

## MAIN CHALLENGES AND DIRECTIONS OF FUTURE RESEARCH

Various aspects of heavy metal pollution assessment in the EMEP region in 2016 are addressed in this report. They include deposition, concentrations and transboundary transport of heavy metals in 2014, progress in model development, cooperation with the EMEP courtiers, CLRTAP subsidiary bodies and international organizations etc. Particular attention is paid to mercury pollution assessment. This section summarizes the main challenges revealed in the report and suggests directions to improve assessment of heavy metal pollution in the EMEP region.

- Background monitoring is one of the key sources of information used for description of current pollution levels and their temporal trends as well as for evaluation of modeling results. Nowadays heavy metal monitoring data are available mainly from the western, central and northern parts of Europe, whereas in the eastern and southern parts of Europe and Central Asia the monitoring network is scarce. Therefore, more sites with continuous measurements in these regions are needed. Partly this situation could be improved by use of biomonitoring data (mosses etc.) Another important issue is related to quality assurance and quality control of heavy metal monitoring in the EMEP region. Analysis of measurement data has shown existence of low quality data at some monitoring sites. Therefore, laboratories in these countries need to evaluate their methodologies.
- Uncertainties of the reported emission data are still high. The key parameters of heavy metal emission which affect quality of the model assessment are analysed and ranked in terms of their priority. It has been indicated that quality of gridded emission data (including completeness of reported data and quality of expert estimates used for the gapfilling) as well as chemical speciation of mercury emissions are at the top of the priority list. Other important parameters include data on temporal variability and vertical distribution of emissions for lead and cadmium, and global scale inventories as well as historical emissions for mercury. This ranking is a basis for further improvement of emission inventories under EMEP.
- Mercury pollution of the EMEP region attracts particular attention within the Convention. Therefore, improvement of the quality of mercury pollution assessment is among of the main tasks under EMEP. Performed multi-model analysis of mercury processes in the atmosphere has revealed a need of update of the current modeling approaches used for mercury pollution assessment within EMEP. Parameterizations of mercury atmospheric chemistry in the GLEMOS modeling system will be improved along with update of input data on air concentration of chemical reactants. Besides, evaluation of mercury pollution changes over long periods requires consideration of cycling and accumulation in different environmental media. The multi-media approach to mercury simulations should be employed in the GLEMOS modeling system.
- Further improvement of the modeling approaches also includes transition of the EMEP operation modeling to the new grid. Pilot simulations of mercury pollution on the new EMEP grid demonstrate promising results. However, additional development and testing are still required for simulation of other heavy metals. Another direction of the model development is connected with preparation and distribution of the GLEMOS modeling system for public use as an open code to support development of country-scale modeling approaches by national experts.

- EMEP national-scale assessments allow detailed investigation of country-specific pollution levels with fine spatial resolution in close cooperation with national experts. The study of lead pollution levels in Belarus reveals that anthropogenic emissions of lead in Belarus and some neighbouring countries are likely incomplete. For the analysis of heavy metal emission data in the EECCA countries joint efforts of national emission experts of these countries together with CEIP and TFEIP are required. Besides, in order to establish quality of measurements in the EECCA region, participation of national laboratories in the regular intercomparisons under the CCC supervision is appreciated. Further investigation of influence of emission data on a country-scale assessment will be continued in a case study for Poland, where possible uncertainties of temporal variation of emissions are identified. In addition, a case study for the United Kingdom has been also initiated. One of the important aims of this study is investigation of role of secondary sources in heavy metal pollution of the country.
- Cooperation between WGE and EMEP in the field of joint analysis and assessment of heavy metal pollution levels and their effects within the EMEP region is highly important. First of all, regular surveys of heavy metal concentrations in mosses, coordinated by the ICP-Vegetation of WGE, are valuable supplementary source of monitoring information for assessment of heavy metal pollution in the EMEP region and could complement the available station-based EMEP monitoring data. Further usage of these biomonitoring data in analysis of spatial distribution and long-term trends of heavy metal pollution and in verification of modeling results could be useful. Furthermore, in spite of long-term decline of lead, cadmium and mercury deposition and their critical loads exceedances, heavy metals continue accumulating in soils. Besides, levels of mercury in fish tend to increase. Further activity on evaluation of negative effects of heavy metals in the environment is significant.