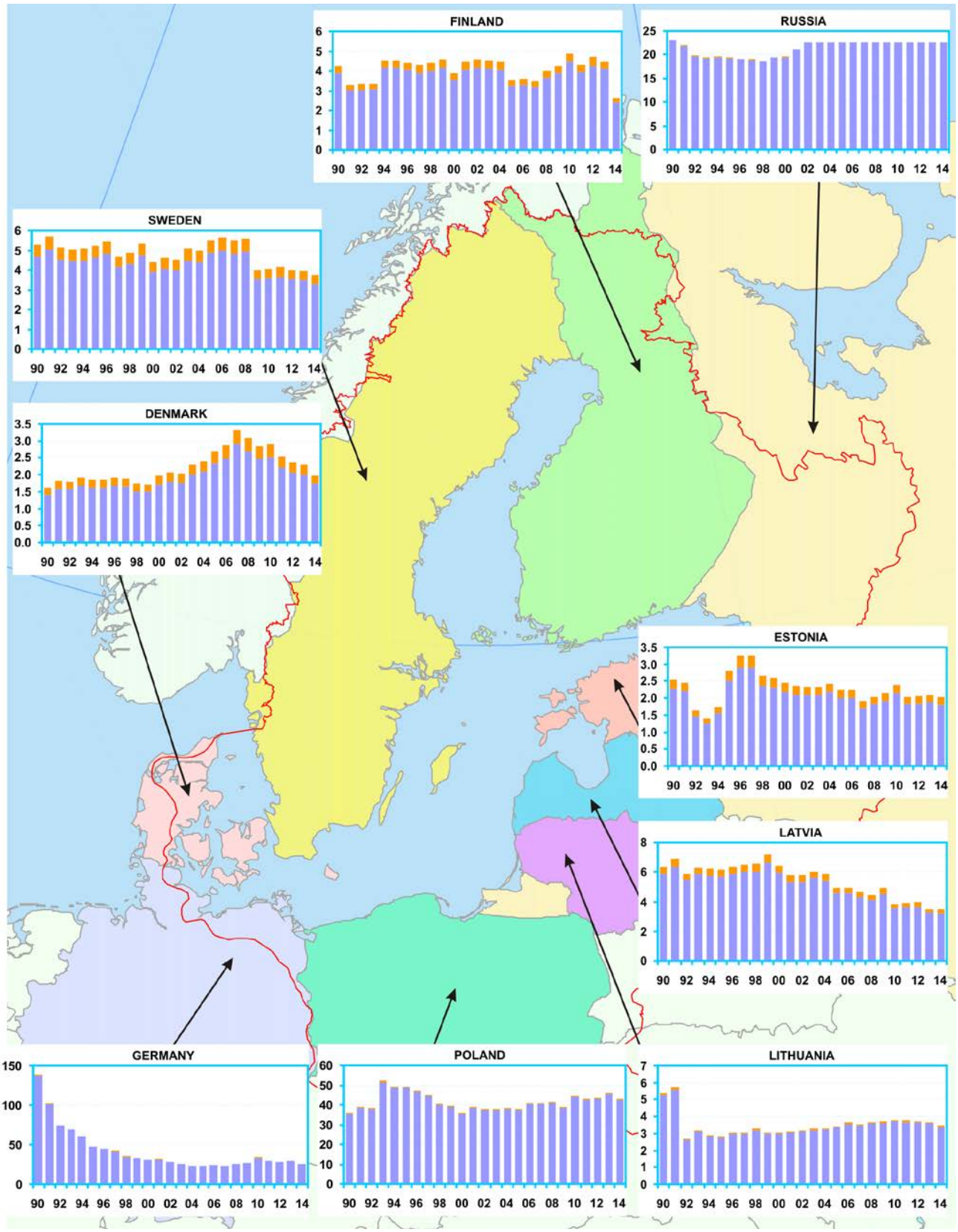

Figure 2: Map of **B(a)P** emissions of HELCOM Contracting Parties (CP) to air as totals in tonnes/year for the period 1990-2014. Red sections of the bars identify the fraction of emission deposited to the Baltic Sea. *(The emission data of the CP refer to the total area of the CP except for Russian 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 B(a)P anthropogenic emissions of HELCOM countries are given in the following table that can be found in the attached Microsoft Excel file (BaP_emissions_data.xls).

Table 1. Total annual B(a)P emissions from anthropogenic sources of HELCOM countries in period from 1990 to 2014.

Metadata

Technical information:

1. Source:

EMEP/MSC-E, EMEP/CEIP.

2. Description of data:

Annual total emissions of 4 PAHs including benzo(a)pyrene are 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 annual emissions of benzo(a)pyrene are available for the period 1990 – 2014 for all HELCOM countries but Russia and Finland. The Russian Federation did not submitted information on B(a)P emissions for the years 2001, 2003 - 2014. Therefore value of PAH emissions for 2001 was obtained using interpolation. The same level of emissions from Russia as for 2002 was assumed in model simulations for 2003 - 2014. Finland submitted emission data for the period 1990-2014 on 4 PAHs without splitting for individual congeners. Estimates of B(a)P emissions from Finland have been prepared by CEIP (*Tista et al.*, 2016).

5. Methodology and frequency of data collection:

National data on emissions of 4 PAHs including benzo(a)pyrene 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: gridded information on PAH emissions

Weakness: gaps in time series of national emissions, uncertainties in national emissions, lack of gridded emissions, and information on congener composition of emissions

7. Uncertainty:

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

Finland: -83 +202%

Denmark: 685%

Estonia: 127%

Latvia: 70%

Sweden: 660%

Belarus: 237%

Belgium: 291%

France: 61%

Croatia: 365%

Cyprus: 129%

UK: 447%

8. Further work required:

Further work of national experts on emissions of B(a)P is required to fill the gaps in the emission time-series and to reduce their uncertainties. The information on seasonal variations of B(a)P emissions and its congener composition is essential for modeling.

References

Tista M., Mareckova K. and R.Wankmueller [2016] Methodologies applied to the CEIP GNFR gap-filling 2016. Part II: Persistent organic pollutants (Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, Dioxin and Furan, Hexachlorobenzene). Technical report CEIP 02/2016.