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**Steering Body to the Cooperative Programme for
Monitoring and Evaluation of the Long-range
Transmission of Air Pollutants in Europe**

Working Group on Effects

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Item 11 (a) of the provisional agenda

**Outreach efforts, information sharing and cooperation
with other organizations and programmes:
hemispheric transport of air pollution**

Hemispheric transport of air pollution

**Report prepared by the Co-Chairs of the Task Force on Hemispheric
Transport of Air Pollution**

Summary

The Task Force on Hemispheric Transport of Air Pollution under the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) carries out the activities specified in its mandate (ECE/EB.AIR/106/Add.1, decision 2010/1). During the reporting period, it was also tasked with carrying out the activities assigned to it in the 2018–2019 workplan for the implementation of the Convention on Long-range Transboundary Air Pollution (ECE/EB.AIR/140/Add.1, items 1.1.4.1–1.1.4.3, 1.3.2 and 1.3.5) and those set out in the informal document submitted to the Executive Body for the Convention at its thirty-seventh session entitled “Draft revised mandates for scientific task forces and centres under the Convention”.

In accordance with the Convention workplan, the Task Force is requested to present an annual report on its work to the EMEP Steering Body. The present report details the progress made by the Task Force since its previous report and provides an overview of upcoming activities through 2019.



I. Progress in implementation of the 2018–2019 workplan

1. The 2018–2019 workplan for the implementation of the Convention (ECE/EB.AIR/140/Add.1) identifies three primary sets of activities and expected outcomes or deliverables for the Task Force on Hemispheric Transport of Air Pollution. These sets of activities are listed below, and their status is discussed in the following paragraphs:

(a) Global-regional modelling and evaluation for ozone, fine particles and deposition (workplan item 1.1.4.1);

(b) Intercontinental transport of mercury and persistent organic pollutants (workplan item 1.1.4.2);

(c) Sectoral opportunities to mitigate intercontinental transport (workplan item 1.1.4.3).

2. Most of the Task Force's efforts have concentrated on the first of these areas (workplan item 1.1.4.1), focusing on global and regional modelling of ozone, fine particles and nitrogen and sulphur deposition through a coordinated set of modelling experiments (HTAP2). To encourage and organize the publication of scientific results from HTAP2, the Task Force launched a special issue of the open-access journal *Atmospheric Chemistry and Physics*.¹ The special issue was open to all papers related to the intercontinental transport of air pollution and addressing the following policy-relevant science questions identified by the Task Force:

(a) What fraction of air pollution concentrations or deposition can be attributed to contemporary anthropogenic regional emissions within the region as compared to extraregional, non-anthropogenic or legacy sources of pollution?;

(b) What impact do these fractions have on human health, ecosystems and climate change?;

(c) How sensitive are regional pollution levels and related impacts to changes in the sources of the various fractions?;

(d) How will the various fractions and sensitivities defined above change as a result of expected air pollution abatement efforts or climate change?;

(e) How do the availability, costs and impacts of additional emission abatement options compare across different regions?

3. A total of 48 articles were published in the special issue, which was finalized in April 2019. The articles cover a variety of topics, including: the development of emission inventories at the global and regional levels; source-receptor relationships for ozone and aerosols; regional and global model evaluation methodologies and applications; and estimates of impacts on human health, deposition and climate change. The majority of the articles focus on the European, North American or global domains, with fewer articles addressing Asia, Africa and the Arctic. The authors of the articles come from a number of countries that are Parties to the Convention, as well as from China, India, Japan and the Republic of Korea.

4. The Co-Chairs are drafting a summary of the main findings from the HTAP2 experiments and other recent literature. As discussed in previous annual reports, the results of the HTAP2 experiments are generally consistent with the findings of the HTAP1 experiments, which were conducted for the year 2001 and reported in the Task Force's 2010 executive summary and its corrigendums (ECE/EB.AIR/2010/10, Corr.1 and Corr.2), as well as in four related reports.² The HTAP2 results show similar ranges of inter-model differences

¹ Frank Dentener, Stefano Galmarini, Christian Hogrefe, Gregory Carmichael, Kathy Law, Bruce Denby and Tim Butler, eds, "Global and regional assessment of intercontinental transport of air pollution: results from HTAP, AQMEII and MICS", *Atmospheric Chemistry and Physics*, special issue, 2019. Available at www.atmos-chem-phys.net/special_issue390.html.

² *Hemispheric Transport of Air Pollution 2010, Part A: Ozone and Particulate Matter*, Air Pollution

and generally similar patterns of source-receptor relationships. However, new insights regarding the contribution of source categories and regions that were not previously considered may emerge from further analysis.

5. A robust finding in the new results is that regional model estimates of ozone concentrations are sensitive to the boundary conditions used to estimate transport of ozone into the regional domain in the free troposphere (i.e. above the mixed layer). Such boundary conditions are often estimated using global models. Thus, future model evaluation and intercomparison efforts may focus on the ability of global models to estimate free troposphere ozone levels near continental boundaries and on the ability of regional models to estimate vertical mixing between the free troposphere and planetary boundary (mixed) layer.

6. With respect to the intercontinental transport of mercury and persistent organic pollutants (workplan item 1.1.4.2), the Meteorological Synthesizing Centre-East has continued its work on model development, evaluation and application, contributing to the Global Mercury Assessment and to discussions under the Minamata Convention on Mercury and the Stockholm Convention on Persistent Organic Pollutants. However, due to resource constraints, the Task Force's plans to hold a workshop to assess the state of the science and to organize new cooperative efforts has been postponed.

7. Some progress has been made under the Task Force to assess sectoral opportunities to mitigate intercontinental transport (workplan item 1.1.4.3). However, a number of the planned efforts have been delayed due to resource constraints. The United States Environmental Protection Agency, in collaboration with the European Commission Joint Research Centre, has continued to support the incorporation of the HTAP2 experiment results into the Joint Research Centre's web-based FASST Scenario Screening Tool.³ The resulting tool is expected to allow users to explore global air pollution scenarios and their impacts, drawing on the average and range of the HTAP2 results. As the HTAP2 version of the tool is being developed, the potential for a more modular, open-source code ("openFASST"), which will allow greater flexibility in selecting data sources and algorithms, is being explored.

8. The workshop for scoping analyses of sectoral mitigation opportunities was planned as a series of joint sessions that began at the forty-eighth meeting of the Task Force on Integrated Assessment Modelling (Berlin, 23 and 24 April 2019), and continued at a meeting of the Task Force on Hemispheric Transport of Air Pollution in Potsdam, Germany, on 25 and 26 April 2019. The results of this meeting are discussed in the following section.

II. Meeting of the Task Force on Hemispheric Transport of Air Pollution, Potsdam, Germany, 25 and 26 April 2019

9. The Task Force on Hemispheric Transport of Air Pollution met in Potsdam, Germany, on 25 and 26 April 2019. Approximately 30 experts attended the meeting in person, including representatives of the Task Force on Integrated Assessment Modelling and the EMEP Centre for Integrated Assessment Modelling, who had just attended the forty-eighth meeting of the Task Force on Integrated Assessment Modelling (Berlin, 23 and 24 April 2019). Mr. Terry Keating (United States of America) chaired the meeting. Mr. Tim Butler (Institute for Advanced Sustainability Studies) welcomed the Task Force to Potsdam, Germany, and opened the meeting.

10. Although the meeting had originally been envisioned as an opportunity to discuss with the Task Force on Integrated Assessment Modelling the scope of future analyses of sectoral mitigation opportunities inside and outside the United Nations Economic Commission for

Studies No. 17 (United Nations publication, Sales No. E.11.II.E.7); *Hemispheric Transport of Air Pollution 2010, Part B: Mercury*, Air Pollution Studies No. 18 (United Nations publication, Sales No. E.11.II.E.8); *Hemispheric Transport of Air Pollution 2010, Part C: Persistent Organic Pollutants*, Air Pollution Studies No. 19 (United Nations publication, Sales No. E.11.II.E.9); and *Hemispheric Transport of Air Pollution 2010, Part D: Answers to Policy-Relevant Science Questions*, Air Pollution Studies No. 20 (United Nations publication, Sales No. E.11.II.E.10).

³ See <http://tm5-fasst.jrc.ec.europa.eu/>.

Europe (ECE) region, the focus of the meeting shifted as a result of discussions at the EMEP Steering Body and Working Group on Effects Extended Bureau meeting (Laxenburg, Austria, 19–21 March 2019). At the Bureaux meeting, it had been noted that the amended Protocol to the 1979 Convention on Long-range Transboundary Air Pollution to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol) was expected to enter into force before December 2019, potentially triggering a decision by the Executive Body to initiate a review of the amended Gothenburg Protocol. The Chairs of the Task Force on Hemispheric Transport of Air Pollution and the Task Force on Integrated Assessment Modelling decided that the joint sessions at their April meetings should focus on how the Task Forces could work together to contribute to the anticipated review, with analysis of sectoral mitigation opportunities being one possible area of cooperation.

11. The participants in the joint session noted that the Task Force on Hemispheric Transport of Air Pollution could contribute to a future review of the Gothenburg Protocol by assessing the contribution of hemispheric transport to recent trends in the ECE region. Such an assessment of extraregional influences should include consideration of changes in emissions outside the ECE region, as well as changes in circulation and climate. The assessment should be coordinated with the Task Force on Measurements and Modelling, the Task Force on Integrated Assessment Modelling and the Centre for Integrated Assessment Modelling.

12. A top priority for the Task Force on Hemispheric Transport of Air Pollution was to identify, develop or compile a global emissions data set that could inform such an assessment of the recent trends in extraregional influences. The participants concluded that the Task Force should convene, in autumn 2019, a small meeting with key experts from the emissions inventory development community to evaluate options for producing a global data set.

13. In terms of analysis of mitigation opportunities in specific sectors, two areas were highlighted as being appropriate for continued analysis by the Task Force: marine shipping emissions; and methane emissions, in general. Both appeared to be important contributors to background ozone levels, but their representation in global models could be improved. The participants concluded that understanding of the impacts of marine shipping emission controls and methane emission control options should be explored further in the Task Force workplan.

14. The participants recognized that the long-term workplan for the Task Force should consider the long-term priorities of the Convention, and recommended that the Task Force consider continuing and expanding research in a number of areas, including:

- (a) Ozone impacts on ecosystems, and their attribution to hemispheric transport;
- (b) Inter-comparison of techniques for ozone source attribution (perturbation, tagging, adjoint sensitivity);
- (c) Continued development of the reduced-form “openFASST” tool and gap-filling of “missing” runs from the HTAP2 set, which would result in improved accessibility of the source/receptor relationships for the broader community;
- (d) Links between air pollution and climate change;
- (e) The Arctic as a receptor region;
- (f) Intercontinental transport of mercury, other heavy metals, persistent organic pollutants and other contaminants of emerging concern.

15. In addition to exploring topics for future work, the participants reviewed the draft summary of HTAP2 findings and related literature prepared by the Co-Chairs for submission to the EMEP Steering Body, as mentioned above. The draft was circulated prior to the meeting. Most participants agreed that the report needed to begin with an executive summary comprised of clear, simple messages about existing knowledge to ensure that the findings were effectively conveyed to the members of the EMEP Steering Body. It was agreed that Mr. Keating would redraft the report with the assistance of selected individuals and recirculate it for comments.

III. Activities during the remainder of 2019

16. The Task Force will propose a change in its leadership structure to the EMEP Steering Body and the Executive Body. Lead Party responsibility will be shared by the United States of America and Canada, with Mr. Keating (United States of America) and Ms. Heather Morrison (Canada) serving as Co-Chairs. In addition, Mr. Butler (Germany) and Mr. Jacek Kaminski (Poland) will serve as Vice-Chairs and help lead implementation of the Task Force's workplan.

17. As discussed above, the Co-Chairs will organize a meeting of emissions inventory experts to discuss the development of an updated global emissions data set for use in future analyses, including an assessment of recent trends in extraregional influences.

18. The Task Force will plan its next full meeting in spring 2020, tentatively scheduled to be held in Edinburgh, United Kingdom of Great Britain and Northern Ireland.
