UNITED
NATIONS

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Economic and Social
Council

Distr.
GENERAL

EB.AIR/GE.1/2005/12
28 June 2005

ORIGINAL: ENGLISH

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 (EMEP)
(Twenty-ninth session, Geneva, 5-7 September 2005)
Item 4(h) of the provisional agenda

HEMISPHERIC TRANSPORT OF AIR POLLUTION

Progress report prepared by the Co-Chairs of the Task Force
on Hemispheric Transport of Air Pollution in collaboration with the secretariat

Introduction

1. This report presents progress in work on hemispheric transport of air pollution and, in particular, the results of the first meeting of the Task Force on Hemispheric Transport of Air Pollution, held in Brussels from 1 to 3 June 2005. The presentations made during the meeting and the reports presented can be accessed on the Internet at www.htap.org.

2. The meeting was attended by more than 60 experts including those from the following Parties: Austria, Belgium, Canada, Czech Republic, Denmark, European Community, France, Germany, Italy, Netherlands, Norway, Poland, Russian Federation, Spain, Sweden, United Kingdom and United States. In addition, following the request of the twenty-second session of the Executive Body and at the invitation of the Co-Chairs, the following countries not Party to the Convention attended: Cambodia, the People's Republic of China, Egypt and Japan.

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Representatives of the following EMEP centers attended: Meteorological Synthesizing Centre-East (MSC-East), Meteorological Synthesizing Centre-West (MSC-West), Chemical Coordinating Centre (CCC); Centre for Integrated Assessment Modelling (CIAM) at the International Institute for Applied Systems Analysis (IIASA). The World Meteorological Organization (WMO), the Arctic Monitoring and Assessment Programme (AMAP) and the United Nations Environment Programme Regional Resource Centre for Asia and the Pacific (UNEP RRC.AP) were represented. In addition, the network centre for the Acid Deposition Monitoring Network for East Asia (EANET), the Clean Air Initiative for Asian Cities (CAI-Asia), the International Union of Air Pollution Prevention and Environmental Protection Associations (IUAPPA), the Oil Companies' European Association for Environment, Health and Safety in Refining and Distribution (CONCAWE), the European Commission's Joint Research Centre (JRC), the Swedish NGO Secretariat on Acid Rain, the European Environment Agency (EEA-ETC/ACC), the Clean Air Task Force and the Union of the Electricity Industry (EURELECTRIC) were also represented. The Chairman of the EMEP Steering Body and a member of the secretariat were present.

3. Mr. A. Zuber (European Commission representing the European Community) and Mr. T. Keating (United States) chaired the meeting. They opened the meeting by welcoming participants, especially those who had travelled from outside the UNECE region.

4. Mr M. Williams (United Kingdom), Vice-Chair of the Executive Body, Mr K. Bull (secretariat) and Mr P. Grennfelt (Sweden), Vice-Chair of the Steering Body of EMEP, provided introductory information on the Convention and the Convention workplan, which invited the EMEP centres to contribute to the work of the Task Force. It was stressed that the Task Force had a wider scope than other task forces under the Convention, involving experts from areas beyond the UNECE region. Attention was drawn to the 2004 Gothenburg workshop that had identified the need for further work on hemispheric transport (EB.AIR/GE.1/2005/13).

I. PAST FINDINGS & FUTURE EXPECTATIONS

5. Mr. Keating noted the reference to hemispheric and intercontinental transport in the Gothenburg Protocol. He described findings of previous workshops on the subject of hemispheric and intercontinental transport of air pollution, in particular the workshop held in Bad Breisig, Germany in 2002 (EB.AIR/GE.1/2003/7). The Task Force would build on the progress made in the past. He hoped that the outputs from the Task Force would be of value both within and outside the Convention.

6. Mr. Zuber drew attention to the policy-relevant science questions drawn up by the Co-Chairs and circulated to the Task Force (annex) noting that they were policy relevant within the context of the Convention. The Task Force would need to address scientific and technical

issues related to processes and models, source-receptor relationships, effects of changing emissions, effects of global changes such as climate change, uncertainties and how to develop an integrated system of observations and models.

7. In the resulting discussion the Task Force noted the implications of the terms hemispheric transport and intercontinental transport and the different definitions of source-receptor relationships. It was noted that the Task Force started from a regional perspective looking out and that the hemispheric scale was a practical first step.

II. OVERVIEW OF THE STATE OF THE SCIENCE

8. The following presentations provided an overview of the state of the science: Mr A. Stohl (Norway) on intercontinental air pollution transport - mechanisms and observational evidence with a focus on trans-Atlantic transport; Mr. D. Jacob (United States) on modelling the transport of ozone and fine particulates to and from North America; Mr H. Akimoto (Japan) on observation and modelling evidence of ozone transport to and from Asia; Mr. J. Lelieveld (Germany) on long-range transboundary air pollution from a European perspective; Mr G. Carmichael (United States) on intercontinental transport of pollutants out and into Asia; Mr. Zhang Yuanhang (China) on ozone and fine particle pollution in China and regional air quality monitoring; Mr J. Munthe (Sweden) on global emissions, transport and effects of mercury; and Mr S. Dutchak (MSC-E) on hemispheric transport of persistent organic pollutants (POPs).

9. The Task Force took particular note of the importance of: emissions from ships, aircraft, wild fires, and lightning; understanding hemispheric background trends in ozone; the processes that bring pollution to the surface from the free troposphere, and the presence of organic aerosols in the free troposphere; additional observational data, especially in remote areas, to establish vertical profiles; reducing emissions uncertainties. The Task Force noted that intercontinental transport of air pollution does not occur in one direction only; each continent can influence pollution on the others, such as North Africa receiving pollution from Europe and southern Asia.

10. For mercury and POPs the Task force recognized the significant work already going on within EMEP.

11. The Task Force took note of all the information presented and agreed to take it into account in the preparation of its conclusions and proposals for further work.

III. COOPERATIVE ACTIVITIES OUTSIDE THE UNECE REGION

12. Mr. M. Iyngararasan (UNEP.RRCAP) described UNEP's work in Asia supporting the development of EANET, the Malé Declaration, the ASEAN legal framework and the

Atmospheric Brown Cloud (ABC) programme. Mr. P. Crutzen (Germany) provided additional information on ABC. Mr. H. Ueda (Japan), Director of the network centre of EANET, described further the EANET activities. Mr A. Elseoud (Egypt) outlined monitoring work in North Africa as well as the air quality problems and the impacts of transport in that region. Mr K. Puckett (Canada) described a proposal for a partnership programme on global fate and transport research under the global mercury programme of the United Nations Environment Programme (UNEP). Mr L. Barrie (WMO) provided information on the Global Atmosphere Watch (GAW) and the Integrated Global Atmospheric Chemistry Observations (IGACO) theme of the Integrated Global Observing Strategy. Ms. L. Remer (United States) described how satellite observations could be used to quantify long-range transport and forest fire emissions. Mr C. Huizenga (CAI-Asia) provided information on pollution in Asia and the work of CAI-Asia.

13. The Task Force took note of all the activities and the need to connect the work of the Task Force to these.

IV. DISCUSSIONS BY NATIONAL EXPERTS

14. The Co-Chairs invited national experts to provide additional information on their experience and perceived priorities. In the following discussion experts welcomed the activities of the Task Force to address issues they considered of importance to the work of the Convention. Some experts noted concern about ozone and airborne particulate matter (PM), while others stressed the importance of including ship and aircraft emissions in calculations. Experts drew attention to national work or participation in international projects that could provide input to the work of the Task Force. They noted the complexity of the issues and the need to think of a longer-term programme of work to achieve the required targets. Some experts expressed an interest in focusing on ozone and PM, others on keeping a broader perspective.

V. FUTURE WORK

15. The Task Force considered its future work through three panel discussions led by groups of experts.

Observations

16. Mr. K. Torseth (CCC) chaired panel presentations including those by Mr. Ueda, Mr R. Scheffe (United States), Mr L. Barrie and Ms. L. Remer.

17. The Task Force took note of the activities of CCC and other organizations such as WMO. It recognized the need for continued funding of long-term measurements at background sites. It noted that the ultimate goal should be an integrated (virtual) data centre containing an adequate

set of observations from satellites, aircraft, ground-based remote sensing and surface measurements, including PM (and its constituents) as well as ozone and its precursors, mercury and POPs, with known quality and representativity.

Emission inventories and projections

18. Mr M.Amann (CIAM) chaired panel presentations that included those of Mr Hao Jiming (China), Mr. J. Van-Aardenne (JRC), Ms C. Granier (France) and Ms K Rypdal (Norway), Co-Chair of the Task Force on Emission Inventories and Projections.

19. The Task Force noted the difficulty of securing resources for emission inventory development and the need for a forum for the exchange of information on a hemispheric scale. It noted the value of a common database for emissions and projections and the need to reconcile top-down and bottom-up inventories.

Regional and global modelling

20. Mr R. Derwent (United Kingdom), Co-Chair of the Task Force on Measurements and Modelling, chaired panel presentations that included those of Ms. L. Tarrason (MSC-W), Mr S. Dutchak (MSC-E), Mr D. Jacob (United States) and Mr. Zhang Yuanhang (China).

21. The Task Force took particular note of the role of models in assessing hemispheric transport. It recognized the need to assess sources of free tropospheric ozone and aerosols, to quantify uncertainties and biases and assess benefits of global emission reductions. It also recognized the use of tracers, such as halocarbons, for generating the climatology of intercontinental transport events and for validation of long-range transport models. The Task Force further recognized the need to validate global emission inventories using observations and models as well as to conduct intercomparisons of modelled source-receptor relationships.

VI. CONCLUSIONS AND RECOMMENDATIONS

22. The Task Force:

(a) Confirmed the general conclusions of the Bad Breisig workshop while recognizing that additional information from space observations and modelling on the magnitude and on the processes for hemispheric transport was now available;

(b) Agreed that the set of policy-relevant science questions (annex) would be useful for guiding the development of the Task Force workplan;

(c) Proposed to work towards an assessment of hemispheric transport of air pollutants over 2005-2009 through activities on (i) models, inventories and data intercomparison and evaluation; and (ii) model- and observation-based assessment. The proposed activities should connect to ongoing and future relevant activities both within the UNECE region and outside.

(d) Recognized the contribution that the currently planned work of the EMEP centres would make to the work of the Task Force;

(e) Welcomed the offer of CCC to compile meta-data for relevant observational databases;

(f) Welcomed the offer of MSC-E to inform the Task Force on the progress in mercury and POPs model intercomparisons on contributions to protocol reviews, assessment of intercontinental transport of mercury and some volatile POPs;

(g) Welcomed the work of MSC-W to develop a hemispheric model;

(h) Appreciated the contribution of the Chairs of the EMEP Task Forces to the first meeting and welcomed future collaboration with the other Task Forces;

(i) Proposed that a further workshop be held in late 2005 on the development of a model intercomparison and evaluation methodology;

(j) Agreed that its draft 2006 workplan be submitted to the Steering Body to EMEP (EB.AIR/GE.1/2005/10). The draft work plan includes a task force meeting and a workshop on emission scenarios, in spring 2006, and a workshop on the use of integrated observations to evaluate models and inventories, in autumn 2006;

(k) Agreed to seek a host country in Asia for one of the 2006 meetings.

Annex

Policy-relevant Science Questions

1. How does the intercontinental or hemispheric transport of air pollutants affect air pollution concentrations or deposition levels in the northern hemisphere for ozone and its precursors, fine particles and their precursors, compounds that contribute to acidification and eutrophication, mercury and persistent organic pollutants?

(a) What evidence do we have of transport pathways and mechanisms from intensive field studies, observations or model predictions?

(b) How do the transport pathways differ by pollutant, source region or by season?

(c) What processes need to be better understood to describe the relative significance of intercontinental transport?

(d) How do processes at the intercontinental or hemispheric scale affect processes at the local or global scales? (Synoptic scale meteorological events/cycles; Hadley circulation; etc.)

2. More specifically, for each region in the northern hemisphere can we define source-receptor relationships and the influence of intercontinental transport on the exceedance of established standards or policy objectives for the pollutants of interest?

(a) What observational evidence exists for attributing pollutant concentrations or deposition levels to source regions or countries?

(b) Using predictive chemical transport models, what are the possible methods for calculating source-receptor relationships? At what spatial resolution (geographic region, individual countries) can such methods be reasonably applied?

(c) How can models with different spatial resolutions be nested within one another to provide an appropriate level of spatial resolution for the entire hemisphere or globe?

(d) What improvements are needed to global and regional transport models to better simulate atmospheric processes to enhance source-receptor predictions?

3. How confident are we of our ability to predict these source-receptor relationships? What is our best estimate of the quantitative uncertainty in our calculations of current source contributions or our predictions of the impacts of future emissions changes?

(a) What metrics and techniques are most appropriate for evaluating global and regional model simulations with observations and for quantifying uncertainties?

(b) Do we have a sufficient database of observed concentrations and deposition levels to evaluate the predictions of current models? How can this observational database be improved for the purposes of evaluating models? Should we develop a set of standard observational platforms and measurements to enhance data consistency globally?

(c) Do we have sufficient observational databases to track long-term progress and change in transport and deposition patterns?

(d) Do we have sufficient data on emissions and on the trends in driving forces to make reasonable future projections? How can these data be improved?

(e) What physical or chemical processes must be better understood to improve confidence in our estimates of source-receptor relationships? What is the minimum level of certainty in our understanding of these processes that must be attained before reasonable/useful estimates can be made?

4. For each country in the northern hemisphere, how will changes in emissions in each of the other countries of the northern hemisphere change pollutant concentrations or deposition levels and the exceedance of established standards or policy objectives for the pollutants of interest?

(a) Is there a simple relationship between changes in emissions and changes in pollutant concentrations and deposition levels?

(b) How is the predicted relationship affected by the spatial resolution of the model?

5. How will these source-receptor relationships change with expected changes in emissions over the next 20 to 50 years?

(a) How might emission quantities and spatial distributions change over the next 20 to 50 years?

(b) How should future emission scenarios be constructed?

6. How will these source-receptor relationships be affected by changes in climate or climate variability?

(a) How will meteorological changes predicted by climate modelling studies affect major transport or chemical processes?

(b) Are there significant feedbacks between the transported air pollutants and regional climate and meteorology?

(c) Are there significant feedbacks between transported air pollution and potential changes in land use, vegetation, or ecosystems, especially with respect to natural emission sources?

(d) Are there predictive relationships between climate system indices that can be used to estimate the impact of changing climates on hemispheric transport of air pollutants?

7. What efforts need to be undertaken to develop an integrated system of observational data sources and predictive models that address the questions above and provide the best attributes of all components?