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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

Second joint session[*]
Geneva, 13–16 September 2016
Item 14 of the provisional agenda
Progress in activities in 2016 and further development of effects-oriented activities

2016 joint progress report on policy-relevant scientific findings[**]

Note prepared by the Chairs of the Steering Body to the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe and the Working Group on Effects, in cooperation with the secretariat

Summary

The present report was drafted by the Extended Bureau of the Working Group on Effects[1] and the Extended Bureau of the Steering Body to the Cooperative Programme for

[*] The Executive Body to the Convention agreed that, as of 2015, the Working Group on Effects and the Steering Body to the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe should meet jointly, to achieve enhanced integration and cooperation between the Convention's two scientific subsidiary bodies (ECE/EB.AIR/122, para. 47 (b)).

[**] The present document is being issued without formal editing.

[1] Comprising: the Bureau of the Working Group; the Chairs of the International Cooperative Programme (ICP) task forces, the Joint Task Force on the Health Effects of Air Pollution and the Joint Expert Group on Dynamic Modelling; and representatives of the ICP programme centres.

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Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP)[2] in cooperation with the secretariat to the Convention on Long-range Transboundary Air Pollution. The review of recent scientific findings is based on the information provided by the lead countries and the International Cooperative Programme programme centres, and is submitted in accordance with the 2016–2017 workplan for the implementation of the Convention (ECE/EB.AIR/133/Add.1) as well as the informal document approved by the Executive Body for the Convention at its thirty-fourth session, "Basic and multi-year activities in the 2016–2017 period" [3] (item 1.8.2).

Contents

[2] Comprising the Bureau of the Steering Body, the Chairs of the EMEP task forces and representatives of EMEP centres.

[3] Available from http://www.unece.org/index.php?id=38060#/.

Figure

I. Introduction

1. This report is compiled by the Chairs of the Steering Body to the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) and the Working Group on Effects (WGE) in accordance with the 2016–2017 workplan for the Convention on Long-range Transboundary Air Pollution (ECE/EB.AIR/133/Add.1) and the informal document approved by the Executive Body for the Convention at its thirty-fourth session "Basic and multi-year activities in the 2016–2017 period"[4] (item 1.8.2). The report reflects achievements during 2015 and 2016 and is prepared with support from the scientific subsidiary bodies. The report is the second common report of the work under EMEP and WGE, reflecting the new organization of the two bodies with joint, integrated sessions based on a common agenda. The reports represent a further integration of the scientific work under the Convention and should be seen as a strengthening of the scientific basis for the Convention's policy development.

2. The integration of work between EMEP and WGE is particularly reflected in an increasing number of common activities. Most important of these is the 2016 assessment report.[5] There are also other examples of close cooperation that are mentioned in this report, e.g., the EMEP and WGE trends reports and effects-oriented activities coordinated by the Task Force on Hemispheric Transport of Air Pollution (TFHTAP).

II. 2016 assessment report

A. Launch of the 2016 assessment report

3. A key activity for the EMEP and WGE communities has been the preparation of the 2016 assessment report, which was launched at Norway House in Brussels on 31 May 2016 and further presented at the Eighth Environment for Europe Ministerial Conference (Batumi, Georgia, 8–10 June 2016).[6] The report contains a scientific evaluation of achievements and future challenges for the Convention. The assessment is partly based on and accompanied by three separate reports: *Trends in ecosystem and health responses to long-range transported atmospheric pollutant* (WGE trends report);[7] *Air Pollution Trends*

[4] Ibid.

[5] Rob Maas and Peringe Grennfelt, eds., *Towards Cleaner Air: Scientific Assessment Report 2016* (Oslo, 2016).

[6] Towards cleaner air: scientific assessment report 2016 — Summary for policymakers (ECE/BATUMI.CONF/2016/12), available from http://www.unece.org/environmental-policy/environment-for-europe/efe-conferences/batumi-conference/documents-and-materials.html (item 5).

[7] Heleen A. De Wit, Jean-Paul Hettelingh and Harry Harmens, eds., ICP Waters report No. 125/2015, NIVA report 6946–2015 (Oslo, Norwegian Institute for Water Research, 2015). Available from available from http://www.unece.org/environmental-policy/conventions/envlrtapwelcome/publications.html.

in the EMEP region between 1990 and 2012 (EMEP trends report);[8] and *Towards Cleaner Air: Scientific Assessment Report 2016 — North America*[9] (North American assessment).

B. Main conclusions of the 2016 assessment report

4. The 2016 assessment report presents the development of air pollution within the United Nation Economic Commission for Europe (ECE) area since 1990 and, in particular, points to some key challenges for the future:

(a) Air quality has improved significantly in Europe and North America over the past three decades. Average life expectancy in Europe has increased by one year and hundreds of thousands of premature deaths every year have been avoided as a result of internationally coordinated policy-driven reductions in air pollution. In addition, soil acidification has been halted in most parts of Europe, and fish stocks are recovering in freshwaters;

(b) Particulate matter concentrations at European measurement sites declined by around a third between 2000 and 2012. National average annual concentrations of fine particulate matter ($PM_{2.5}$) fell by 33 per cent between 2000 and 2012 in the United States of America, and by 4 per cent in Canada. The number of days exceeding the World Health Organization (WHO) guideline level for ozone concentrations is now about 20 per cent lower than in 1990;

(c) Despite these successes, air pollution is still the primary environmental cause of premature death notably due to high concentrations of fine particles and ground-level ozone, and ecosystem biodiversity is threatened due to nitrogen deposition;

(d) The report shows that solutions are at hand and that action pays off. Implementing the protocols under the Convention could not only significantly reduce air pollution but also enable an international level playing field for industries and prevent countries from competing with each other at the expense of the environment and human health;

(e) Without any policy measures, acidification of forests and lakes would have been 30 times higher than today. Instead, the area threatened by acidification was reduced by more than 90 per cent;

(f) Economic growth and trends in air pollution have progressively been decoupled. In Western Europe, environmental measures were responsible for around a third of this decoupling; energy policies that brought a shift towards cleaner fuels and increased energy efficiency also played an important role;

(g) Without decoupling, average levels for $PM_{2.5}$ would have been similar to levels in current European hotspots, with three times more health impacts than today and an additional 600,000 premature deaths every year;

[8] Augustin Colette and others, EMEP/CCC report 1–2016 (Kjeller, Norway, Norwegian Institute for Air Research, 2016). Available from available from http://www.unece.org/environmental-policy/conventions/envlrtapwelcome/publications.html

[9] United States Environmental Protection Agency and Environment and Climate Change Canada, (2016, online report), available from http://www.unece.org/environmental-policy/conventions/envlrtapwelcome/publications.html.

(h) Further efforts are also needed to abate ammonia emissions, contributing to cardiovascular and respiratory diseases in humans and loss of biodiversity in many of the most vulnerable ecosystems. Agriculture is the major culprit for ammonia emissions, and action is needed to reduce livestock densities in and around sensitive nature areas, reduce food waste and encourage low-meat diets;

(i) Because transboundary sources are often major contributors to urban pollution, local and even national action alone will not be enough to tackle these problems. Broader international cooperation is needed across the northern hemisphere and with Asia to reduce a number of air pollutants;

(j) In the coming decades climate and energy policy is expected to improve air quality further. However, policies leading to promoting domestic wood burning, diesel cars or the use of biofuels and biodigesters could actually increase air pollution if not accompanied with additional technical measures. A holistic approach combining air quality policies with climate and sectoral policies in transport, energy, agriculture and biodiversity is therefore needed to avoid such problems;

(k) The cost of damage to human health from air pollution (excluding damage to crops or buildings) is about €1.1 trillion per year in Europe and over US$1 trillion in the United States. For half the ECE countries, the total health costs of air pollution represent more than 10 per cent of gross domestic product (GDP). The report finds that air pollution control costs are significantly lower than the health costs, which makes abatement measures a sound investment.

5. The full report as well as its Summary for Policymakers are available both in printed versions and in electronic form to be downloaded from the Convention website.[10] The Summary for Policymakers has also been translated into Russian.

III. Three scientific reports in support of the assessment report

A. Trends in effects from air pollution

6. Trends in ecosystem and health responses to long-range transported atmospheric pollutants are presented in the WGE trends report. The report presents trends primarily focusing on the period 1990 to 2012. Some longer-term trends and prognoses based on scenarios for future emissions and climate are also included. Air pollutants included in the report are sulphur and nitrogen as acidifying agents, nitrogen as a nutrient, ground-level ozone, particulate matter, heavy metals and persistent organic pollutants (POPs). Most trends are reported for Europe, as data collection is concentrated there. So far, too few data have been collected from the countries of Eastern Europe, the Caucasus and Central Asia to provide trend assessments. The main conclusions of the report were presented in the 2015 EMEP/WGE Chairs report (ECE/EB.AIR/GE.1/2015/3–ECE/EB.AIR/WG.1/2015/3).

7. The documented trends stem primarily from work done under the WGE and EMEP bodies. The Arctic Monitoring and Assessment Programme (AMAP) also contributed to the report.

[10] See www.unece.org/environmental-policy/conventions/envlrtapwelcome/publications.html.

B. EMEP trends report

8. Trends in air pollutant concentrations and deposition throughout the EMEP domain over the past 20 years have been extensively documented, for the first time, in a dedicated report based on both observations from the EMEP network and model data. Trends in sulphur and nitrogen compounds, ground-level ozone, particulate matter but also heavy metals and persistent organic pollutants are presented and discussed in this report. Trends calculations are based on a common methodological approach which allows comparison of results. This work demonstrated the outstanding value of the EMEP monitoring and modelling strategies in supporting the implementation of the protocols to the Convention.

9. This work demonstrates the overall efficiency of emission control strategies to decrease air pollutant concentrations and deposition. It also shows the complexity of some processes, depending on the period and geographical region considered, and the impact of external factors that could hamper some decreasing trends (e.g., annual ozone levels). Chemical composition of particulate matter is considered as well. Finally, encouraging results for trends in heavy metals and persistent organic pollutants are proposed. Generally good agreement between observations and model trends is obtained, demonstrating relevance of the modelling tools developed for several years.

C. North American assessment

10. As part of the work on the 2016 assessment report, the environmental authorities in Canada and the United States made their own North American assessment, with an emphasis on transboundary regionally distributed pollutants. These include particulate matter, acidifying compounds and ozone. The main conclusions include:

(a) In both countries, ambient concentrations of $PM_{2.5}$ have diminished significantly. More specifically, between 2000 and 2012 the national United States average annual and 24-hour concentrations of $PM_{2.5}$ decreased by 33 per cent and 37 per cent, respectively. In Canada, the national averages of the annual and the 24-hour concentrations of $PM_{2.5}$ decreased by 4 per cent and 6.5 per cent, respectively, over the same period. However, between 2003 and 2012, the percentage of Canadians living in communities where ambient concentrations of $PM_{2.5}$ exceeded the 2015 Canadian Ambient Air Quality Standard for $PM_{2.5}$ dropped from approximately 40 per cent to 11 per cent. In 2012, ambient concentrations reported at most monitoring sites in the United States along the Canadian border met the United States annual and 24-hour National Ambient Air Quality Standards for $PM_{2.5}$ set in 2012;

(b) For acidification, wet sulphate deposition is consistently highest in eastern North America, around the lower Great Lakes, with a gradient following a south-west to north-east axis running from the confluence of the Mississippi and Ohio Rivers through the lower Great Lakes. In the eastern United States, the impact of anthropogenic sulphur and nitrogen emissions on terrestrial and aquatic ecosystems is widely assessed using a critical load approach. The area exceeded or at risk for aquatic acidification diminished from 40 per cent in 1990 to 20 per cent in 2013 for acid sensitive areas with data. This analysis suggests that emission reductions achieved since 1990 have contributed to broad aquatic ecosystems improvements and increased aquatic ecosystem protection across the Eastern United States. For Canada, critical loads for lakes and upland forest soils are exceeded in various areas across the country;

(c) Ambient ozone levels have been reduced in Canada and United States owing to collaborative efforts between the two countries to control precursor emissions. Between 2000 and 2012, Canada's total nitrogen oxides (NO_x) emissions in the region assessed for the collaboration (Pollution Emission Management Area region) decreased by 45 per cent, while in the United States total NO_x emissions in the region declined by 47 per cent. In Canada, average ozone levels decreased by 15 per cent between 1998 and 2012. Between 2003 and 2012, the percentage of Canadians living in communities where ambient concentrations of ground-level ozone exceeded established air quality standards dropped from approximately 50 per cent to 28 per cent. In the United States, nationally, average ozone levels declined in the 1980s, levelled off in the 1990s and showed a notable decline after 2002. From 1990 to 2014 national average ozone levels decreased 23 per cent. Emissions are projected to continue to decline through to 2025.

IV. Health effects

11. At its nineteenth meeting (Bonn, Germany, 18–19 May 2016), the Joint Task Force on Health Aspects of Air Pollution heard updates on relevant regional and global activities in relation to air quality and health. A road map for implementation of the first World Health Assembly resolution on air pollution and health, adopted in May 2015, was welcomed at the sixty-ninth World Health Assembly in May 2016. The road map is based on four pillars to enhance the global response to the adverse health effects of air pollution:

(a) Expanding the knowledge base;

(b) Monitoring and reporting;

(c) Global leadership and coordination;

(d) Institutional strengthening.

12. The road map was also aligned with the health-relevant indicators included in the United Nations Sustainable Development Goals to be achieved by 2030. The Task Force further discussed the various existing commitments relevant for air quality and health, and gathered views among participants on the formulation of a region-wide policy commitment, in view of the upcoming Ministerial Conference on Environment and Health scheduled to be held in 2017.

13. A representative of WHO informed the Task Force about the process of updating the WHO air quality guidelines for ambient air pollutants, which had been initiated in 2016. The project, of an estimated four-year duration, came as a response to an increasingly relevant global public health need and in the view of the requests from member States at the 2015 World Health Assembly, where countries had expressed the need to be provided with up-to-date, evidence-based recommendations to support effective decision-making in relation to air quality management.

V. Air pollution effects on materials

A. A broader study of air pollution effects at United Nations Educational, Scientific and Cultural Organization cultural heritage sites

14. In 2015, the International Cooperative Programme (ICP) on Effects of Air Pollution on Materials, including Historic and Cultural Monuments (ICP Materials) finalized the

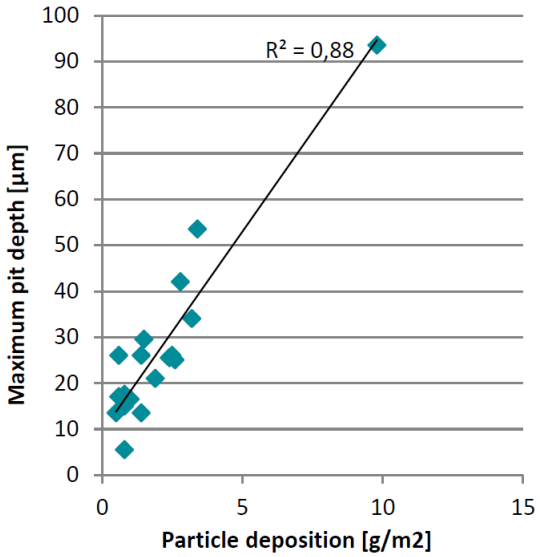
"Pilot study on inventory and conditions of stock of materials at risk at five United Nations Educational, Scientific and Cultural Organization (UNESCO) cultural heritage sites". Located in the heart of European capitals, the UNESCO sites studied are impacted by air pollution, mainly due to nitric acid (HNO_3) and particulate matter with a diameter of 10 micrometres or less (PM_{10}), two pollutants that currently seem to play a prominent role in determining damage to limestone. The improvement of air quality between 2000 and 2010, mainly attributable to a significant reduction of air concentration of sulphur dioxide (SO_2), produced a small decrease in the recession rate for limestone. Corrosion due to air pollution would result in material deterioration costs ranging from €9.2 per square metre per year (m^{-2} $year^{-1}$) to €43.8 m^{-2} $year^{-1}$, depending on the status of the material, the pollution level and the climatic conditions. These costs add to the cost in background areas, estimated from €14 m^{-2} $year^{-1}$ to €28 m^{-2} $year^{-1}$. In developing future air pollution abatement strategies it will be important to consider the reduction of atmospheric nitrogen dioxide (NO_2) and PM_{10} concentrations to protect historical and cultural monuments.

15. Based on the pilot study, ICP Materials has launched a call for data on "Inventory and condition of stock of materials at UNESCO cultural World heritage sites" and six Parties to the Convention have already announced their intention to participate in the call: Croatia, Germany, Italy, Norway, Sweden and Switzerland. Of these, Croatia has previously not participated in the activities of ICP Materials and its contribution is therefore especially welcomed.

B. Trends in corrosion and soiling of materials

16. The 2014–2015 exposure for trend analysis has been successfully completed and a detailed analysis of trend results for the period 1987–2015 are expected in 2017. New scientific findings have already been obtained, especially regarding the corrosion of aluminium where one result is the correlation between particulate deposition and the maximum pit depth.

Figure 1
Maximum pit depth on aluminium after four years of exposure versus particle deposition



VI. Ozone effects on vegetation

17. The first global stomatal flux-based assessment of ozone impacts on wheat yield revealed a global yield loss due to ozone of 9.4 per cent, which equates to an annual economic loss of $24.3 billion globally. Economic losses are highest in Central Europe, the eastern United States, western China and northern India, all important wheat-growing areas.

18 In many parts of Central and Southern Europe, Natura 2000 grassland habitats are at risk from impacts of ozone pollution. The risk is highest in regions with high ozone fluxes (phytotoxic ozone dose) and relatively large grassland habitat area.

VII. Ecosystem damages and their costs

19. Through the European Union-supported Effects of Climate Change on Air Pollution and Response Strategies for European Ecosystems (ÉCLAIRE) project, crop losses and reduced forest growth due to ozone exposure have been investigated. Currently ozone reduces crop and timber production as well as carbon sequestration by 15 per cent in the European Union. Climate warming is expected to increase the emissions of many trace gases, such as biogenic volatile organic compounds (BVOCs), ammonia (NH_3) and the soil component of NO_x emissions. These effects are expected to increase ground-level concentrations of NH_3, NO_x and ozone (O_3), as well as atmospheric nitrogen deposition. Climate warming may increase the vulnerability of ecosystems to air pollution and atmospheric deposition.

20. Recent experiments and analytical work in the ÉCLAIRE project have further established evidence of the benefits of reducing nitrogen emissions in Europe. While nitrogen (N) deposition enhances net primary production in the short term in N-limited areas, excess nitrogen may have negative effects on biomass growth in the long run. To adapt to climate change, additional nitrogen emission reduction is needed.

21. Moreover, excess nitrogen is the dominant cause of biodiversity loss in several ecosystems of Europe. Reducing nitrogen deposition will contribute to the achievement of biodiversity policy targets.

22. Several methodologies were applied to value biodiversity losses due to excess nitrogen, i.e., in terms of: (a) the willingness to pay for biodiversity protection; (b) the restoration costs to maintain favourable conditions for species in nature areas; and (c) the emission mitigation costs to comply with the European Union Nature Directives[11] or the United Nation Convention on Biological Diversity. The third method is called the "regulatory revealed preference approach", which assumes that in establishing the Natura 2000 network policymakers revealed their preparedness to reduce nitrogen emissions to ensure that critical loads would be met in Natura 2000 areas.

23. The "willingness to pay approach" and the "restoration cost approach" show that the monetary benefits of moving from the current legislation scenario in 2030 (CLE-2030) to a maximum feasible reduction scenario (MFR) would be €1–€3 billion. Following the regulatory revealed preference method this value would be €10 billion. The Greenhouse Gas and Air Pollution Interactions and Synergies (GAINS) model optimizations showed

[11] A group of several laws protecting nature and biodiversity. See http://ec.europa.eu/environment/nature/legislation/index_en.htm.

that an optimal strategy based on health impacts only would entail biodiversity co-benefits, but that the benefits of an additional biodiversity ambition would exceed the additional costs, even if the method with the lowest monetary value for biodiversity was used.

24. The results from the ÉCLAIRE project demonstrate that an integrated policy approach with regard to ozone, nitrogen and climate is necessary. Such an integration allows the selection of win-win scenarios and would give priority to more effective policy measures. It turns out that the most effective way forward is to reduce emissions of NH_3 in Europe to halt the loss of biodiversity and of methane (CH_4) at the hemispheric scale to reduce ozone damage.

25. The ÉCLAIRE project also included the development of science behind critical loads for biodiversity (CLbio). This work was performed in conjunction with Convention workplan requirements for the ICP on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends/Coordination Centre for Effects call for data 2015–2017. Under ÉCLAIRE a European CLbio database was compiled for 23 habitats, in about 1.3 million ecosystem data points, covering around 2.4 million km^2 including various classes following the European Nature Information System (EUNIS).

VIII. Heavy metals and persistent organic pollutants

26. Freshwater fish in lakes in boreal regions often contain levels of mercury above recommended limits for human consumption, and even further above environmental quality standards proposed by the European Union Water Framework Directive[12] to protect ecosystem health. Long-range atmospheric transport of mercury is the primary source of mercury contamination in these fish. Recently, indications of increases of mercury in fish have been observed. An analysis of temporal and spatial patterns of mercury in freshwater fish from boreal regions is needed to contribute to understanding of factors leading to high mercury levels in fish, and thus far such an analysis is lacking. The ICP on Assessment and Monitoring of the Effects of Air Pollution on Rivers and Lakes (ICP Waters) will, in collaboration with the ICP on Integrated Monitoring of Air Pollution Effects on Ecosystems (ICP Integrated Monitoring) and other experts, collate relevant data from countries in circumpolar regions with the aim to study spatial and temporal patterns of mercury in freshwater fish, which will be presented in the spring of 2017.

27. Recent developments of the EMEP Multi-media Modelling System (GLEMOS) by the Meteorological Synthesizing Centre-East (MSC-E) make it possible to consider heavy metals and POPs issues on regional and global scales. Particular attention was paid to cooperative work on a country-scale assessment of heavy metal pollution, with a case study for Belarus and scientific cooperation with other international bodies, including the Stockholm Convention on Persistent Organic Pollutants and the Minamata Convention on Mercury, both serviced by the United Nations Environment Programme. The need to collect additional POPs and heavy metal regional and global emissions and measurement data from different national and international programmes under EMEP was also a priority, as was the need to structure outreach activities on this topic.

[12] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.

IX. Collaboration with countries of Eastern Europe, the Caucasus and Central Asia

28. Transfer of the moss survey coordination from the United Kingdom of Great Britain and Northern Ireland to the Russian Federation has enhanced participation of countries of Eastern Europe, the Caucasus and Central Asia and several other Asian countries in the 2015/16 survey to monitor heavy metal and nitrogen deposition to vegetation using mosses.

X. Emissions

A. Improvements of national emission inventories

29. The gridding system for 0.1° x 0.1° (longitude-latitude) for the new EMEP area is in place. The distribution of emissions is harmonized with the Emission Database for Global Atmospheric Research (EDGAR) inventory from the European Commission Joint Research Centre. Next steps should be the improvement of spatial distribution and update of expert estimates, particularly for the EMEP East area. Redistribution of historical years in the new 0.1° x 0.1° resolution (requested by modellers) would be very challenging. Before such activity can be planned, an assessment of the availability of digitized information for the considered years will be needed. In any case, promotion of the new set of gridded emissions for use in the chemistry transport models, and especially in the assessment activities performed by the modelling centres, should develop. Comparison of those official data with other emissions inventories built up in other scientific frameworks (Horizon 2020 of the European Union, the Copernicus Atmosphere Monitoring Service) will contribute to this objective.

30. It should be noted that the reporting of inventories to EMEP slightly improved, particularly among countries in Eastern Europe, the Caucasus and Central Asia. The capacity-building activities organized by the ECE secretariat seem to motivate countries to improve their data. Continuation of such activities would be welcomed.

31. A new sensitive topic requires joint activities from both emission and modelling communities. It relates to the treatment of condensable and semi-volatile organic compounds in emission inventories that could impact the amount of particulate matter emissions and ambient air concentrations. Recent scientific studies prove the major role of semi-volatile organic species in the formation of secondary aerosols. A joint workshop on this topic was therefore organized in Zagreb in May 2016, hosted by the Croatian Agency for the Environment and Nature.

32. The Task Force on Emission Inventories and Projections earlier identified as a high priority the need to undertake a comprehensive review of the particulate matter (PM) emission factors proposed in the EMEP/EEA [European Environment Agency] air pollutant emission inventory guidebook,[13] to understand whether they include the condensable fraction or not. Discussions during the Zagreb workshop confirmed that more information on whether reported PM emissions include condensables or not would help to build up

[13] The most recent edition is the *EMEP/EEA air pollutant emission inventory guidebook 2013*, EEA Technical report No. 12/2013 (Luxembourg, Publication Office of the European Union, 2013). Available from http://www.eea.europa.eu/publications/emep-eea-guidebook-2013.

more consistent data sets for the models. Participants highlighted the need to harmonize, in a longer-term perspective, more detailed metadata reported with PM emission inventories, to describe the chemical composition of PM emissions. The Task Force will investigate the feasibility of such an objective. At the same time a small group gathering experts from both the emission and modelling communities will work on the impact of using more detailed information on semi-volatile organic compounds emitted on simulations of air particulate matter concentrations. First results are expected by 2017.

B. Applications for adjustments to emission inventories

33. For the year 2016, two new applications (Luxembourg and Germany) for adjustments to emission inventories in the agriculture sector have been confirmed by the Centre on Emission Inventories and Projections, and a third application relates to significant recalculations by Germany in the transport sector. Furthermore, the reviewers are supposed to check also adjustments approved in the years 2014 and 2015. To make the procedure more efficient, the Centre developed an online database system[14] that allows online calculation of differences between emission data approved in 2014 and 2015, and the latest reporting in 2016. Moreover, countries are invited to declare in a one-page Word document that there are no significant changes in criteria/methods and respectively explain reasons if there are minor differences in calculated emissions. If all countries provide the requested information the review of adjustments approved in 2014 and 2015 should be significantly less resource demanding. This process has been piloted for the first time this year.

XI. Hemispheric transport of air pollution

34. The work of the Task Force on Hemispheric Transport of Air Pollution (TF HTAP) aims at developing international cooperation for global scale assessment of air pollution patterns. It established a set-up for a model intercomparison experiment which should provide outputs that will update the findings of the HTAP (2010) exercise, and also allow new analysis of impacts (e.g., ozone fluxes, higher resolution results). Currently, approximately 20 global and 15 regional models are running coordinated experiments evaluating the impacts on ozone and aerosol of emission reductions of air pollutants. It is expected that the results of this work will be published soon in scientific literature. A workshop organized in Potsdam, Germany, in February 2016 and hosted by the Institute for Advanced Sustainability Studies aimed at evaluating methodologies to better quantify impacts of air pollution on human health, ecosystems (including crops) and climate.

35. This workshop also provided the opportunity to explore possible linkages between TFHATP, EMEP and WGE activities and those carried out by AMAP under the Arctic Council. Among the topics for enhanced collaboration are evaluation of mitigation strategies for mercury, persistent organic pollutants, and short-lived climate pollutants (including black carbon and methane). There are relatively few dedicated scenario studies for Arctic development and impact studies, and TF HTAP and AMAP can work together to better understand the benefits of mitigation strategies in the Arctic and elsewhere.

[14] See webdab.umweltbundesamt.at/adjustments.

XII. Methodological developments for particulate matter assessment

36. An improved understanding of modelling of particulate matter has been achieved by the Meteorological Synthesizing Centre-West (MSC-W). There is a better understanding of the effect of the missing "condensables" in the modelling (see above), and the natural part of PM (especially dust) is better represented in the EMEP/MSC-W model. For the first time, reported elemental carbon (black carbon) emissions have been used in modelling and compared with measurements, with reasonable agreement. For ammonia, which is important for ammonium nitrate formation, several new parametrizations have been developed (including meteorology-dependent ammonia emissions and bidirectional exchange), although this is not yet implemented in the operational EMEP/MSC-W model.

37. Interactions between air quality and climate change have become better understood. The development in emissions will in general be more important than climate change itself for air quality in the coming decades, but it is still uncertain what climate change will do to climate-sensitive emissions such as biogenic volatile organic compounds and NH_3. The uncertainties in black carbon (elemental carbon) with respect to climate effects are still large.

XIII. Integrated assessment modelling

38. New GAINS model results were presented by the Centre on Integrated Assessment Modelling during the forty-fifth meeting of the Task Force on Integrated Assessment Modelling. The analysis of the European Union Ecodesign Directive, the Medium Combustion Plants Directive, and the revised Non-Road Mobile Machinery Directive showed that the three directives would achieve additional emission reductions in comparison to the current National Emission Ceilings Directive proposal. The turnover rate of the existing capital stock was a critical assumption in the calculations.

39. National analyses of the impact of additional climate and energy policies on air pollution show that in general these policies would offer more reduction of emissions of SO_2 and NO_x than included in the current national baseline scenarios in GAINS. In those cases where climate measures also included reductions of methane and nitrous oxide (N_2O) emissions from the agricultural sector, also ammonia emissions could become lower, because such policies would lead to a reduction in fertilizer use, cattle numbers and dietary change.

40. Source-apportionment calculations for particulate matter concentrations in cities in Asia showed that even in megacities like Delhi, up to 60 per cent of total concentration is caused by sources far outside of the cities.

XIV. Financing scientific activities under the Convention

41. Over the last years, many activities under EMEP and WGE have been put under financial pressure. It is directed both to national activities (monitoring, emission inventories, collection of critical loads data etc.) and to centres and task forces. The issue became acute when the Netherlands at the first joint session of EMEP Steering Body/WGE in September and further at the Executive Body in December 2015 announced a cease in the support to the Coordination Centre for Effects (CCE). In order to consider the financial

situation both with respect to the CCE but also in a wider perspective, the chairs of the Executive Body, EMEP and WGE invited representatives of the hosting countries to a meeting in Brussels 26 April 2016. All countries except two (which provided written statements) participated in the meeting.

42. The financial situation differs between EMEP and WGE. EMEP Centres receive a basis for their work through the trust fund under the 1984 Geneva Protocol on Long-term Financing of EMEP. In most cases additional support is however needed to fully finance the activities; hosting countries have a particular responsibility but from time to time other sources support project-oriented activities. For the International Cooperative Programmes under WGE, there is a voluntary trust fund through which many countries give their support.

43. All the hosting parties (except the Netherlands) expressed their interest to continue their support to the International Cooperative Programs, Task Forces or technical centres. However, some parties review their work programmes and/or mentioned potential difficulties to keep the effort at the same level.

44. For CCE the EMEP and WGE communities regretted the decision by the Dutch Government to cease the funding of the centre and expressed the crucial role the centre is playing for the development of policies for the Convention as well as for other bodies (in particular the European Union). In the short term (2016–2017) the Centre has launched a call for data for mapping risks for effects to biodiversity and it is of vital interest that the submitted data to the centre can be compiled processed and further integrated into the work under the Convention. CCE has presented a detailed budget for these activities and in addition to support given by the National Institute for Public Health and the Environment (RIVM), through the trust fund and by in kind contributions from other organizations, additional €154 000 are needed. The WGE Bureau together with others are working on raising the missing amount.