

MAIN CHALLENGES AND DIRECTIONS OF FUTURE RESEARCH

This Status Report summarizes results of current activities performed by the EMEP Centres, MSC-E and CCC, in the field of the assessment of POP pollution in the EMEP region. Progress in monitoring of pollution levels, modelling of long-range transport and fate, and analysis of POP pollution on global, regional, and national scales are overviewed. Main emphasis of the report is given to the analysis of PAH pollution levels in the EMEP region as well as in particular EMEP countries. Directions of future work and main challenges that need to be addressed are outlined below.

- Accuracy of model assessment of POP pollution significantly depends on the quality of officially reported emissions data. In spite of gradual improving of national inventories, estimates of POP emissions are still subject to considerable uncertainties. Country-scale case studies for B(a)P and scenario simulations of PCDD/Fs pollution showed potential significant uncertainties of the reported POP emissions, particularly, from the source categories 'Residential combustion' and 'Field burning of agricultural residues'. Further improvement of reported POP emissions requires harmonization of methodologies and update of emission factors currently used by the EMEP countries for the evaluation of emissions from these source categories.
- Available expert estimates of POPs anthropogenic emissions are important for the evaluation of pollution levels and can be used for complementary analysis of national inventories. Besides, construction of experimental emission scenarios and test model simulations allows evaluating sensitivity of model predictions to possible uncertainties in the officially reported emission data. Thus, the air quality modelling can be used as a tool for evaluation of reported emissions with regard to their magnitude and spatial distribution.
- Country-specific studies performed by MSC-E in co-operation with national experts present an important activity aimed at improvement of POP pollution assessment in the EMEP region. In the current studies for Spain and France, fine-resolution model simulations with two different models (GLEMOS and CHIMERE) and comparison with measurements allowed revealing inconsistencies in the reported B(a)P emissions and pointed out directions for further improvement of the emission inventories. The case studies for these and some other EMEP countries (e.g. Germany, Poland, Portugal) will be continued including more detailed analysis of B(a)P pollution on a national scale and evaluation of the key processes governing B(a)P atmospheric dispersion (gas-particle partitioning, degradation etc.)
- Recent studies of PAH long-range transport and heterogeneous chemistry suggested that their phase partitioning can be influenced by secondary organic aerosols, which might protect particle-phase PAHs from degradation and evaporation. Furthermore, variations of temperature and humidity in the atmosphere affect multiphase degradation of PAHs and, ultimately, long-range transport and spatial variability of these pollutants. Influence of these factors on the model predictions will be analyzed using test model simulations and the results will be used for updating the GLEMOS modelling system.

- Monitoring and modelling activities indicate high levels of air concentrations of carcinogenic PAHs and exceedances of air quality guidelines for B(a)P in the EMEP countries, especially in areas with high emissions and dense population. To improve evaluation of city pollution by PAHs the methodologies based on complementary use of multiple regression analysis, fine resolution modelling, and measurements will be further developed within the framework of the country-specific case studies in close co-operation with national experts and relevant scientific Centres and Task Forces (TFEIP, CEIP, TFMM, CCC, and EEA).
- The EMEP monitoring network for POP is still very limited and covers mostly Central and Northern Europe. It mitigates opportunities for more comprehensive model evaluation. The spatial coverage can be improved by involvement of data from various passive air sampling studies. However, application of data from passive air sampling is also limited for the analysis of POP pollution as passive air sampling is still considered to be a semi-quantitative method. This is especially important for POPs that mainly are associated with the particulate phase (e.g. benzo(a)pyrene). In addition, since some POPs (PAHs, PCBs, etc.) may partition between the gas and particulate phases, more data on the observed partitioning between these two phases (i.e. by measuring and reporting both gaseous and particulate concentrations in air) may additionally help to increase confidence in the model predictions.
- Environmental dispersion of some POPs (PCDD/Fs, PCBs, HCB) have a pronounced multi-media character and are highly affected by the exchange between and accumulation in the environmental compartments (atmosphere, soil, water, etc.) Model assessment of POP content in the terrestrial and aquatic ecosystems can provide valuable information for the effect community (WGE) for evaluation of possible adverse effects on human health and biota. Further improvement of the GLEMOS model parameterizations for these pollutants requires complementary use of national/regional air monitoring data within EMEP and beyond, as well as measurement data on POP content in other compartments. Strengthening of co-operation with relevant activities of other international organizations (e.g. the Stockholm Convention, AMAP, HELCOM, and OSPAR) is needed to collect appropriate data.
- Exchange of information and the expertise between EMEP and the Stockholm Convention on the evaluation of POP releases to the environment is important for further progress in the assessment of POP pollution in the EMEP region. Development and improvement of methodologies for compilation of national inventories of POP emissions to the atmosphere and other environmental compartments, performed under the Stockholm Convention, can provide valuable information for the studies of environmental pollution by PCDD/Fs, PCBs, and HCB in the EMEP region and on a global scale.