

Introduction

Heavy metals are toxic pollutants, which are within the scope of the UNECE Convention on Long-range Transboundary Air Pollution (hereafter, CLRTAP or the Convention) for a long period. Despite a rapid decrease of emissions of heavy metals in the past decades, long-term risks continue to exist for human health and biota. Therefore, as it is stated in the updates and revisions to the long-term strategy for the Convention [ECE/EB.AIR/WG.5/2018/3], “... the Convention should pursue mitigation activities on heavy metals within the ECE region and consider acting as a centre of expertise ... on reducing heavy metals, focusing on sharing its technical knowledge in terms of best available techniques, emission inventories, modelling and monitoring”.

Variety of information related to transboundary pollution by heavy metals, including lead (Pb), cadmium (Cd) and mercury (Hg), is collected and analysed by research centres of the Co-operative Programme for Monitoring and Evaluation of Long-range Transmission of Air Pollutants in Europe (EMEP) – the Centre of Emission Inventories and Projections (CEIP), the Chemical Coordinating Centre (CCC), the Meteorological Synthesizing Centre – East (MSC-E) and the Centre for Integrated Assessment Modelling (CIAM). More detailed information on operational activities of EMEP and its research centres is available at the EMEP website [www.emep.int].

The current Status Report overviews research activities of the EMEP Centres in the field of heavy metal pollution performed in accordance with the bi-annual workplan of the Convention for 2018-2019 [ECE/EB.AIR/GE.1/2017/20-ECE/EB.AIR/WG.1/2017/13]. The report covers various aspects of heavy metal pollution assessment based both on monitoring and modelling, research and development aimed at improvement of the modelling approaches, co-operation with national experts within the framework of country-scale case studies as well as collaboration with Subsidiary Bodies to the Convention and other international programmes.

Assessment of heavy metal pollution in the EMEP countries is based on a synergy of research efforts of the EMEP Centres. CCC contributes information on measurements of heavy metals in air and precipitation at the EMEP monitoring network. Information on gridded sector-specific emissions of heavy metals is prepared by CEIP based on reported data and expert estimates. MSC-E prepares variety of input information required for modelling (*Chapter 1*) and performs model assessment of heavy metal pollution. The assessment results include modelled patterns of air concentration and deposition of Pb, Cd, and Hg within the EMEP region in 2016, source-receptor relationships, contribution of various emission sectors, and estimates of ecosystem-specific deposition for evaluation of adverse effects (*Chapter 2*). In addition, information on heavy metal pollution of the Arctic sector of the EMEP region is also presented.

Assessment of Hg pollution is among priority tasks within the Convention. Significant efforts of MSC-E during the past year were focused on collaborative work with the scientific community for evaluation of Hg pollution on global and regional scales as a part of the UN Environment Global Mercury Assessment 2018. The Centre co-ordinated a multi-model study of Hg dispersion on a global scale (*Chapter 3*). Results of the analysis contain information on spatial patterns, source apportionment and sectoral composition of Hg deposition in various terrestrial and aquatic regions, and are relevant for both better understanding of Hg atmospheric cycle and improvement of

pollution assessment for the EMEP countries. In addition, the work on refinement of the Hg chemical scheme applied in the Global EMEP Multi-media Modelling System (GLEMOS) was further continued. For this purpose, the chemical mechanism of Hg oxidation by Br was incorporated into the model and evaluated in test runs and comparison with measurements. Further steps of the chemical scheme development were formulated.

The Centre co-operates with Parties to the Convention in the framework of heavy metal pollution assessment on a country scale. This year a case study for Poland has been completed (*Chapter 4*). The analysis of heavy metal pollution of the country includes model assessment of Cd air concentration and deposition levels with fine spatial resolution, evaluation of national anthropogenic emissions, source apportionment of Cd deposition to various provinces of the country including contribution of different emission sectors. A special attention is paid to assessment of Cd pollution of cities. The source-receptor approach was applied to distinguish contribution of internal and external sources to pollution in selected cities of Poland. The results of the study were published in a special Technical Report [*Ilyin et al., 2018*]. In addition, major findings of the country-scale studies gained during the whole period of the project were summarised in [*Travnikov et al., 2018*].

Collaboration with subsidiary bodies to the Convention and other international organisations is also an important part of MSC-E activities (*Chapter 5*). Results of MSC-E research and development activities as well as plans for future research were presented and discussed at the Task Force on Measurements and Modelling (TFMM). The Centre also contributed to the Task Force on Emission Inventories and Projections (TFEIP) with discussion on possible application of transport models for evaluation of reported emissions. Besides, new results of combined analysis of heavy metal pollution using both model estimates and measurements in mosses were presented to the Working Group on Effects (WGE). Moreover, the Centre continued co-operation with other international organizations and programmes (the United Nations Environmental Programme, the Arctic Monitoring and Assessment Programme, Helsinki Commission etc.) to broaden dissemination of the scientific and policy oriented information generated within EMEP.

Detailed information on transboundary pollution by heavy metals of the EMEP region and individual EMEP countries is available at the MSC-E website [www.msceast.org]. Additionally, information on heavy metal pollution of the countries of Eastern Europe, Caucasus and Central Asia (EECCA) and the Russian Federation is given in Russian [www.ru.msceast.org].