

## MAIN CHALLENGES AND DIRECTIONS OF FUTURE RESEARCH

The Status Report summarizes EMEP activities in the field of heavy metal pollution assessment in 2018. It includes information on spatial patterns of Pb, Cd and Hg pollution levels and transboundary transport, research and development activities on improvement of the modelling tool, cooperation with national experts of the EMEP countries, CLRTAP Subsidiary Bodies, and international organizations. Main challenges of heavy metal pollution assessment and directions of future research are overviewed below.

- Emissions data reported by countries still contain significant uncertainties, particularly, in terms of completeness and sectoral composition. The dispersion modelling supplemented by monitoring data can be used as an independent tool for evaluation of reported emissions. The evaluation is particularly relevant when performed on a country scale with involvement of detailed national data. Besides, the model evaluation of national emissions can be applied on a regular basis as a part of the emissions review process.
- The country-scale case studies demonstrated high effectiveness in evaluation of various aspects of heavy metal pollution. They provide valuable information on pollution assessment with fine spatial resolution, detailed source apportionment of pollution levels, evaluation of national emissions etc. The studies will be continued for a number of countries (e.g. Germany, the UK, Norway) with particular focus on Hg pollution and the link with adverse effects on human health and biota.
- The problem of the limited coverage of the EMEP region with measurements of heavy metals remains unresolved. Monitoring sites, which perform heavy metal measurements, are mostly located in Central, Western, and Northern Europe, whereas observations in Eastern Europe and Central Asia are scarce. The problem can be partly resolved by involvement of data from other networks or using data of biomonitoring (e.g. measurements in mosses). However, the latter require thorough interpretation when used for model evaluation.
- Recent studies revealed possible important role of vegetation uptake for Hg atmospheric cycle and deposition. Further improvement of understanding of Hg deposition processes and development of model parameterization require more measurements of Hg air-vegetation exchange that could be reflected in the revised EMEP monitoring strategy.
- Mercury pollution of the EMEP countries attracts particular attention within the Convention. Therefore, update and improvement of modelling approaches for Hg pollution assessment is among the priority tasks. The Hg chemical scheme of the GLEMOS model will be revised including further testing of the Br oxidation mechanism and evaluation of possible reduction pathways. Besides, evaluation of Hg pollution over long periods requires consideration of cycling and accumulation in different environmental media. The multi-media approach for Hg simulations in GLEMOS will be further developed.
- Another important issue of human exposure to airborne contaminants is pollution of cities. A tentative approach of assessment of the city pollution by heavy metals using the direct fine

resolution modelling with source apportionment demonstrated promising performance when compared with urban observations and other assessment methods. Thorough testing and evaluation of the approach will be continued for other countries and pollutants.

- Evaluation of adverse effects of heavy metal pollution on human health and ecosystems is of high importance. Long-term co-operation between EMEP and WGE led to successful application of the critical loads approach for risk assessment of heavy metal pollution within the EMEP region. However, the estimates of critical load exceedances for heavy metals are outdated. Additional efforts on development of the effect assessment are needed (e.g. for Hg pollution of aquatic ecosystems) in close co-operation between the monitoring, modelling and effect communities.