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Transboundary Air Pollution

### Working Group on Effects

#### Thirty-third session

Geneva, 17–19 September 2014

Item 7 of the provisional agenda

**Progress in activities in 2014 and further development  
of effects-oriented activities**

## Effects of Air Pollution on Health

### Report by the Joint<sup>1</sup> Task Force on the Health Aspects of Air Pollution on its seventeenth meeting

#### *Summary*

In the 2014–2015 workplan for the implementation of the Convention on Long-range Transboundary Air Pollution (ECE/EB.AIR/122/Add.2, items 1.1.0, 1.2.3 and 1.2.4), the Executive Body for the Convention called for the preparation of reports on the effects of long-range transboundary air pollution on human health. In particular, the Joint Task Force on the Health Effects of Air Pollution was requested to develop further the methodologies for assessment of the direct and indirect effects of long-range transboundary air pollution on human health and to collect and analyse the evidence on the health impacts of ozone and particulate matter, including black carbon, and to report on the subject.

The present report presents the results of the discussions on the health impacts of ambient air pollution as well as a summary of progress on the other workplan items discussed at the Task Force's seventeenth meeting (Bonn, Germany, 14 and 15 May 2014).

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<sup>1</sup> The Task Force is a joint body of the World Health Organization (WHO)/European Centre for Environment and Health (ECEH) and the Executive Body for the Convention on Long-range Transboundary Air Pollution.



## **I. Introduction**

1. The present report on the seventeenth meeting of the Joint Task Force on the Health Aspects of Air Pollution (Task Force on Health) of the World Health Organization (WHO)/European Centre for Environment and Health (ECEH) and the United Nations Economic Commission for Europe (ECE) Executive Body for the Convention on Long-range Transboundary Air Pollution (CLRTAP) presents the results of the discussion on the health impacts of ambient air pollution. It also provides a summary of progress on other workplan items discussed at the meeting, i.e., items 1.1.10, 1.2.3 and 1.2.4 of the 2014–2015 workplan for the implementation of the Convention (ECE/EB.AIR/122/Add.2) adopted by the Executive Body for the Convention at its thirty-second session in December 2013.

2. The seventeenth meeting of the Task Force was held in Bonn, Germany, on 14 and 15 May 2014. Altogether, 50 experts from 34 Parties to the Convention attended the meeting, as well as a representative of the Convention secretariat. The European Union (EU), a Party to the Convention, was represented by the European Commission (EC). The meeting was co-chaired by Ms. M. E. Héroux (WHO/ECEH) and Mr. M. Kochubovski (the former Yugoslav Republic of Macedonia). Mr. S. Vardoulakis (United Kingdom of Great Britain and Northern Ireland) acted as a rapporteur. A representative of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) Centre for Integrated Assessment Modelling and the Chair of the former CLRTAP Network of Experts on Benefits and Economic Instruments were also present. Seven observers, including from the European Environment Agency and the European Topic Centre on Air Pollution and Climate Change Mitigation, and staff of WHO also attended the meeting. Financial support for the meeting was provided by the Swiss and German Governments.

3. A representative of the Convention secretariat presented an update on CLRTAP activities, focusing on: (a) the amendments to the three most recent protocols to the Convention (the Protocol to Abate Acidification, Eutrophication and Ground-Level Ozone (Gothenburg Protocol); the Protocol on Heavy Metals; and the Protocol on Persistent Organic Pollutants); (b) capacity-building activities in countries of Eastern Europe, the Caucasus and Central Asia; (c) the 2014–2015 workplan for the implementation of the Convention; and (d) recent meetings of the bureaux of the EMEP Steering Body, the Working Group on Effects and the Executive Body. He stressed that the health effects of air pollutants had been the driving force behind the Convention since the adoption of the Gothenburg Protocol in 1999.

## **II. Health impacts of particulate matter and ozone**

### **A. World Health Organization public health recommendations for air quality**

4. The Task Force on Health was informed of recent WHO estimates released in March 2014<sup>2</sup> that showed that exposure to ambient and household air pollution accounted for 7 million deaths worldwide in 2012, including almost 600,000 in the WHO European

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<sup>2</sup> See [http://www.who.int/phe/health\\_topics/outdoorair/databases/en/](http://www.who.int/phe/health_topics/outdoorair/databases/en/).

Region. Specifically, 482,000 deaths were attributable to ambient air pollution and 117,200 deaths to household air pollution in the WHO European Region. Those deaths were due to ischemic heart disease, chronic obstructive pulmonary disease, lung cancer and acute lower respiratory infections. Exposure to air pollution was a more important risk factor for major non-communicable diseases (such as cardiovascular diseases) than had been previously thought.

5. In addition, WHO had recently launched an update of its database on air pollution in cities. It currently included ground-level measurements of annual average particulate matter from approximately 1,600 cities worldwide. Fine particulate matter (PM<sub>2.5</sub>) measurements were available from slightly more than 50 per cent of cities, mostly in North America and Europe, with measurements of particulate matter with a size less than or equal to 10 microns in diameter (PM<sub>10</sub>) in the remainder. The database included ground-level monitoring from the small number of monitoring stations in countries of Eastern Europe, the Caucasus and Central Asia, for which data were very limited. The great majority of cities worldwide (88 per cent), including in Europe, exceeded WHO air quality guidelines levels.<sup>3</sup>

6. The Task Force was also updated on the recent results on carcinogenicity of air pollution from the International Research Agency on Cancer (IARC), a WHO specialized agency. IARC announced in October 2013 that it had classified the air pollution mixture, as well as particulate matter, as carcinogenic to humans (Group 1). That came after careful review by a group of experts of the evidence of cancer in humans and animals, as well as underlying biological mechanisms. Classifying air pollution as a carcinogen was an important step forward. The IARC evaluation of air pollution was a call to take action, as effective measures for reducing air pollution were available; but most required a collective response.<sup>4</sup> Estimates from the Global Burden of Disease Study 2010<sup>5</sup> indicated that in 2010 223,000 lung cancer deaths worldwide (15 per cent of all lung cancers) had been related to air pollution.<sup>6</sup>

7. The Task Force discussed a new set of indoor air quality guidelines for household fuel combustion, which would be launched by WHO later in 2014. Those guidelines provided guidance on policies and the impact of different fuels and technologies (for cooking, heating and lighting) on health. The guidelines included recommendations for emission rate targets in order to meet the WHO air quality guidelines for carbon monoxide and PM<sub>2.5</sub>. In addition, they included recommendations for household energy transition from traditional and low emission biomass to clean fuel use. The guidelines recommended that unprocessed coal should not be used as a household fuel, and that household combustion of kerosene should be discouraged while further research into its health impacts was conducted. Further work would take place in relation to the implementation of the guidelines, including field research on health impacts and assessment of the effectiveness of various interventions (technologies, fuel switch, behaviours), with proper monitoring and evaluation.<sup>7</sup>

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<sup>3</sup> See [http://www.who.int/phe/health\\_topics/outdoorair/databases/cities/en/](http://www.who.int/phe/health_topics/outdoorair/databases/cities/en/).

<sup>4</sup> See Dana Loomis and others, "The carcinogenicity of outdoor air pollution", *The Lancet Oncology*, vol. 14, No. 13 (December 2013), pp. 1262–1263. Available from [http://dx.doi.org/10.1016/S1470-2045\(13\)70487-X](http://dx.doi.org/10.1016/S1470-2045(13)70487-X).

<sup>5</sup> In particular, see S. S. Lim and others, "A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010", *The Lancet*, vol. 380 (December 2012), pp. 2224–2260.

<sup>6</sup> See [http://www.iarc.fr/en/media-centre/iarcnews/pdf/pr221\\_E.pdf](http://www.iarc.fr/en/media-centre/iarcnews/pdf/pr221_E.pdf).

<sup>7</sup> *WHO guidelines for indoor air quality: household fuel combustion* (in press).

8. The considerable evidence, summarized in the 2005 update to the WHO air quality guidelines, linking exposure to ambient air pollutants such as particulate matter and ozone with adverse health effects, had evolved further in recent years. Several important key evaluations had recently been conducted, prompting the need for WHO to systematically review and assess the quality of the evidence on the health effects of ambient air pollution, for the purpose of developing up-to-date public health recommendations in the form of guidelines. The Task Force discussed the role of the WHO air quality guidelines and the need for their revision. The WHO guidelines were viewed as a very important driver and tool for awareness-raising, as they were based on the strength of the health evidence and not on other considerations. While an update of the limit values contained in the guidelines was warranted, the Task Force considered that the guidelines should also focus on providing recommendations on reducing exposure and on the benefit for health of improving air quality.

## **B. Progress in research on health effects**

9. The most recent estimates of the burden of disease attributable to ambient air pollution and other major risk factors from the Global Burden of Disease study group<sup>8</sup> were presented to the Task Force. Ambient air pollution now ranked among the top 10 risk factors for mortality and lost years of healthy life globally and in Europe in 2010.<sup>9</sup> The combined public health impact of air pollution, both ambient and household, was substantial, and developing countries in Asia experienced some of the highest levels of exposure and the largest burdens of disease from both risk factors in the world. With development increasing the size of the susceptible, potentially exposed population, the burden was likely to increase even if air concentrations decreased. Given the widespread exposures, interventions could be very (cost-) effective. The non-linearity in the exposure-response functions and their relative flatness at high levels of air pollution, as assessed by PM<sub>2.5</sub>, implied that achieving large benefits from air pollution reduction in the most polluted settings required large improvements in air quality.

10. The results from the research project “Air Pollution — Climate Change Health Impact Assessment” were presented to the Task Force. The project had as its overall objective to apply state-of-the-art climate, air quality and health modelling tools to assess the future health impacts of ozone and PM<sub>2.5</sub> under different climate change scenarios, focusing specifically on pollution-related health co-benefits that could be achieved under alternative climate mitigation pathways in the period 2030–2050. That question was examined at three spatial scales (and domains): coarse (global); medium (Europe); and fine (Île-de-France). Each of those scales of analysis provided data that was useful in different policymaking contexts, from global to regional to local.

## **C. Communication of scientific evidence**

11. The expert opinion of the French High Council for Public Health concerning public health messages to be broadcast during episodes of air pollution was presented to the Task Force.<sup>10</sup> Simplified public health messages, irrespective of the air pollutants measured, had

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<sup>8</sup> See <http://www.healthdata.org/gbd>.

<sup>9</sup> See S. S. Lim and others, “A comparative risk assessment”.

<sup>10</sup> See [http://www.sante.gouv.fr/IMG/pdf/Expert\\_opinion\\_for\\_public\\_health\\_messages\\_for\\_pollution\\_episodes\\_15th\\_november\\_13.pdf](http://www.sante.gouv.fr/IMG/pdf/Expert_opinion_for_public_health_messages_for_pollution_episodes_15th_november_13.pdf).

been proposed. The Council recommended categorizing the targeted population, disseminating the information throughout the year and making the connection between long-term exposure to air pollution and peak episodes. The development and assessment of the effectiveness of communication campaigns should be ensured. The important air pollution episode of March 2014 in France was discussed, as it was exceptional in terms of size, air pollution levels and duration. That episode related mainly to increased PM<sub>2.5</sub> levels, with an important contribution of emissions from international sources. Different measures were implemented during the episode, such as alternate traffic circulation and free public transports in Paris. There had been strong media coverage of the episode, and a high demand for information, particularly for health recommendations for vulnerable persons. Further work was ongoing to develop additional health messages for specific situations and various audiences.

12. A paper, “Residential Heating with Wood and Coal: Health Impacts and Policy Options” was presented for discussion. That policy-relevant paper had been developed following the Task Force’s recommendation at its sixteenth meeting (Bonn, Germany, 11–12 June 2013). The paper highlighted the importance of residential biomass combustion for space heating as a major source of ambient PM<sub>2.5</sub> and black carbon across Europe (north and south) and in temperate forested countries on other continents. It emphasized that it would be difficult to tackle outdoor air pollution problems in many parts of the world without reducing emissions from household heating with wood and coal. To protect health, there was a need for policymakers to incentivize switching from solid fuel heating to gas- or electricity-based heating, or to greatly improve the efficiency of home wood combustion devices. Climate-oriented policies that advocated for wood combustion should promote only best available (lowest emission) technologies. Following the discussion at the Task Force meeting, the paper would be finalized and submitted to the Executive Body as an official document for its thirty-third session in December 2014. The paper would also be used to prepare a WHO publication on the topic.

13. The Task Force viewed the topic as particularly important and proposed to add an agenda item at the next Task Force meeting on communication and public health messages related to air pollution within States Parties to the Convention.

#### **D. Monitoring and modelling of air pollution and its health impacts in States Parties of the Convention**

14. The Task Force was updated on the status of monitoring and modelling of air pollution and its health impacts in the following countries: Albania, Georgia, Israel and the former Yugoslav Republic of Macedonia. Air quality issues in those countries were substantial and were due to a variety of sources, such as residential heating and desert dust episodes (particularly in Israel), as well as traffic and industry. In some countries, such as Israel, a dense ground monitoring network had been established, while in others monitoring was either limited or non-existent. Few studies had been conducted to investigate the health impacts of air pollution in those countries. The limited data showed particulate matter concentrations exceeding the WHO recommendations, and highlighted the need to improve monitoring in many countries to assess population exposure and assist local authorities in establishing plans for improving air quality. The contribution to population exposure of overall emissions from domestic heating, and specifically biomass burning, was often not properly quantified, and the Task Force proposed to discuss that issue at its next meeting.

15. The presentations revealed the need to increase general knowledge as well as expert capacity on population-based air quality monitoring, data analysis and health impact assessment in countries of Eastern Europe, the Caucasus and Central Asia. As such, a WHO representative provided an update on the training session on “Ambient air quality

monitoring and applied health risk assessment” as part of the “Multiple exposures and risks: evidence review, knowledge transfer and policy implication training workshop” held in Bonn, Germany from 16 to 18 October 2013. The training material had been translated into Russian and simultaneous interpretation had been provided. Twenty-eight national experts had participated in the session. As a result of the workshop, participants had identified the need for further training of public health staff on the new tools and methods for health risk assessment. A suggestion was made to organize similar training workshops at the subregional level.

### **III. Methodologies for and approaches to quantification of the burden of disease due to air pollution**

#### **A. Methods and tools for assessing the health risks of air pollution at the local, national and international levels**

16. The Task Force meeting also included a special session summarizing the discussions held at a WHO expert meeting on the methods and tools for assessing the health risks of air pollution at the local, national and international levels held in Bonn, Germany, on 12 and 13 May 2014. The expert meeting had been organized to discuss the evidence of air pollution health effects and to propose expert advice on the best options and methods to estimate the health risks from air pollution and its sources. The advice from the WHO workshop was expected to inform a variety of health risk assessment (HRA) efforts at different scales, including but not limited to those of the Task Force, the Task Force on Hemispheric Transport of Air Pollution and the United Nations Environment Programme Climate and Clean Air Coalition. It would also be used as the basis for the development of a WHO publication that would highlight general principles for the proper conduct of HRA for various scenarios and purposes. The target audience for the publication as the community of policymakers and the HRA practitioners at the local, national and international level, as well as end users from various sectors in international agencies, research and advocacy groups.

17. An increasing number of HRAs of air pollution were being developed for a variety of policy scenarios, using different methodologies and spatial and temporal scales. In many countries, HRAs were a formally required policy tool, accompanying all new programmes, projects, regulations and policies. In many other countries, an HRA conducted as part of assessment or research projects even though there was no legal requirement for its implementation. The results of HRAs helped to optimize the policies with respect to their health benefits and costs.

18. An HRA required information about air pollution concentration levels, the relationship between concentrations and health outcomes and the characteristics of the populations exposed, which generally included their baseline health status, age and location, in order to provide a quantification of the risk for a given scenario. There were now techniques available to combine ground monitoring results with modelling and satellite data and to improve the precision of estimates and the coverage of rural areas. However, ground monitoring data were still instrumental for validation and to assist local authorities in establishing plans for improving air quality.

19. A variety of models and software tools were available to perform HRAs. The range of key characteristics among the tools demonstrated that there was an important trade-off between technical refinement and accessibility for a broad range of applications. Quantitative HRA could now be performed at various scales and resolutions (local, national and international) for many air pollutants, including PM<sub>2.5</sub>, ground-level ozone, nitrogen

oxides and black carbon. Results of those assessments were often reported in numbers of attributable deaths and disease cases, years of life lost and disability-adjusted life years, or change in life expectancy attributable to total air pollution exposure or a change in air pollution exposure.

20. The health burden of air pollution was dominated by mortality impacts (quantified as natural or total, non-accidental mortality, cardiovascular mortality, respiratory mortality, and mortality from lung cancer). The evidence and methods for morbidity outcomes, such as hospital admissions (cardiovascular disease and/or respiratory), respiratory symptoms (bronchitis, asthma), and restricted activity days (also called work loss days) were less robust than for mortality. However, it was still important to consider morbidity outcomes in order to obtain more precise estimates of the true burden of air pollution.

## B. Update on the revision of the European Union air policy

21. The representative of the EU presented the main elements of the proposed new Clean Air Policy Package<sup>11</sup> for the EU. The package included policy objectives for 2020 and 2030. For 2020, the aim was to resolve non-compliance with current air quality objectives and for 2030, inter alia, to achieve a 52 per cent reduction of air pollution mortality compared with 2005. The programme would thus take decisive steps towards achieving long-term objectives for the protection of the environment and human health and the WHO guidelines. The package included EU action on pollution sources already regulated currently and, in addition, a proposal for a revised National Emission Ceilings Directive<sup>12</sup> and a proposal for a directive on controlling emissions from medium-sized combustion plants.

22. The methodology for cost-effectiveness analysis of the EU Clean Air Policy package, following the WHO “Health risks of air pollution in Europe” (HRAPIE) project recommendations,<sup>13</sup> was presented. Modelled trends in pollutant levels showed that under a business as usual scenario (baseline projection) the impacts of air pollution would continue to decrease by 2020, where they would amount to an estimated 340,000 premature deaths. The progress in further reducing the health impacts from air pollution was expected to be considerably slower beyond 2020. On average across Europe, baseline projection suggested a decline of the loss of statistical life expectancy attributable to the exposure to PM<sub>2.5</sub> from 8.3 months in 2005 to 5.3 months in 2025. Health impact information was most instrumental for reaching agreement on the ambition level of the proposal (i.e., the “70 per cent gap closure”).

23. The cost-benefit analysis as part of the EU Clean Air Policy Package, also using the recommendations from HRAPIE, was presented. The results showed that, while moving from the baseline to the selected policy scenario would cost €3.3 billion a year, the implementation of the selected policy scenario would generate a benefit to people’s health between 12 and 42 times larger. The range reflected different positions on mortality valuation. However, moving further from the policy scenario to the maximum technically feasible reduction scenario generated a net loss for all positions on mortality valuation

<sup>11</sup> See [http://ec.europa.eu/environment/air/clean\\_air\\_policy.htm](http://ec.europa.eu/environment/air/clean_air_policy.htm).

<sup>12</sup> Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants.

<sup>13</sup> World Health Organization Regional Office for Europe, *Recommendations for concentration–response functions for cost–benefit analysis of particulate matter, ozone and nitrogen dioxide* (Copenhagen, 2013), available from <http://www.euro.who.int/en/health-topics/environment-and-health/air-quality/publications>.

except the least conservative. Those results provided some justification for the selection of the policy scenario.

24. The role of WHO reviews of air pollution health aspects (i.e., the Review of evidence on health aspects of air pollution (REVIHAAP)<sup>14</sup> and HRAPIE projects) conducted from 2011 to 2013 was emphasized, as those reviews had been decisive in informing the policy choices as part of the revision of the EU air policy.

#### **IV. Cross-cutting issues**

25. The Task Force continued to encourage WHO and others to provide recent reports and scientific information in the Russian language. A summary of the results of the WHO REVIHAAP project had been translated into Russian and was available on WHO website.<sup>15</sup>

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<sup>14</sup> See [http://www.euro.who.int/\\_\\_data/assets/pdf\\_file/0004/193108/REVIHAAP-Final-technical-report-final-version.pdf?ua=1](http://www.euro.who.int/__data/assets/pdf_file/0004/193108/REVIHAAP-Final-technical-report-final-version.pdf?ua=1).

<sup>15</sup> See [http://www.euro.who.int/\\_\\_data/assets/pdf\\_file/0009/218574/REVIHAAP-Final-technical-report-Rus.pdf?ua=1](http://www.euro.who.int/__data/assets/pdf_file/0009/218574/REVIHAAP-Final-technical-report-Rus.pdf?ua=1).