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**Economic Commission for Europe**

Executive Body for the Convention on Long-range  
Transboundary Air Pollution

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

**Working Group on Effects**

**Eighth joint session**

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Item 10 (d) of the provisional agenda

**Progress in activities of the Cooperative Programme for Monitoring  
and Evaluation of the Long-range Transmission of Air Pollutants in  
Europe in 2022 and future work: 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 carries out the activities specified in its revised mandate (Executive Body decision 2019/9)<sup>1</sup>. During the reporting period, it was also tasked with carrying out the activities assigned to it in the 2022–2023 workplan for the implementation of the Convention on Long-range Transboundary Air Pollution (ECE/EB.AIR/148/Add.1) in particular, workplan items 1.1.4.2–1.1.4.6) approved by the Executive Body at its forty-first session (Geneva, 6–8 December 2021).

In accordance with the Convention workplan, the Task Force is requested to present an annual report on its work to the Steering Body of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe. The present report details the progress made by the Task Force since its previous report and provides an overview of upcoming activities through 2023.

<sup>a</sup> Available at <https://unece.org/decisions>.<sup>”</sup>



## I. Progress in implementation of the 2022–2023 workplan

1. The 2022–2023 workplan for the implementation of the Convention on Long-range Transboundary Air Pollution (Air Convention) (ECE/EB.AIR/148/Add.1) identifies a series of activities and expected outcomes or deliverables for the Task Force on Hemispheric Transport of Air Pollution that fall into four main thematic areas that cut across the pollutants addressed by protocols of the Air Convention:

(a) Development and evaluation of global emissions data sets that provide the basis for estimating the impact of extraregional emissions sources (i.e., sources geographically outside the Air Convention) (workplan item 1.1.4.3);

(b) Intercomparison and evaluation of global to regional scale models to improve estimates of source-receptor relationships over intercontinental scales and of health and environmental benefits of mitigating extraregional emission sources (workplan items 1.1.1.6, 1.1.1.14, 1.1.3.3, 1.1.3.5 and 1.1.4.5–1.1.4.6);

(c) Assessment of global scenarios to explore the relative health and environmental benefits of mitigation of extraregional emissions sources (workplan items 1.1.4.2, 1.1.4.4 and 2.1.3);

(d) Outreach and cooperation with other relevant multilateral forums (workplan items 1.3.2–1.3.4 and 1.3.7).

2. To review progress and organize additional efforts on these tasks, the Task Force held a virtual meeting divided into four 4-hour-long online sessions on 17, 18, 19 and 25 May 2022. More than 245 individual experts from 34 countries, including 14 countries from outside the Air Convention, and representatives of the European Union, the United Nations Environment Programme and the World Meteorological Organization, participated in one or more sessions. Agendas and presentation materials are available on the Task Force website.<sup>1</sup> The progress and next steps discussed in each session are described below.

3. The focus of the 17 May session was the development and evaluation of global emissions data sets for ozone precursors and fine particle precursors and components. The session was divided into two parts:

(a) The first half of the session featured the release of the HTAPv3 global emissions mosaic (workplan item 1.1.4.3). The mosaic, compiled by the European Commission Joint Research Centre, is comprised of ozone and fine particle precursor emissions estimates from policy-relevant national and regional data sets for Europe, North America and Asia, with data for remaining countries provided by the Emissions Database for Global Atmospheric Research v6.1 global inventory. The mosaic is provided on a 0.1° x 0.1° grid at monthly resolution for the period 2000–2018, for nine pollutants from 16 anthropogenic emission sectors. The data are available in several formats.<sup>2</sup> The Task Force heard a number of presentations comparing the new HTAPv3 data set to existing estimates from the Community Emissions Data System and the Copernicus Atmospheric Monitoring Service global inventory. The Task Force identified areas where further clarifications and corrections of the HTAPv3 may be needed and where future investigation and collaboration would be most useful;

(b) The second half of the session was organized in conjunction with the Global Emissions Initiative of the International Global Atmospheric Chemistry project. This part included status reports from the Global Emissions Initiative regional working groups in China, Africa and Latin America and topical working groups on volatile organic compound (VOC) speciation and on the impact of the coronavirus disease (COVID-19) pandemic on air pollutant emissions. The Task Force discussed potential areas for future collaboration, in particular to provide information on VOC speciation and to update and expand the number of regional data sets incorporated into the HTAP global mosaic.

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<sup>1</sup> See <http://htap.org>.

<sup>2</sup> See [https://edgar.jrc.ec.europa.eu/dataset\\_htap\\_v3](https://edgar.jrc.ec.europa.eu/dataset_htap_v3)

4. The 18 May session focused on global and regional emissions and modelling of mercury (workplan items 1.1.4.3 and 1.1.4.5). The Task Force reviewed recent and ongoing work under the Global Observation System for Mercury (GOS<sup>4</sup>M) project, the Global Mercury Observation Training Network in Support of the Minamata Convention project, the Arctic Monitoring and Assessment Programme, the Joint Research Centre Emissions Database for Global Atmospheric Research programme, and the Centre for Integrated Assessment Modelling. The Task Force took note that, in March 2022, the Minamata Convention on Mercury had agreed to begin an effectiveness evaluation process scheduled to run until at least 2025. The effectiveness evaluation is expected to include efforts to compile and analyse global and regional trends in mercury emissions and mercury levels in air, biota and humans and, to the extent possible, attribute changes to the implementation of the Minamata Convention. Recognizing the Air Convention's mutual interest in understanding and attribution of mercury trends at the regional to global scale, the Task Force discussed how its current workplan could be refocused to continue to advance the interests of the Air Convention while contributing to the evolving process under the Minamata Convention and avoiding duplication of effort or competition for scarce expertise and resources. The Task Force identified two efforts to pursue over the remainder of 2022 that will help advance work under both the Minamata Convention and the Air Convention:

(a) The compilation of existing global mercury emissions data sets in a common framework that will facilitate comparison (e.g., workplan item 1.1.4.3);

(b) The development of a white paper that describes how a global (and regional) mercury model ensemble may be constructed to assist in the analysis of mercury trends and source attribution. Such a white paper would serve to better define future multimodel work under the Air Convention (e.g., workplan item 1.1.4.5), but could also serve as a starting point for the development of a modelling and analysis plan under the Minamata Convention.

5. The 19 May session focused on taking stock of recent and ongoing efforts inside and outside the Air Convention on global and regional modelling of ozone and aerosols. The session was divided into two parts:

(a) The first part of the session focused on questions related to review of the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol), in particular the role of methane as an ozone precursor and the impacts of marine shipping (workplan items 1.1.3.3, 1.1.3.5 and 1.1.4.2). The Task Force took note of several recent analyses:

(i) Model simulations performed for the Copernicus Atmospheric Monitoring Service policy services suggest that ozone levels (annual average, accumulated ozone exposure over a threshold of 40 parts per billion (AOT40), and sum of ozone means over 35 parts per billion (SOMO35) in 2050 change very little across Europe compared to 2015 under a current legislation scenario, and, in some areas, increase due to decreased nitrogen oxides (NO<sub>x</sub>) titration. Decreasing global methane concentrations under this scenario produce a small but consistent decrease in ozone levels, with maximum benefits in the areas affected by NO<sub>x</sub> titration. A maximum feasible reduction scenario, however, is able to decrease both peak and average ozone concentrations. Consistent qualitative results were seen in both regional and global models;

(ii) Using an Earth systems model driven by dynamic, fully coupled methane and carbon dioxide emissions, the Met Office (United Kingdom of Great Britain and Northern Ireland) demonstrated that representing methane emissions dynamically increased the estimated global methane climate and ozone responses by 20–30 per cent;

(iii) Using the TM5-FAst Scenario Screening Tool model, the Joint Research Centre of the European Commission projected an increasing trend in ozone-related mortality and crop losses within the ECE region between 2020 and 2050 due to the growing impact of methane emissions outside the region. Implementing maximum feasible reductions within the ECE region led to limited decreases in ozone-related exposures and mortality in the ECE region compared to implementing maximum feasible reductions globally;

(iv) Examining the contribution of shipping in different ocean regions to European ozone levels, the Meteorological Synthesizing Centre-West (MSC-W) demonstrated how emissions perturbation and tagging techniques can lead to differences in source attribution estimates;

(b) The second part of the session focused on updates from relevant international cooperative scientific efforts, including the Air Quality Model Evaluation International Initiative, the Model Intercomparison Study for Asia, the Tropospheric Ozone Assessment Report, the World Meteorological Organization Measurement-Model Fusion for Global Total Atmospheric Deposition project, the International Global Atmospheric Chemistry Air Pollution in the Arctic: Climate, Environment and Societies(PACES) project, and the Chemistry-Climate Model Initiative. The Task Force took note of the ongoing work in several forums on ozone deposition, and the potential to incorporate insights from those studies into future Task Force efforts to estimate the benefits of potential revisions to the Gothenburg Protocol, specifically with respect to impacts on vegetation (workplan item 1.1.1.14).

6. The 25 May session focused on emissions and modelling of persistent organic pollutants (POPs) and chemicals of emerging concern. The session began with reports on recent activities related to Arctic contamination and on perspectives from the Convention on Persistent Organic Pollutants (Stockholm Convention). The Task Force then divided the discussion of ongoing and future work into two parts:

(a) The first half of the session focused on the availability of emissions inventories for combustion-related POPs (workplan item 1.1.4.3) and initial findings from national and regional scale modelling of benzo(a)pyrene and the potential to extend the analysis to the global scale (workplan item 1.1.4.6). The initial benzo(a)pyrene modelling results highlighted the importance of residential heating and transportation emissions on the local scale and the relatively low contribution of extraregional atmospheric transport. Based on these findings, the Task Force decided to shift the focus of workplan item 1.1.4.6 to emissions of wildfires and agricultural burning, which are known to be transported over intercontinental to hemispheric scales and are increasingly important contributors to air pollution episodes. Moreover, the Task Force noted that a model intercomparison and evaluation exercise focused on wildfires and agricultural burning could be designed as a multipollutant test case to compare emissions, models and measurements across POPs, mercury, aerosols and ozone;

(b) The second half of the session focused on the multimedia modelling of the long-range transport of micro- and nano-plastics (MNP) and per- and polyfluoroalkyl substances (PFAS). The Task Force recognized the significant emerging literature on these issues and their importance for health and environmental protection, as well as the need to engage with new expert communities and bodies of knowledge to better understand the relevance of these issues to the Air Convention. To further understanding and foster more sustained connections with other relevant activities, the Task Force decided to organize a series of quarterly webinars to continue to explore these emerging issues.

7. The Task Force leadership team has continued to contribute to the review of the Gothenburg Protocol (workplan item 1.1.3.3) and to engage with the Working Group on Strategies and Review (workplan item 2.1.7) at its sixtieth session (Geneva (hybrid), 11–14 April 2022) to discuss the impact of emission sources outside the ECE region on the achievement of objectives within the region.

## **II. Activities during the remainder of 2022 and 2023**

8. The Task Force will continue its work on global emissions inventories (workplan item 1.1.4.3):

(a) Publishing documentation of the HTAPv3 global emissions mosaic and exploring the potential for updates and extensions of the data set;

(b) Compiling and comparing available global and regional emissions inventories for mercury;

(c) Developing a global multipollutant emissions data set for wildfires and agricultural burning for use in multipollutant model intercomparisons.

9. The Task Force will continue to organize global and regional model evaluation and intercomparison activities:

(a) Completing the ongoing source attribution analysis of recent ozone trends using tagging methods in global and regional models (workplan item 1.1.3.3);

(b) Developing a white paper on the use of a global and regional multimodel ensemble to assist in the source attribution of mercury trends (workplan item 1.1.4.5);

(c) Developing a white paper on the design of a global and regional multimodel evaluation and intercomparison of the contribution of wildfires and agricultural burning to ozone, fine particles, mercury and POPs (workplan item 1.1.4.6).

10. The Task Force will continue to assess global air pollution scenarios to explore the relative health and environmental benefits of mitigating extraregional emissions sources, including:

(a) Completing the ongoing analysis of intercontinental-scale transport from marine shipping and the impact of emission control areas in other parts of the world on the ECE region;

(b) Working with the Task Force on Integrated Assessment Modelling and the Centre for Integrated Assessment Modelling to define future global emissions scenarios and explore their implications (workplan items 1.1.4.2 and 2.1.7);

(c) Continuing the development of the open-source Fast Scenario Screening Tool for screening analysis of future scenarios and implications of global and regional model uncertainties (workplan item 1.1.4.4);

(d) Applying tagging methods and other source apportionment techniques in global and regional models to better understand the impacts of global methane reductions on local ozone production (workplan item 1.1.3.3).

11. The Task Force will continue to coordinate its work with the other subsidiary bodies of the Air Convention and to reach out to coordinate with a wide variety of relevant international cooperative scientific efforts (workplan items 1.3.2–1.3.4 and 1.3.7). In particular, the Task Force will organize a quarterly webinar series focused on the very long-range transport of chemicals of emerging concern, including MNP and PFAS.