Economic and Social Council

Distr.: General
15 July 2020

English only

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

Sixth joint session
Geneva, 14–18 September 2020
Item 3 of the provisional agenda
Progress in activities in 2020 and further development of effects-oriented activities

Effects of air pollution on health

Report of the Joint Task Force on the Health Aspects of Air Pollution on its twenty-third meeting

Summary

The present report is being submitted for the consideration 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 accordance with both the 2020–2021 workplan for the implementation of the Convention (ECE/EB.AIR/144/Add.2, items 1.1.1.7, 1.1.1.17–1.1.1.19 and 1.1.3.1–1.1.3.3) and the revised mandate for the Joint Task Force on the Health Aspects of Air Pollution (Executive Body decision 2019/21).[1]

The report presents the results of the discussions on the health impacts of ambient air pollution and other workplan items at the Task Force's twenty-third meeting (online, 12 and 13 May 2020).

[1] Available at www.unece.org/env/lrtap/executivebody/eb_decision.html.

I. Introduction

1. The present report summarizes the results and discussions on the health impacts of ambient air pollution presented at the twenty-third meeting of the Joint Task Force on the Health Aspects of Air Pollution (Task Force on Health) under the World Health Organization (WHO) European Centre for Environment and Health and the United Nations Economic Commission for Europe (ECE) Executive Body for the Convention on Long-Range Transboundary Air Pollution (online, 12 and 13 May 2020). The report also provides a summary of workplan items discussed at the meeting, in accordance with both the 2020–2021 workplan for the implementation of the Convention (ECE/EB.AIR/144/Add.2, items 1.1.1.7, 1.1.1.17–1.1.1.19 and 1.1.3.1–1.1.3.3) and the revised mandate for the Task Force on the Health (Executive Body decision 2019/21).[2]

2. The twenty-third meeting of the Task Force on Health was held online on 12 and 13 May 2020. Altogether, 36 representatives from 33 Parties to the Convention attended the meeting, in addition to two representatives of the Convention secretariat. The European Union – a Party to the Convention – was represented by the European Commission and the European Environment Agency. The meeting was chaired by Ms. Dorota Jarosińska (WHO European Centre for Environment and Health). Mr. Fahad Alfahad (WHO European Centre for Environment and Health) acted as rapporteur. Ten temporary advisers participated in the meeting from the following organizations: the International Institute for Applied Systems Analysis; Utrecht University (Netherlands); King’s College London (two experts) (United Kingdom of Great Britain and Northern Ireland); Imperial College London (United Kingdom of Great Britain and Northern Ireland); the Swedish Environmental Protection Agency (Sweden); Queensland University of Technology (Australia); the Paul Scherrer Institute (Switzerland); the Health and Environmental Alliance (Belgium); and the German Environment Agency (Germany). Fourteen observers participated in the meeting. The Governments of Germany and Switzerland both provided financial support for the Task Force on Health activities.

II. International policies and processes on air quality and health

A. Updates on partner organizations’ activities

3. A representative of the Convention secretariat provided an overview of the outcomes of the thirty-ninth session of the Executive Body of the Convention (Geneva, 9–13 December 2019). Highlights of the session included the launch of the review of the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol), as amended in 2012 (Executive Body decision 2019/4). The workplan of the review process would be adopted at the fortieth session of the Executive Body (Geneva, 17 and 18 December 2020). The review might potentially lead to the revision of the Gothenburg Protocol in the coming years. The Executive Body had adopted the 2020–2021 workplan for the implementation of the Convention (ECE/EB.AIR/144/Add.2) and revised mandates for scientific centres, task forces and international cooperative programmes under the Convention (Executive Body decisions 2019/6–2019/21). The newly established Centre for Dynamic Modelling and the Coordination Centre for Effects had been placed under the International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends (ICP Modelling and Mapping). The Executive Body had celebrated the fortieth anniversary of the Convention with a high-level session, at which the Declaration on Clean Air for 2020–2030 and beyond in the United Nations Economic Commission for Europe region on the occasion of the fortieth anniversary of the Convention on Long-range Transboundary Air Pollution (ECE/EB.AIR/2019/6) had been adopted, and had established a forum for international cooperation on air pollution (Executive Body decision 2019/5). The main objective of the forum was to share information and experiences on effective air pollution mitigation measures between the Parties and non-ECE partners and stakeholders. The representative of the secretariat provided an update on the fifth joint session of the Steering Body to the Cooperative Programme for Monitoring and Evaluation of the

[2] Available at www.unece.org/env/lrtap/executivebody/eb_decision.html.

Long-range Transmission of Air Pollutants in Europe (EMEP) and the Working Group on Effects (Geneva, 9–13 September 2019), highlighting the thematic sessions focused on nitrogen and black carbon (BC). The joint meeting of the Extended Bureaux of the EMEP Steering Body and the Working Group on Effects (online, 24–26 March 2020) focused on the update of the revised strategy for EMEP for 2010–2019[3] and the revised long-term strategy of the effects-oriented activities.[4] The meeting discussed the outcomes of the workshop on the inclusion of condensables in particulate matter (PM) emission inventories and modelling (online, 17–19 March 2020), and featured the launch of a new Working Group on Effects website.[5] Several workshops had been held focusing on the region of Eastern Europe, Caucasus and Central Asia, and covering topics related to national action plans and the development of national emission inventories. Forthcoming communications and outreach events included the first International Day of Clean Air for Blue Skies, scheduled for 7 September 2020.

4. A representative of the European Commission provided an update on recent activities, notably the Ambient Air Quality Directives fitness check[6] and the European Green Deal.[7] An overview of the European Union clean air policy framework was provided, which aimed to reduce the negative health impacts of air pollution by 50 per cent by 2030. The fitness check was an evidence-based retrospective review of the first ten years (2008–2018) of applying the Directives. The exercise was not intended to propose new legislation; however, it would help to inform future policy and action. The main conclusions confirmed that the Directives were broadly fit for purpose, especially regarding the legally binding limits, which were instrumental in reducing concentrations of ambient air pollutants. Potential areas for improvements included: using less ambiguous language in prescribing how to perform monitoring; and reducing delays between reporting exceedances and taking action. Overall, good progress had been made in reducing ambient air pollution concentrations across the European Union. However, some exceedances persisted, which were mainly related to PM_{10}, mainly in the Po Valley, Italy, and Central Europe, linked to heating and transport emissions; and nitrogen dioxide (NO_2) exceedances, mainly linked to traffic emissions. There were approximately 30 legal cases affecting 18 member States related to exceedances in PM_{10}, NO_2 and sulphur dioxide (SO_2) concentrations, and monitoring deficiencies. The fitness check recognized: the importance of a robust civil society, such as environmental non-governmental organizations; the potential for setting more ambitious limits, based on the currently available scientific evidence; and the scope for further harmonizing monitoring networks and air quality plans. It also provided lessons learned that would help to shape the upcoming plan for a zero pollution ambition for a toxic-free environment in 2021, as part of the European Green Deal. The aim of the Green Deal was to ensure that the European Union became climate-neutral by 2050, which had various co-benefits with the clean air policy. It would lead the European Commission to take several actions, including aligning more closely with World Health Organization (WHO) air quality guideline values, and revising several pieces of legislation on pollution source.

B. Updates on World Health Organization regional activities

5. Two representatives of WHO headquarters provided an overview of the activities related to air pollution. The WHO Thirteenth General Programme of Work 2019–2023 highlighted the continued commitment of WHO to scale up its work with different sectors −

[3] Available at http://www.unece.org/fileadmin/DAM/env/documents/2012/EB/Informal_document_no_20_Revised_Strategy_for_EMEP_for_2010-2019_clean_text.pdf.

[4] Available at www.unece.org/fileadmin/DAM/env/documents/2012/EB/Informal_document_no_18_Revised_Long-term_Strategy_of_the_effects-oriented_activities_clean_text.pdf.

[5] See www.unece-wge.org.

[6] European Commission, "Fitness Check of the Ambient Air Quality Directives: Directive 2004/107/EC relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air and Directive 2008/50/EC on ambient air quality and cleaner air for Europe", SWD (2019) 427 final.

[7] See https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en.

including transport, energy, housing, waste, labour and urban planning − at the national and local levels to monitor air quality, develop strategies for transitioning to healthier technologies and fuels and for ensuring that all populations breathed air that met WHO air quality guideline values, and that scientific evidence would be translated into effective policies. Following the first WHO Global Conference on Air Pollution and Health (Geneva, 30 October–1 November 2018), the BreatheLife Network had grown to 76 members committed to improve air quality and monitoring. Following the United Nations Climate Action Summit (New York, 23 September 2019), 50 countries had committed to achieving WHO air quality guideline values. Three main lines of work in the 2020–2021 biennium were global goods, country support plans and leadership. In an effort to strengthen regional capacities, WHO had organized a regional workshop on air pollution and health in Addis Ababa (25–27 February 2020), with the participation of 41 member States of the WHO African Region. In collaboration with other United Nations and international organizations, WHO co-led the Health and Energy Platform of Action, with the initial focus on clean cooking and electrification of health-care facilities. It supported the transition to clean energy and continued to develop its Clean Household Energy Solutions Toolkit, with plans to implement it in selected member States under the Health and Energy Platform of Action framework. A current priority area was the definition of policy options to tackle air pollution as a recognized risk factor for non-communicable diseases. A catalogue of policy interventions had been compiled of existing WHO and United Nations guidance. Related to capacity-building, WHO was developing health sector training material on air pollution and health, including: a mapping report of existing training opportunities for the health sector; and a toolkit for clinicians, which comprised, among other things, training slides and a training-of-the-trainers manual. Distance learning was being considered in collaboration with the WHO Academy. Upcoming activities included the update of the WHO Ambient Air Quality Database, the development of methods for modelling, and country consultation on the Database and modelling.

III. Country experiences and building capacities on air quality and health

6. A representative of the National Centre for Disease Control and Public Health of Georgia presented the experiences from the second subregional WHO training workshop on air quality and health – strengthening capacities in assessing health risks of air pollution (Tbilisi, 12–15 November 2019), organized by the WHO European Centre for Environment and Health in cooperation with the ECE Secretariat and the European Environment Agency. Organization of the workshop was part of the implementation of the 2018–2019 Task Force on Health workplan, related to capacity-building activities for the health impact assessment of air pollution. The training workshop had: targeted countries in the South Caucasus; included 15 participants from both the environment and health sectors from Armenia, Azerbaijan and Georgia; aimed to foster the evolution of knowledge about air pollution and health, and introduce the principles of assessing and quantifying the impacts of air pollution on population health; involved the extensive practical application of AirQ+ software; concluded with a discussion on policy and communication aspects; assessed the current gaps for participating countries; identified further actions needed; and involved lectures, small group discussions and hands-on exercises using AirQ+. Feedback had been positive overall, especially regarding the hands-on exercises. Some areas of improvement included: having more practical exercises; increasing the length of the training sessions; conducting preparatory work; and sending the materials in advance. An overview was provided of the status of burden of disease attributable to environmental factors in Georgia, as well as the policies and measures aimed at improving air quality. Further support was requested from WHO in conducting health impact assessments, as well as in developing a collaboration platform for South Caucasus member States on strengthening their health impact assessment capacities.

7. An expert from King’s College London (United Kingdom of Great Britain and Northern Ireland) gave a presentation on the health impacts of air pollution in the Western Balkans. An assessment had been initiated at the first subregional WHO training workshop on air quality and health– strengthening capacities in assessing health risks of air pollution

(Sarajevo, 12–16 November 2018) based on the air quality, population and health data provided by the workshop participants. Some of those data had been analysed by the workshop participants at the exercise sessions using AirQ+ software. The results of the assessment had first been presented in Sarajevo on World Environment Day (5 June 2019). Air quality data had been collected from 20 cities in Albania, Bosnia and Herzegovina, Montenegro, North Macedonia and Serbia. Most cities had shown exceedances of WHO guideline values for $PM_{2.5}$, NO_2 and ozone (O_3). Not all participating cities had been able to provide the relevant population and health data. The main results showed that, in most cities, more than 10 per cent of all-cause natural mortality in age groups over 30 years was attributable to air pollution exceeding WHO air quality guidelines level, reaching up to 18 per cent in some cities. In several cities, the corresponding all-cause natural mortality rate attributable to air pollution exceeded 200 deaths per 100,000 population. More than one year of life was lost due to exposure to air pollution in persons aged over 30 years. The most prominent causes of deaths associated with air pollution were chronic obstructive pulmonary disease and lung cancer, followed by stroke and ischemic heart disease. Analysis performed by WHO showed that a significant number of deaths was attributable to $PM_{2.5}$ exposures below WHO air quality guidelines, therefore, the estimates provided by the assessment potentially underestimated the health impacts due to air pollution in the Western Balkan cities.

IV. Tools on air quality and health

8. A representative of the WHO European Centre for Environment and Health provided an update on developments related to AirQ+ software. AirQ+ version 1.0 had been available online since 2016, and regular funding from the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety had allowed for its continuous long-term development. The software used Java programming language, allowing for a user-friendly graphical user interface. AirQ+ also allowed users to estimate the health impacts given different future scenarios for air pollution levels. The software was flexible in allowing the use of custom values, such as using different risk ratios from those from the *Health risks of air pollution in Europe–HRAPIE project: Recommendations for concentration-response functions for cost-benefit analysis of particulate matter, ozone and nitrogen dioxide*.[8] A voluntary online user survey had collected over 300 responses from 94 countries and over 200 cities. It showed an increase in users from State and regional authorities, which could be attributed to the capacity-building activities delivered by WHO in member States. There was growing interest from the agriculture and industry sectors. Analysis at the local or city level continued to dominate usage, however, there was strong interest at the national level. $PM_{2.5}$ was the most frequently analysed pollutant, which reflected the status of $PM_{2.5}$ as the most relevant indicator for health effects. The current AirQ+ version 2, released in December 2019, had new functionalities including the possibility for data entry from multiple populations, whereas version 2.1 – to be launched later in 2020 – would include a German-language version and five manuals. Future activities included: the preparation of a Spanish-language translation, the introduction of an economic module; and ensuring harmonization with other WHO tools. A journal article had been published critically assessing the features and capabilities of AirQ+ and the United States Environmental Protection Agency Environmental Benefits Mapping and Analysis Programme – Community Edition.[9]

9. An expert from the German Environment Agency/WHO Collaborating Centre for Air Quality Management and Air Pollution Control provided an update on the latest developments regarding the German-language version of AirQ+ software. German would be the fourth language in AirQ+ following the English-, French- and Russian-language versions, covering the four official languages of the WHO Regional Office for Europe. A beta-version of the German-language AirQ+ had been shared with the German Environment Agency,

[8] World Health Organization (WHO) Regional Office for Europe (Copenhagen, 2013).

[9] Jason D Sacks and others, “Quantifying the Public Health Benefits of Reducing Air Pollution: Critically Assessing the Features and Capabilities of WHO’s AirQ+ and U.S. EPA’s Environmental Benefits Mapping and Analysis Program–Community Edition (BenMAP–CE)”, *Atmosphere*, vol.11, No. 5 (May 2020).

which was conducting the final language check of both the software and corresponding manuals. Although certified translators had been commissioned by WHO to provide the translations, the involvement of technical experts was useful to ensure that the terms used were comprehensible and best reflected the English-language equivalent. The check was expected to be finalized later in the year in preparation for the launch of the German-language AirQ+ version 2.0.

V. Progress in research on health impacts of air pollution

10. An expert from Utrecht University (Netherlands) presented the results of a recent study on the effects of low-level air pollution in Europe. The study had been sponsored by the Health Effects Institute, and covered Canada, Europe and the United States of America. For Europe, both pooled cohorts and administrative cohorts had been used covering a population size of over 28 million subjects, and a common codebook had been used to harmonize the variables between cohorts. The objective of the study had been to investigate associations between long-term exposure to $PM_{2.5}$, NO_2, O_3 and BC in relation to natural and cause-specific mortality and the incidence of lung cancer and cardiovascular events. For exposure assessment, a Europe-wide hybrid land use regression model had been used, in addition to satellite observations and dispersion model estimates. Preliminary results for pooled cohorts showed all cohorts with $PM_{2.5}$ concentrations below the European Union limit values, whereas only one was within WHO air quality guideline values. For NO_2, some cohorts exceeded both the WHO and the European Union limit values. The Cox Proportional Hazard Models for all-cause and cardiovascular disease mortality showed a significant positive association for $PM_{2.5}$, NO_2 and BC, whereas O_3 showed a protective association that had not yet been explained. Natural cubic spline concentration response functions showed an increase in all-cause mortality even below concentrations of 10 micrograms per cubic meter ($\mu g/m^3$) and 20 $\mu g/m^3$ for $PM_{2.5}$ and NO_2, respectively. Sensitivity analysis was conducted adjusting for the combined effects of pollutants, with the exception of NO_2 and BC where there was high correlation. Results showed a positive association for coronary events and lung cancer with NO_2 and $PM_{2.5}$, respectively, whereas stroke had a positive association with $PM_{2.5,}$ NO_2 and O_3. Administrative cohorts results also showed a positive association between long-term exposure to $PM_{2.5}$, NO_2, and BC and all-cause mortality and cause-specific mortality, including lung cancer, cardiovascular and respiratory disease mortality. Study limitation included the relatively low number of subjects in areas with $PM_{2.5}$ concentrations below 10$\mu g/m^3$, and the lack of lifestyle data in large administrative cohorts.

11. A representative of the WHO European Centre for Environment and Health provided a brief overview of the process and progress of the update of the WHO global air quality guidelines. The process had been initiated in 2016 as a response to several factors including: a greater recognition of air pollution as a global health issue; the accumulation of new scientific evidence on the health effects of low levels of air pollution; and World Health Assembly resolution 68/8 on health and the environment: addressing the health impact of air pollution on air quality and health,[10] adopted on 26 May 2015. Objectives of the update included developing numerical guideline exposure levels for $PM_{2.5}$, PM_{10}, NO_2, O_3, SO_2 and carbon monoxide (CO), indicating the shape of the concentration–response function where possible. Additionally, qualitative good practice statements were being developed on BC, ultrafine particles and dust and sandstorms. Interim targets would be retained as a policy tool to support the tracking and implementation of the guideline exposure levels. They were offered as incremental steps in progressive reduction of air pollution, intended for use in areas where air pollution was high. To inform the update of the guideline exposure levels and interim targets, six commissioned systematic reviews were undergoing peer review for publication in a special issue of *Environment International*. In the past year, the Guideline Development Group had held its third (Bonn, 4–6 June 2019) and fourth meeting (Bonn, 4–6 February 2020), respectively. Discussions had been focused on preliminary findings of the systematic reviews, the approaches to updating guideline exposure levels and interim targets, and the draft good practice statements. A meeting of a small working group on

[10] See https://apps.who.int/gb/ebwha/pdf_files/WHA68/A68_R8-en.pdf.

deriving guideline exposure levels and interim targets had been scheduled for May 2020, in preparation for the fifth Guideline Development Group meeting in June 2020, when a decision would be expected on the guideline recommendations. Future steps would also include receiving feedback from the External Review Group and a series of internal WHO approvals prior to the publication of the updated guidelines.

12. An expert from King's College London (United Kingdom of Great Britain and Northern Ireland), presented, on behalf of WHO headquarters, the recent work on a new project related to the estimation of morbidity from air pollution and its economic costs. Currently, evaluations of health-related economic costs of air pollution were mostly based on mortality, using indicators such as the value of statistical life or the value of life year lost. However, direct costs of illnesses, for example, hospitalization, direct non-health-care costs, for example, childcare, and indirect costs such as productivity losses – were likely to be more persuasive in the communication of economic costs of air pollution health effects. Non-fatal impacts, however, were more difficult to register in administrative systems, and hence were used less than mortality in epidemiological research. The project aimed to establish a methodology to estimate economic costs of selected morbidity outcomes of exposure to air pollution in a population, and test its application at various geographical scales: national; regional; and global. That would be done through reviewing the literature to derive morbidity-related concentration response functions, identifying morbidity data, developing methods for quantifying economic costs, and conducting an assessment of the associated costs. Due to data availability, the project would focus on health and economic effects associated with exposure to $PM_{2.5}$, initially in Europe. A pilot project would be carried out in selected member States, depending on data availability. The results of the project would feed into further development of the WHO AirQ+ tool, and would also be implemented in the Greenhouse Gas and Air Pollution Interactions and Synergies model. The outcomes of the projects would also support the work of the Climate and Clean Air Coalition through the enhancement of the quantification of the health and economic benefits of mitigating short-lived climatic pollutants, especially BC, by including morbidity impacts. The duration of the project was one year, expected to end in June 2021.

13. An expert from Imperial College London (United Kingdom of Great Britain and Northern Ireland) gave a presentation on the need to quantify the health impacts of air pollutants. The publication *Health risks of air pollution in Europe–HRAPIE project: Recommendations for concentration-response functions for cost-benefit analysis of particulate matter, ozone and nitrogen dioxide*[11] provided recommendations for concentrations-response functions for cost-benefit analysis of PM, O_3 and NO_2. The purpose of the review was to investigate whether there was sufficient evidence to update those recommendations, prior to conducting a full review. A brief review had been conducted that had found growing evidence from epidemiological research suggesting additional information on health endpoints already provided by *Health risks of air pollution in Europe–HRAPIE project*. Additionally, new evidence had been found for several endpoints, including on stroke, myocardial infarction, diabetes and low birth weight. Cost-benefit analysis had been used to inform policy development since the 1990s and the update on *Health risks of air pollution in Europe–HRAPIE project* could serve to shape the analysis for the second edition of the European Union *Clean Air Outlook*, and the review of the Gothenburg Protocol. Preliminary observations, related to mortality, showed higher relative risks associated with $PM_{2.5}$ than those in *Health risks of air pollution in Europe–HRAPIE project*, whereas for NO_2 a lower relative risk was suggested by the Committee on the Medical Effects of Air Pollutants (United Kingdom of Great Britain and Northern Ireland). It was observed that most European economic assessments did retain *Health risks of air pollution in Europe–HRAPIE project* as the main source, yet with a growing tendency to include additional health endpoints. Ones that did impact the economic outcomes, included diabetes, stroke and dementia. There was little evidence that the use of *Health risks of air pollution in Europe–HRAPIE project* would lead to overestimation of the health effects, whereas, underestimation seemed more likely. A request was made to the Task Force on Health members to provide feedback on several questions to better inform the direction of the study.

[11] WHO Regional Office for Europe (Copenhagen, 2013).

14. An expert from the International Institute for Applied Systems Analysis gave a presentation on the key findings of a recent study[12] on developing an outlook for global air quality to 2040. Despite the record levels of air pollution in some developing countries, policy interventions decoupled energy-related air pollution from economic development, with gross domestic product growing faster than air pollution. Decomposition analysis was applied to three policy intervention scenarios; first, without any air pollution policies as a hypothetical benchmark; second, with policies introduced as of 2018; and third, with an ambitious yet technically feasible clean air scenario with cross-cutting air pollution, energy and climate change, agricultural and food policies. The dispersion calculations used the Greenhouse Gas and Air Pollution Interactions and Synergies model to establish emission trends for 180 source regions worldwide, and source-receptor relationships from the global EMEP model to cover approximately 6,000 cities. The model identified the contributions from different sources, where, in some regions, natural sources, of mainly soil and desert dust, contributed to the majority of $PM_{2.5}$ concentrations. Ambitious policy interventions could limit $PM_{2.5}$ concentrations to below the WHO air quality guideline values, except in areas where natural sources were the main contributor. At a global scale, it was found that current policies were unlikely to be able to reduce exposure of air pollution and the related health burden. That was due to regional variations, with improvements in North America, Europe and East Asia contrasting with increased pollution levels in other regions. To enhance the effectiveness of policy interventions, a coordinated multisectoral approach was required. Lowering emissions from agricultural activities and meat production were found to be critical. The clean air scenario would achieve fundamental transformations, and hence was considered to be visionary and required strong political but was technically achievable. Linkages with the different Sustainable Development Goals and identification of co-benefits could act as a stimulus for such political will.

15. A representative of the United States Environmental Protection Agency provided an overview of the main conclusions of the Integrated Science Assessment for Ozone and Related Photochemical Oxidants.[13] The peer-reviewed document aimed to provide policy-relevant scientific literature necessary to conduct the review of the United States National Ambient Air Quality Standards, and to make causality determinations for both human health and welfare effects. An overview was given of the approach to causality determination, which used a weight-of-evidence approach to provide a transparent framework. Similar to the conclusion of the previous assessment of 2013, the evidence continued to suggest a causal relationship between short-term ozone exposure and respiratory effects. Emerging evidence suggested a likely to be causal relationship between metabolic effects, such as metabolic syndrome or diabetes, and exposure to short-term ozone. Evidence for cardiovascular effects and mortality led to the revision of causality determination for short-term exposure of ozone from likely to be causal to suggestive of, but not sufficient to infer, a causal relationship. For long-term ozone exposure it was found that metabolic and reproductive effects were suggestive of, but not sufficient to infer, a causal relationship. Evidence continued to support a linear concentration-response relationship, but with less certainty at lower concentrations below 30–40 parts per billion (ppb). Regarding the welfare effects, conclusions were similar to those drawn in 2013, demonstrating ozone effects on vegetation and ecosystems, and on radiative forces and climate variables, such as temperature and precipitation. Ozone concentrations in the United States of America had remained relatively constant since 2013, with a median of less than 70 ppb, while the three-month mean background, or non-anthropogenic, ozone ranged from 20 to 50 ppb. The estimate range was relatively large as it was modelled and depended on multiple factors such as elevation, meteorology and proximity to ozone precursor sources.

16. An expert from Queensland University of Technology (Australia), gave a presentation on ambient ultrafine particles, evidence for policymakers. The white paper report was the result of a collaboration between experts in exposure science, toxicology and epidemiology. In relation to exposure, five main recommendations were highlighted. It was

[12] *Philosophical Transactions A* issue on "Air quality, past present and future" The issue will be published online on 28 September 2020. See also https://iiasa.ac.at/web/home/research/researchPrograms/air/policy/9_amann-TFIAM20-globalWHO.pdf.

[13] https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=348522.

recommended that particle number concentrations be used instead of particle mass and surface area to quantify ambient quasi-ultrafine particles, for a range down to at least 10 nanometres. That parameter would be used in designing epidemiological studies and conducting meta analyses. It was suggested that focusing only on $PM_{2.5}$ would overlook the impact of ultrafine particles, as the different particle sizes suggested regional differences in the deposited dose and potentially different biological responses. Currently, there was no WHO reference guideline value for exposure to ultrafine particles. The report suggested that typical daily, 24-hour mean particle number concentration was less than 1,000 particles per cm^3 for clean environments not affected by anthropogenic emissions, and less than 10,000 particles per cm^3 for urban backgrounds. The typical hourly mean concentrations for clean environments were below 20,000 particles per cm^3. Additionally, the report recommended that other pollutants, such as $PM_{2.5}$, CO, NO_x and BC, not be used as proxies to ultrafine particles to prevent exposure misclassification. In relation to regulatory air quality monitoring strategies, it was recommended that ultrafine particles be used for reporting purposes and that allowance be made for the quantification and characterization of primary versus secondary particles and their source contribution. Finally, it was recommended that efforts to utilise emerging science and technology in order to advance assessment of ultrafine particles for application in epidemiological studies and management be increased.

17. An expert from the Paul Scherrer Institute, Switzerland, gave a presentation on advances in source-apportioned particulate matter for health studies. A four-year project entitled Chemical On-Line cOmpoSition and Source Apportionment of fine aerosoL had been conducted under the framework of the European Cooperation in Science and Technology organization, supported by the European Union Framework Programme Horizon 2020. It aimed to systematically assess the spatial and temporal variability of fine aerosol composition and sources in Europe, with emphasis on their relation to health and climate. Apparatus used included aerosol chemical speciation monitors, for PM_{10} and $PM_{2.5}$, and aethalometers, for BC. Source apportionment for BC could attribute its source to fossil fuel combustion, for example, from traffic, or biomass burning. The chemical analysis of aerosols had developed greatly in the last 15 years by using high-resolution time-of-flight aerosol mass spectrometers. Across Europe, the project had set up around 25 aerosol chemical speciation monitors to form the Aerosols, Clouds and Trace Gases Research Infrastructure network, which provided long-term continuous measurements. In terms of statistical methods used, a rolling positive matrix factorization was used that accounted for the temporal variations of secondary organics – for example, in summer compared to winter – and allowed the source profiles to adjust over time. An offline aerosol mass spectrometry could be adopted by using extracts from filters that could be preserved by freezing. Results from a study on source apportionment of PM_{10} in Switzerland showed that, in an alpine valley, primary organic aerosols from biomass burning dominated in winter, compared to more secondary organic aerosols in summer. Secondary organic aerosols were found to be mainly anthropogenic in winter, compared to biogenic in summer. A new European Cooperation in Science and Technology action project on fine particles: chemical composition and sources, atmospheric modelling and healing effects was planned for submission later in 2020.

18. An expert from the Swedish Environmental Protection Agency reported on the progress of (report on polycyclic aromatic hydrocarbons. A study had been carried out by the Working Group on Polycyclic Aromatic Hydrocarbons, established by the Task Force on Health in accordance with the 2018–2019 workplan (see ECE/EB.AIR/140/Add.1, workplan item 1.1.1.27). with members representing six Parties to the Convention. The report was based on a broad review of the literature and aimed to produce a short summary to support health risk assessments of polycyclic aromatic hydrocarbons in ambient air and the abatement of air pollution. The study had found that only a few epidemiological studies had been published in the past two decades, albeit, with evidence suggestive of increased cancer incidence associated with polycyclic aromatic hydrocarbon exposure in ambient air. Exposure assessment was difficult to conduct in the general population due to the long timespan for cancer development and changing exposure conditions. Additional studies would be required, especially ones with a longitudinal design, high temporal and spatial resolution of exposure, and consideration of carcinogenic potency. Experimental studies were important in supporting epidemiological studies, and explaining the mechanism behind the adverse health effect. Evidence reviewed suggested that organic compounds attached to polycyclic aromatic hydrocarbons increased the risk of cardiovascular and non-malignant

respiratory diseases, and that aryl hydrocarbon receptors might partly have a role for observed non-cancer effects. Some evidence suggested associations with prenatal and early life exposure, and adverse effects on lung development, cognitive and behavioural functions. In terms of policy implications, it was not possible either to conclude whether current air quality guidelines for benzo(a)pyrene provided sufficient protection again diseases other than cancer, or to set specific guideline values for non-malignant effects. Evidence was inconclusive on whether benzo(a)pyrene was a representative marker for exposure to other polycyclic aromatic hydrocarbons. It was found that among the different carcinogenic polycyclic aromatic hydrocarbons, carcinogenic potency differed in an order of magnitude. It was suggested that, for carcinogenic air pollutants, a lowest possible exposure should be acknowledged in view of the acceptance of a no-effect threshold.

19. A representative of the Finnish Institute for Health and Welfare presented the potential for large co-benefits of climate change mitigation measures for BC on air quality and health. BC mainly originated from residential burning of wood and coal, combustion engines, some old power plants and wildfires. BC also indicated co-released pollutants such as toxic and carcinogenic polycyclic aromatic hydrocarbons compounds and other persistent organic pollutants adsorbed on its surfaces. Since the publication of the Task Force on Health report entitled *Health effects of black carbon* in 2012,[14] the body of evidence had grown to include additional health endpoints, hence there was a need to update the document. The new evidence included nasal deposition of BC affecting the central nervous system and potentially leading to increased incidence of neurodegenerative conditions such as Alzheimer’s disease and Parkinson’s disease in the elderly and of impaired neurodevelopment in children. The Arctic Council had established the Arctic Monitoring and Assessment Programme, an expert group for short-lived climatic forcers, such as BC, O_3 and methane, with a subgroup of experts focusing on health. Climate change in northern countries had been predicted to cause two to three times stronger and already much faster atmospheric warming compared to the global averages. Hence, it was important to emphasize the substantial co-benefits on the health of populations and climate change when reducing especially the atmospheric BC levels originating from different kinds of combustion sources on local and regional scales and from long-range transport of smoke, for example, from prescribed and accidental forest and agricultural fires. A case study was presented for Finland, where the use of residential combustion of solid fuels, primarily wood for heating, fell during the 1970s, because individual oil-fired boilers and district heating networks offered more convenient alternatives to owners of detached and semi-detached houses in cities and towns. However, a shallow upward trend in wood use had appeared since 1980, followed by a steeper trend since 2000 that had levelled off at a 40–50 per cent higher level in the 2010s. That was due to the misconception among the public that wood-fired heating was always good for the environment, as well as to the low cost of wood fuel from forests that were largely owned by ordinary Finnish citizens. The study suggested that long-term exposure to increased levels of close neighbourhood wood smoke in densely built suburban residential areas in the Helsinki metropolitan area had relatively strong association with premature cardiovascular and respiratory mortality (25-year follow-up since 1981) and with increased incidence of pulmonary cancers (32-year follow-up since 1981) in a closed retrospective cohort of 93,500 persons. The work had continued, with a number of subsequent analyses on the influence of co-factors, such as socioeconomic status, as well as sensitivity analyses on the categorization of local exposures in 250 m by 250 m grids in the closed cohort. Moreover, local residential area and home outdoor and indoor concentrations of $PM_{2.5}$, BC, polycyclic aromatic hydrocarbons and source markers of biomass combustion had recently been measured, especially during wintertime, by using real-time and integrated monitoring methods in order to describe the detailed close neighbourhood exposure patterns in residential areas favouring wood-fired heating.

[14] Nicole AH Janssen and others, (Copenhagen, WHO Regional Office for Europe, 2012).

VI. Air pollution and health in the time of the coronavirus disease pandemic

20. A representative of the WHO European Centre for Environment and Health provided a brief summary of a WHO scientific brief[15] on the modes of transmission of SARS-CoV-2 virus in the context of infection, protection and control recommendations. According to the evidence available at the time, the virus causing coronavirus disease (COVID-19) was primarily transmitted between people through respiratory droplets larger than 5–10 micrometres in diameter. Droplet transmission could occur if in close contact – less than 1 m – with someone with respiratory symptoms. Airborne transmission of microbes, with droplet nuclei of less than 5 micrometres in diameter, could remain in the air for longer periods and be transmitted over distances greater than 1 m. Airborne transmission might be possible in certain health-care settings in which aerosol-generating medical procedures were performed. The report recognized the emerging scientific evidence on the presence of the virus in the air, which triggered suggestions of airborne transmission. It critically evaluated the studies and expressed the need for caution in interpreting the findings of those studies. It emphasized that the detection of COVID-19 ribonucleic acid (RNA) in environmental samples based on polymerase chain reaction (PCR)-based assays was not indicative of viable virus that could be transmissible, and that more research was needed. Main recommendations were that droplet and contact precautions should be required for personnel caring for COVID-19 patients; and that a risk assessment should be carried out for aerosol-generating procedures. The recommendations emphasized the importance of: rational and appropriate use of all personal protective equipment, in addition to training health-care workers on its use; frequent hand hygiene, respiratory etiquette, and environmental cleaning and disinfection; and physical distancing and avoidance of close and unprotected contact with persons with fever or respiratory symptoms. WHO carefully monitored the emerging evidence about that critical topic and would issue updates as more information became available.

21. A representative of WHO headquarters provided a summary of current WHO activities in the context of air pollution and COVID-19. WHO work related to COVID-19 was carried out by the Health Emergencies Programme. However, the Department of Environment, Climate Change and Health had received some inquiries from the media, members States and other partners, including on: the status of airborne transmission of SARS-COV-2; the relationship between exposure to air pollution and COVID-19 incidence and severity; and the next steps required. In response, WHO had initiated several rounds of consultation with multidisciplinary experts on epidemiology, toxicology and air pollution exposure assessment, as well as atmospheric scientists and clinical experts. A set of questions had been identified and were in the process of being addressed before being published in a peer-reviewed journal article. The paper would critically evaluate the level of knowledge to date and the certainty of scientific evidence, and identify the next steps to address the gaps. A frequently asked questions document, based on the scientific paper, would be published on the WHO website.

22. An expert from King’s College London (United Kingdom of Great Britain and Northern Ireland) gave an overview of emerging evidence of linkages between air pollution and COVID-19. Studies linking air pollution to pandemics had existed since the 1918 influenza pandemic. Short-term exposure to air pollution had been associated with excess hospitalization for respiratory diseases and an increased risk of pneumonia. That could raise the question of whether pneumonia caused by COVID-19 was linked to air pollution. There were several correlation studies, for example, on the correlation between daily PM exceedances and COVID-19 cases, and on presumed evidence of SARS-CoV-2 RNA found on PM in northern Italy. However, those studies were preliminary and not peer-reviewed by experts in the field, and were refuted by other publications. Following the publication by Harvard University (United States of America) of a cross-sectional study, which had initially found a 15 per cent increase in COVID-19 mortality rate due to an increase of 1μg/m^3 of

[15] WHO, “Modes of transmission of virus causing COVID-19: Implications for IPC precaution recommendations. Scientific brief”, WHO reference No. WHO/2019-nCoV/Sci_Brief/Transmission_modes/2020.2, 9 July 2020.

$PM_{2.5}$, Harvard University had published a revised paper with a mortality rate of just 7 per cent after receiving criticism regarding the study. A more comprehensive study had found positive associations between NO_2 concentrations and COVID-19 case-fatality and mortality rates. However, the study did not address spatial confounding and did not evaluate temporal variations. An open question was whether that was the true effect of NO_2 or instead a proxy for social connectivity unexplained by the available covariates. Open research questions included whether exposure to air pollution increased susceptibility to the illness or changed its prognosis in terms of severity, long-term consequences and mortality. Emphasis was placed on the responsibility of science to establish a firm research hypothesis, proper study design and statistical approach, to allow for peer review, acknowledge the limitations and conduct a health impact assessment of the benefits.

23. A representative of the European Environment Agency presented the Agency's viewer on the effect of the COVID-19 lockdown measures on air pollutants concentrations. The European Environment Agency collected two types of data: up-to-date, or near real-time, data, which were on an hourly basis and were used, for instance, to calculate the European Air Quality Index; and historical validated air quality data, which were collected once a year by the Agency, to be used, for instance, for compliance checks. The COVID-19 viewer offered city-level weekly and monthly average concentrations of NO_2, $PM_{2.5}$ and PM_{10}, using hourly data aggregated into daily data. The viewer was updated weekly and available publicly in order to address media and public inquiries. A main limitation was not accounting for meteorological variability, which should be acknowledged when interpreting the results. Preliminary analysis from Milan, Italy, showed NO_2 concentration reductions of up to 30 per cent after one week of imposing lockdown measures. In Madrid, the reduction in NO_2 concentrations after one week of lockdown measures was 60 per cent. In order to minimize the influence of meteorological variability, the data was averaged over several weeks before and after the lockdown measures. For Copenhagen, similar pattern of reduction in NO_2 concentrations were observed after applying lockdown measures; however, it increased again after relaxing movement restrictions. In the case of $PM_{2.5}$ concentrations, it was more difficult to draw conclusions on the effect of COVID-19 lockdown measures, giving that the trend in $PM_{2.5}$ concentrations decrease was similar to that of previous years, over the same period. Unlike NO_2 which was mainly linked to road traffic on a city scale, PM in Europe was more complex, with contributions from residential heating, agricultural activities, transport and natural sources. Future activities would include more in-depth analysis of the data over a longer timespan as more data became available and taking into account the meteorological variability.

VII. Communication and public health messages on air pollution

24. An expert from the Health and Environment Alliance (Belgium) gave a presentation on the European Union European Green Deal and the current economic recovery efforts. The European Green Deal, presented in December 2019, aimed at making the European Union climate neutral by 2050, boosting the economy through green technology, creating sustainable industry and transport and cutting pollution. In order to achieve cleaner air, an integrated policy was promoted, which included a set of measures across different sectors. Despite climate neutrality being the overarching goal, sectors targeted by the Green Deal included: energy; buildings; industry; mobility; and a farm-to-fork strategy for sustainable food systems. Directly linked to air pollution, a zero pollution action plan would be proposed in 2021, in addition to the goal to align the European Union Air Quality Standards more closely with WHO air quality guidelines. With regards to COVID-19 pandemic recovery efforts, there were positive signs from the European Commission that the Green Deal would be used as a blueprint for recovery activities. A letter[16] signed by climate and environment ministers of 17 European Union member States emphasized that the Green Deal should be central to resilient recovery after the pandemic. The Secretary-General of the United Nations had issued an open letter[17] to world leaders urging nations to "recover better". Civil society

[16] See https://www.climatechangenews.com/2020/04/09/european-green-deal-must-central-resilient-recovery-covid-19/.

[17] https://www.un.org/en/un-coronavirus-communications-team/un-urges-countries-'build-back-better'.

also played a role in supporting investment in a green and just recovery, and called for the establishment of the biggest green investment programme in the world. On a city level, mayors representing 40 cities across the world had issued a statement of principles, which included: a commitment to adhere to public health and scientific expertise; and a pledge to build a better, more sustainable and fairer society out of the recovery from the pandemic.

25. A representative of WHO headquarters provided an update of the status of the WHO Expert Consultation: Risk communication and intervention to reduce exposure and to minimize the health effects of air pollution (Geneva, 12–14 February 2019),[18] which had set milestones for personal interventions and risk communication on air pollution. The Expert Consultation had been organized in response to demands for guidance on acute episodes of air pollution. It had aimed to agree on the best ways to communicate potential risks and to reduce exposure by providing practical advice, and to identify research gaps. Systematic reviews had been conducted on personal interventions on the use of respirators, or facemasks, and portable air filters. Some of the key messages of the report included emphasizing a hierarchy of interventions where identifying the pollution source and targeting public policies to reduce emissions were preferred to personal intervention, due to equity issues. Respirators were not recommended as a public health measure, whereas it was premature to recommend portable air filters as a public health measure. To achieve the greatest health benefits, efforts on exposure reduction should be aimed at the long-term and not only on acute air pollution episodes. Air quality indexes were found to be useful in promoting individual behaviour modification only if relevant actions were feasible in the affected population. Staying indoors to avoid air pollution might be beneficial, but largely depended on the level of indoor exposure. However, it was found in high-income countries that the health benefits from regular physical activities were maintained even in settings of high air pollution, with the advice to reduce moderate and vigorous activities during episodes. Categories at risk were identified as children and pregnant women, older adults, people with pre-existing conditions and outdoor workers. The Expert Consultation concluded that communication strategies should be tailored to different geographical and socioeconomic settings, preferably in consultation with institutions of civil society to better adapt the messages.

26. A representative of the WHO European Centre for Environment and Health shared some good practice examples in communicating public health messages on air pollution. The goals of risk communications included: tackling differences between the perception of risk and actual risk; and ensuring that relevant information was made available to reconcile such differences. In order to change the perception of risk, establishing relationships was identified as a key aspect to enable dissemination of knowledge to encourage long-term change. Task Force on Health participants had taken part in an interactive exercise where they had expressed, in one word, their ideas regarding the fundamental principles for good communications, with answers including clarity, honesty, simplicity and promptness. The six WHO principles for risk communication had been identified as: accessible, actionable, credible, relevant, timely and understandable. A particular challenge identified, was creating a balance between establishing credible risk communication messages, which required thorough checks, and their timely dissemination. Messages needed to be tailored to a specific target audience, including policymakers, health-care providers and the general public, including both adults and children, with a pilot WHO activity including a podcast aimed specifically at children. Good practice examples of risk communication included an incident where over one hundred pulmonologists in Germany had signed an open letter[19] claiming that pollution levels from combustion engines were harmless. Instead of direct confrontation, which could have had a counter-effect, efforts had been directed towards providing fact checks to the media and mobilizing "champions", such as the national authorities and learned societies, to harmonize messages and disseminate coherent information, which eventually led to the letter being discredited. In response to ambient air quality queries, which normally peaked in summer and winter, WHO periodically published news stories and technical interviews, with an emphasis on the long-term health effects. A communications strategy was

[18] https://www.c40.org/press_releases/taskforce-principles#principles.

[19] https://www.lungenaerzte-im-netz.de/fileadmin/pdf/Stellungnahme__NOx_und__Feinstaub.pdf. See also https://www.dw.com/en/nitrogen-oxide-is-it-really-that-dangerous-lung-doctors-ask/a-47202076.

being developed, and preliminary feedback from the Task Force on Health participants had been collected on the questions that WHO should address through its strategy.

VIII. Current activities and workplan of the Task Force on Health for 2020–2021

27. A representative of the WHO European Centre for Environment and Health presented an overview of activities undertaken under the 2020–2021 workplan (ECE/EB.AIR/144/Add.2), including the following:

(a) Consolidate existing evidence on health outcomes of exposure to air pollution (item 1.1.1.18): a main activity feeding into the workplan item was the update of the evidence on the health impacts of NO_2, O_3, $PM_{2.5}$, PM_{10}, SO_2 and CO, through systematic reviews, commissioned in the context of the project on the WHO global air quality guidelines, to be published in a peer-reviewed journal. Further plans involved preparing a scoping report on the emerging issues and methods for health impact and risk assessment of air pollution and cost benefit analysis, to facilitate work towards an update of the Health risks of air pollution in Europe–HRAPIE project (pending availability of resources);

(b) Evaluate the current knowledge on the health risk of polycyclic aromatic hydrocarbons and identify critical gaps and assess feasibility of continuing the work under the Task Force on Health (item 1.1.1.19): a technical report on the health risks of polycyclic aromatic hydrocarbons had been drafted by the Working Group on Polycyclic Aromatic Hydrocarbons and key findings had been presented at the Task Force on Health meeting (see para. 18 above for summary); the work on the draft report, including gathering feedback from the Task Force on Health members, would continue in the coming months;

(c) Capacity-building for the health impact assessment of air pollution at regional and subregional levels (item 1.2.2): a capacity-building curriculum had been further developed and implemented through a training workshop for countries in the South Caucasus (see para. 6 above for details). Funding had been secured for a subregional workshop to be held in Central Asian countries (implementation pending travel restrictions due to the pandemic);

(d) Further develop methodologies for assessment of direct and indirect impacts of long-range transboundary air pollution on human health (item 1.3.5): ongoing work on tools included further developmental work and update of the Carbon Reduction Benefits on Health (CaRBonHtool) and AirQ+ software (see paras. 8 and 9 above for further details);

(e) Development of communication strategies for health messages related to air pollution in Europe (item 1.3.6.): regional activities developed in coordination with WHO headquarters (see para. 25 above for summary). The interactive session to strengthen capacities in communicating strategies for health-related messages related to air pollution, originally planned for the current meeting, had been postponed until the next physical Task Force on Health meeting.