5. CO-OPERATION AND DISSEMINATION OF INFORMATION

Co-operation is an important component of research and operational pollution assessment performed by MSC-E to support countries with information on POP pollution levels in Europe and other regions. In this context MSC-E closely collaborates with Parties to the Convention and its Subsidiary Bodies and exchanges information with various international organizations.

5.1. Task Force on Measurements and Modelling (TFMM)

In the framework of cooperation with TFMM, MSC-E participated in 19th meeting of the Task Force, held in May 2018 in Geneva (Switzerland). The progress in the assessment of POP pollution using the fine resolution POP emission data, reported by the EMEP countries, was outlined and discussed. Model simulations for PAHs, PCDD/Fs, PCBs, and HCB showed in general reasonable level of agreement with measurements. At the same time, significant deviations between observed PAH pollution levels and model predictions for some of the EMEP countries including Spain, France, Germany, and Poland were noted. Substantial under-prediction of measured HCB concentrations was also obtained by the model for several monitoring sites in the northern part of the EMEP domain. Analysis of these discrepancies indicated the need of further refinement of national emission inventories as well as modelling approach for the assessment of pollution levels for these POPs.

The outcome of country-specific case study on B(a)P pollution in Spain and France, performed in co-operation with experts from these countries, was also presented. In particular, preliminary results of GLEMOS and CHIMERE models, simulated B(a)P pollution levels in European region, were demonstrated. It was shown that modelling on the basis of officially reported emissions resulted in significant deviations between modelled and measured B(a)P concentrations for some monitoring sites in several EMEP countries (e.g. France, Germany, Poland and Spain). These deviations were mainly attributed to the uncertainties in currently reported emission inventories. However, the need to analyze the effect of uncertainties of modelling approaches (e.g. parameterizations of B(a)P degradation, gas-particle partitioning, and deposition) was also highlighted.

Besides, analysis of methodologies, used to evaluate PAH/B(a)P emissions in Spain and France, was presented by national experts. In particular, it was shown that underestimation of B(a)P emissions in France could be associated with low values of emission factors used for the estimation of emissions from residential combustion. In case of Spain, overestimation of emission from field burning of agricultural residues was related to the uncertainties of several parameters in the applied methodology (e.g. burning area, crop specific emission factors).

Simulations with experimental emission scenario, based on scaling of sectoral emissions of selected countries, indicated substantial sensitivity of model predictions to the estimates of B(a)P emissions from the 'Residential combustion' and 'Field burning of agricultural residues' sectors. Refinement of emissions from these source categories can be important for the improvement of pollution assessment results. Continuation of B(a)P pollution case study for Spain and France will include analysis of model parameterizations applied for B(a)P degradation and gas-particle partitioning, model simulations with

expert estimates of B(a)P emissions, and fine resolution modelling. Further national case studies on B(a)P pollution might also be carried out for Germany, Poland or Croatia.

5.2. Helsinki Commission

In the framework of cooperation with the Helsinki Commission, MSC-E performs regular evaluation of airborne pollution load of POPs to the Baltic Sea. This work is carried out in accordance with the Memorandum of Understanding between the Baltic Marine Environment Protection Commission (HELCOM) and the United Nations Economic Commission for Europe (UN ECE) and is based on the long-term EMEP/HELCOM contract.

During the recent year this activity was focused on the evaluation of PCDD/F pollution of the Baltic Sea. In particular, long-term variations of PCDD/F deposition fluxes to the Baltic Sea were estimated for the period 1990-2015. Besides, source apportionment of annual deposition was carried out for 2015. Results of the assessment were summarized in the Joint report of the EMEP Centres for HELCOM [*Bartnicki et al*., 2017] and presented in the indicator fact sheets, published on the HELCOM website [*http://www.helcom.fi*].

Anthropogenic emissions of dioxins and furans in the HELCOM countries declined from 1990 to 2015 by 33%. Russia, Poland, and Germany were the main contributors to the PCDD/F emissions among the HELCOM countries in 2015. The major emission source categories in total PCDD/F emissions of HELCOM countries, according to the officially reported data, were the 'Residential combustion', 'Industry', and 'Waste'.

Results of model simulations indicated considerable decrease (67%) of atmospheric PCDD/F deposition to the Baltic Sea in the period 1990-2015 (Fig. 5.1a). The largest changes of deposition were estimated for the Sound and the Western Baltic sub-basins (decrease by 76% and 73%, respectively). The first decade of the considered period is characterized by more substantial decline of PCDD/F deposition (about 40%), while during the subsequent period decline of deposition was less significant. PCDD/F deposition fluxes to the Baltic Sea are subject to noticeable inter-annual variations due to variability of meteorological conditions (e.g. atmospheric transport pathways). Particularly, deposition in 2015 was lower comparing to the previous year by 22%. Seasonal variations of PCDD/F deposition are characterised by higher values of fluxes in the cold period of the year and lower values of fluxes in the warm period.

Anthropogenic emission sources of the HELCOM countries contributed about 47% to annual PCDD/F deposition to the Baltic Sea in 2015. Russia, Poland, and Denmark were the main contributors of anthropogenic PCDD/F deposition to the Baltic Sea (Fig. 5.1b). Along with anthropogenic emissions significant contribution (more than 50%) to PCDD/F deposition to the Baltic Sea was made by secondary emission sources (e.g. re-emission from soil and sea water compartments) as well as by the long-range transport from the emission sources located outside the HELCOM countries.

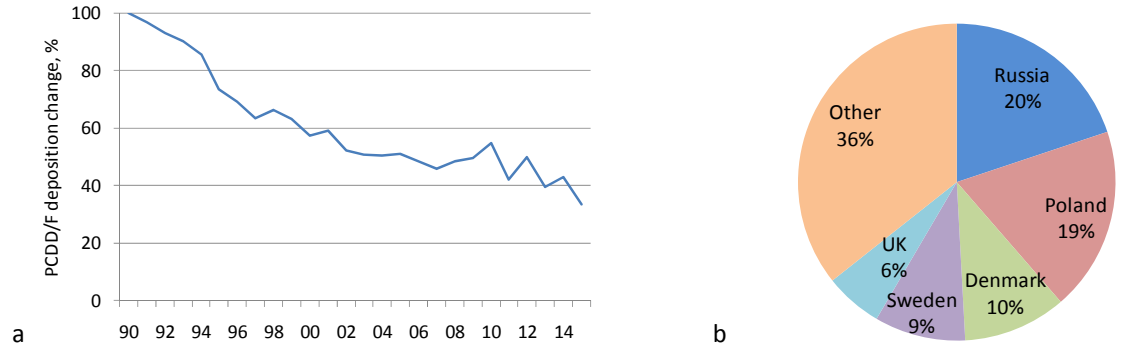


Fig. 5.1. *Relative changes of annual atmospheric PCDD/F deposition to the Baltic Sea in the period 1990-2015 (a) and contribution of emission sources from the EMEP countries to total anthropogenic deposition of PCDD/Fs to the Baltic Sea in 2015 (b).*

Spatial distribution of annual modelled PCDD/F deposition fluxes in 2015 shows elevated deposition levels in the southern and western parts of the Baltic Sea, located closer to the industrial and densely populated areas of Europe. At the same time, the northern part of the sea was characterised by the lowest deposition fluxes.

5.3. Stockholm Convention

Co-operation and exchange of information with the Stockholm Convention on POPs is of importance for the assessment of environmental pollution of the EMEP region. In the framework of this activity MSC-E continued the use of data on POP emissions, compiled under the Stockholm Convention (SC) on POPs, for the development of global scale scenario of PCDD/F emissions.

There is significant progress in the development and updating of national PCDD/F emission inventories, performed by countries, parties to the Stockholm Convention, on the basis of the Toolkit for Identification and Quantification of releases of unintentional POPs. National emission inventories are being revised due to updating of the Toolkit as well as recalculations of national emission data. Provided data comprise emissions to the atmosphere and other environmental compartments that can be used as additional source of information on PCDD/F emissions in the EMEP region. Similar activities on the collection of information on emissions and improvement of methodology for their evaluation are also performed for other POPs (e.g. PCBs and HCB [*Gong et al.*, 2017a; *Gong et al.*, 2017b]).

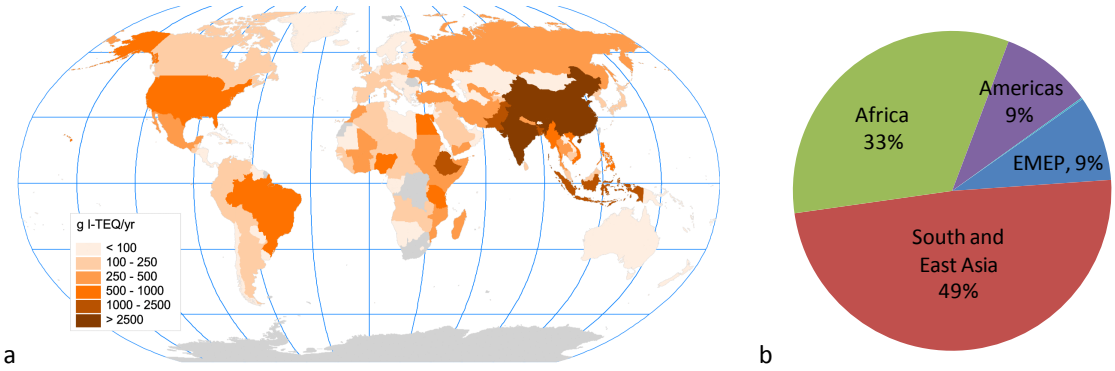
According to national reports, provided by the countries, information on dioxins and furans emissions is currently available for more than 140 countries[8]. National PCDD/F emissions were reported for the period of time starting from around 1990 up to 2014 covering several vectors of releases (e.g. to the atmosphere, land, water). Majority of emission data were reported for the recent years. In addition, significant part of inventories included estimates of releases for several years that can be used for the evaluation of temporal changes of emissions. This information was used for the updating of the scenario of global PCDD/F emission developed previously by MSC-E [*Shatalov et al.,* 2014]. In particular,

[8] List of National Implementation Plan reports (http://chm.pops.int/Implementation/NIPs/NIPTransmission/tabid/253/Default.aspx)

available data permitted to prepare scenario of annual PCDD/F emissions to the atmosphere and to soil for the period 2012 – 2014.

Along with updated information on emissions, different statistical methodology was used for the evaluation of national PCDD/F emissions. In particular, updated emission scenario was constructed using the approach described in [*Wang et al.*, 2016]. The following factors were considered in the regression analysis for the evaluation of PCDD/F emissions, namely, gross national input, country area, gross national input per capita, and CO_2 emissions per million of gross national product. Numerical values for these parameters for each of considered years were taken from the World Bank database (https://data.worldbank.org/).

Geographical distribution of national PCDD/F emissions to the atmosphere estimated using regression analysis reported is shown in Fig.5.2a. In accordance with these data the largest contributions to the global emission was made by South and East Asia (49%) followed by Africa (33%). The contributions of the EMEP countries and of North and South Americas were estimates to 9%. It is planned to use updated scenario of global PCDD/F emissions in model simulations for the next year.



a b

Fig. 5.2. *Total releases of PCDD/Fs (a) to the atmosphere from anthropogenic emission sources in different countries (g TEQ/y) and contributions of major source regions (b) to global PCDD/F emissions estimated for 2014.*

Another important area of collaboration with the Stockholm Convention is the analysis of global-scale monitoring data on POP concentrations. National POP monitoring activities are performed under the Global Monitoring Plan (GMP) of the Convention, which is established as a global framework for the evaluation of information on POP content in the environmental media [*Mogulova and Priceputu*, 2016]. Results of long-term monitoring of PCDD/F air concentrations in some of the EMEP countries (e.g. in Spain and the UK) were used in the analysis of pollution levels for the year 2016 in this report (Section 4.3).