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

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

Working Group on Effects

Seventh joint session
Geneva, 13–16 September 2021
Item 10 (a) of the provisional agenda
Progress in activities in 2021 and further development of effects-oriented activities: air pollution effects on health

Effects of air pollution on health

Report of the Joint Task Force on the Health Aspects of Air Pollution on its twenty-fourth 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 1.1.1.1, 1.1.1.18, 1.1.1.19, 1.2.2, 1.3.5 and 1.3.6) and the revised mandate for the Joint Task Force on the Health Aspects of Air Pollution (Executive Body decision 2019/21).

The report presents the results of the discussions on the health impacts of ambient air pollution and other workplan items at the Joint Task Force's twenty-fourth meeting (online, 10 and 11 May 2021).

I. Introduction

1. The present report summarizes the results and discussions on the health impacts of ambient air pollution presented at the twenty-fourth 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, 10 and 11 May 2021). 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 on Long-Range Transboundary Air Pollution (ECE/EB.AIR/144/Add.2, items 1.1.1.1, 1.1.1.18, 1.1.1.19, 1.2.2, 1.3.5 and 1.3.6) and the revised mandate for the Task Force on the Health (Executive Body decision 2019/21).[1]

2. Altogether, 46 representatives from 34 Parties to the Convention attended the twenty-fourth meeting, in addition to 2 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. Pilmu Ryu (WHO European Centre for Environment and Health) acted as rapporteur. Eighteen temporary advisers participated in the meeting from the following organizations: IVL Swedish Environmental Research Institute; Utrecht University (Netherlands, two experts); Paul Scherrer Institute (Switzerland); Institute for Biomedical Research and Innovation-National Research Council (Italy); London School of Hygiene and Tropical Medicine (United Kingdom of Great Britain and Northern Ireland); Guangzhou Institute of Respiratory Health (China); Meteorological Synthesizing Centre-East (Russian Federation); St George's University of London (United Kingdom of Great Britain and Northern Ireland); Ecometrics Research and Consulting (United Kingdom of Great Britain and Northern Ireland); Swiss Tropical and Public Health Institute; Imperial College London (United Kingdom of Great Britain and Northern Ireland); Swedish Environmental Protection Agency; University of Edinburgh (United Kingdom of Great Britain and Northern Ireland); Santé publique France; Environmental Epidemiology ISGlobal (Spain); National Scientific and Technical Research Council (Argentina); and Spadaro Environmental Research Consultants (United States of America). Twelve 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

3. A representative of the Convention secretariat provided an overview of recent developments under the Convention on Long-Range Transboundary Air Pollution. The fifty-eighth session of the Working Group on Strategies and Review (Geneva (hybrid), 14–17 December 2020)[2] highlighted: progress in the implementation of the 2020–2021 workplan; the review of the sufficiency and effectiveness of the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol); hemispheric transport and control strategies for use in future scenarios; and reporting of the condensable part in emissions of particulate matter (PM). The Executive Body for the Convention at its fortieth session (Geneva (hybrid), 18 December 2020) adopted the guidance document on integrated sustainable nitrogen management (ECE/EB.AIR/2020/6–ECE/EB.AIR/WG.5/2020/5) and the work schedule of the review of the Gothenburg Protocol, which was expected to be concluded at the forty-second session of the Executive Body (December 2022), including the answers to the questions (ECE/EB.AIR/2020/3−ECE/EB.AIR/WG.5/2020/3, annex I). The Executive Body also reviewed the implementation of the 2020–2021 workplan for the implementation of the Convention. In relation to updates on recent developments in science, the sixth Joint Session of the Steering Body to the Cooperative Programme for Monitoring

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

[2] See https://unece.org/environmental-policy/events/working-group-strategies-and-review-fifty-eighth-session.

and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) and the Working Group on Effects (online, 14–17 September 2020) covered condensable in particulate matter in inventories and modelling, and ozone pollution, with extensive contributions by centres and task forces. The Joint Meeting of the Extended Bureaux of the EMEP Steering Body and of the Working Group on Effects (online, 1–4 March 2021) covered progress in the implementation of the 2020–2021 workplan, and proposals for the 2022–2023 workplan, including various recommendations for further activities and research, as well as common EMEP and Working Group on Effects issues. A representative of the Convention also presented a variety of capacity-building and awareness-raising activities for 2020–2021, including training workshops on the development of national emission inventories in Kazakhstan, Kyrgyzstan and the Republic of Moldova (first part: November–December 2020; second part: March–June 2021). The first International Day of Clean Air for Blue Skies (online, 7 September 2020) was promoted by the Convention secretariat. The e-learning starter course on the Convention and its protocols would be developed in 2021–2022.

4. A representative of the European Commission provided an overview of the upcoming revision of the European Union rules on air quality, aiming to draw on the lessons learned from the evaluation of current air quality legislation, and to revise air quality standards to align them more closely with the WHO recommendations. The Commission had conducted a "fitness check" of the Ambient Air Quality Directives,[3] an evidence-based and retrospective evaluation that offered the following lessons: air quality remained a major health and environmental concern; air quality standards had been instrumental, and partially effective, in reducing pollution; current European Union standards were less ambitious than scientific advice; limit values had been more effective than other types of air standards; legal enforcement action by the European Commission, and action by civil society, worked; there was scope for further harmonization of monitoring, modelling and air quality plans; and all reported data were not equally useful, while e-reporting allowed for further efficiency. The representative presented key shortcomings of current European Union air quality legislation. Premature deaths due to air pollution had been halved during the past two decades; however, the European Union air quality standards were not fully aligned with scientific advice, showing exceedances above WHO Air Quality Guidelines. Frequency, extent and magnitude of exceedances of air quality standards had declined; however, exceedances were not always addressed sufficiently and/or on time due to inefficient plans and measures, and insufficient penalties linked to exceedances. Competent authorities had developed plans to limit exceedances of air quality standards; however, air quality plans did not always address all sources effectively because of air quality governance shortcomings. Reliable air quality information needed to be widely available, often even in real time; however, the public felt underinformed about poor air quality and its impacts (including health impacts), and public information was not always clear or harmonized. Revision of ambient air pollution legislation was expected to focus on three policy areas: closer alignment of European Union air quality standards with scientific knowledge, including the latest WHO recommendations; improvement of the air quality legislative framework, including provisions on penalties and public information, in order to enhance effectiveness, efficiency and coherence; and strengthening of air quality monitoring, modelling and plans.

5. A representative of WHO headquarters provided an update on WHO activities. WHO would release *Tracking SDG7: The Energy Progress Report 2021* in June 2021, and would co-chair Technical Working Group 3: Enabling SDGs through Inclusive Just Energy for the High-level Dialogue on Energy at the seventy-sixth session of the General Assembly (New York, 14–30 September 2021). The Health and Energy Platform of Action[4] had been created, aiming at a world in which the health and well-being of the poorest billions would be improved through access to clean and sustainable energy, with the initial focus on clean cooking and health-care facilities. WHO had launched a new tool, Benefits of Action to Reduce Household Air Pollution, which could calculate costs and benefits (including health, social, climate and environmental) of transitions to clean/cleaner household energy. The

[3] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe, *Official Journal of the European Union*, L 152 (2008), pp. 1–44.

[4] See www.who.int/initiatives/health-and-energy-platform-of-action.

Clean Household Energy Solutions Toolkit had been updated, and a household energy policy database would be made available by the end of 2021. The Urban Health Initiative had been launched in the recent past, with two pilot studies in Accra and Kathmandu, aiming to empower the health sector at the local level through data analysis and different policy action. In relation to the Urban Health Initiative, the Health Economic Assessment Tool for walking and cycling[5] had been applied, which allowed health to be taken into account in planning decisions, implementation and tracking progress. For health sector training on air pollution and health, WHO had started a project to develop capacity-building materials for public health professionals. WHO had established an expert group to develop a set of interactive clinical case scenarios that could be used as part of the WHO training toolkit on air pollution and health for the health workforce. In addition, WHO would establish a technical advisory group on global air pollution and health, the priority work areas of which would be exposure assessment, methodologies for the burden of disease, source attribution, health outcomes and exposure-response functions, desert dust and health, interventions and responses, and climate change and air pollution. WHO was planning to turn in Sustainable Development Goal reports on clean household fuel, in May 2021, and on air pollution and the health effects thereof, at the end of 2021 (Goals 3 and 11).

III. Update of the World Health Organization Global Air Quality Guidelines: systematic reviews

6. An expert from Utrecht University (Netherlands) gave a presentation on methodological considerations for systematic reviews to inform the forthcoming WHO Global Air Quality Guidelines (WHO Global AQGs) to be published in 2021. The expert explained that the previous edition of the WHO AQGs (2006) had been developed based on narrative reviews, expert opinion, inclusive of epidemiology, in-vivo and in-vitro toxicology, human chamber studies, inclusive of most mortality and morbidity endpoints. However, since 2006, there had been many changes and new relevant studies, including Integrated Science Assessments (ISAs) for carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM) and ozone (O_3) published by the United States Environmental Protection Agency, the WHO project “Review of evidence on health aspects of air pollution”, and the *WHO Handbook for Guideline Development: Second edition*.[6] The expert mentioned that the *WHO Handbook for Guideline Development* had provided a detailed protocol for formulating questions, systematic reviews of evidence and assessing evidence to move from evidence to recommendations. The guideline development process had begun in mid 2016, and systematic reviews had been commissioned for 2017–2020, followed by publication of the reviews’ results in 2020-2021.[7] A total of 42 pollutant-outcome pairs had been reviewed. Thousands of abstracts and titles had been screened, and hundreds of papers had been included for the systematic reviews. Transparency had been increased by developing and applying detailed protocols for systematic reviews, certainty of evidence assessment and guideline development. Certainty of evidence had been assessed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach, which had required adaptation to become informative in the AQG context. Lastly, certainty assessments for the systematic reviews to inform the WHO Global AQGs had shown: high certainty (24 pollutant-outcome pairs); moderate certainty (13 pollutant-outcome pairs); and low certainty (5 pollutant-outcome pairs).

7. A guest expert from Utrecht University (Netherlands) presented the systematic review of long-term exposure to PM and all-cause and specific-cause mortality. In the systematic review, inclusion and exclusion criteria had been structured based on population, exposure, comparator, outcome and study (PECOS). The general human population, including subgroups at risk, was included, and no restrictions on age or geographical location were set. Long-term exposure to ambient air $PM_{2.5}$ and PM_{10} was included; however, exposure in

[5] See www.heatwalkingcycling.org/#homepage.
[6] World Health Organization (WHO) (Geneva, 2014).
[7] Paul Whaley, Mark Nieuwenhuijsen and Jake Burns, eds., “Update of the WHO Global Air Quality Guidelines: Systematic Reviews”, *Environmental International*, 6 February 2021. Available at www.sciencedirect.com/journal/environment-international/special-issue/10MTC4W8FXJ.

occupational settings or indoor exposure exclusively was excluded. Additionally, exposure to lower levels of $PM_{2.5}$ and PM_{10} in the same or in a control population, outcome of all-cause mortality, and cause-specific mortality due to circulatory and respiratory diseases were included. The systematic review included human epidemiological studies (cohort studies, case-control studies) and published journal articles in any language; however, the review excluded qualitative studies, studies without individual level data and/or reviews, methodological papers, non-human studies (in vivo, in vitro, other), conference abstracts, papers, letters, notes and grey literature. The steps in the systematic review included: systematic search; evaluation of abstracts by two investigators; evaluation of full-text papers; data extraction with standard form; assessment of risk of bias (RoB) for individual studies; meta-analysis; indication of the shape of the concentration-response functions (CRFs); and adapted GRADE assessment for the body of evidence. Through the screening by title and abstract, 216 relevant records were searched, and 2,946 records were excluded. Lastly, 105 records from search and 2 records identified from other sources were chosen for the systematic review, which could be subgrouped into cohort study design (104 records), studies conducted in North America (62 records), Europe (25 records) and Asia (19 records). The results of meta-analysis for all-cause mortality and $PM_{2.5}$ and PM_{10} were associated with increased mortality from natural causes, cardiovascular disease, respiratory disease and lung cancer. $PM_{2.5}$ showed positive association with a relative risk (RR) of 1.08 per 10 $\mu g/m^3$ of $PM_{2.5}$, the same as subgroup analysis by geographical region and by level of mean $PM_{2.5}$ concentrations. RR in all-cause mortality and PM_{10} was smaller than in $PM_{2.5}$, and cause-specific mortality on PM_{10} was not statistically significant for circulatory disease, stroke and chronic obstructive pulmonary disease (COPD), but was for ischemic heart disease (IHD), respiratory disease, lung cancer.

8. An expert from the University of London (United Kingdom of Great Britain and Northern Ireland) gave a presentation on the systematic reviews of long-term exposure to NO_2 and O_3 and all-cause and cause-specific mortality. The systematic review included: general population, including subgroups at risk of all ages; no geographical restriction; long-term exposure to ambient air NO_2 and O_3 expressed in a concentration unit; exposure to lower levels of the air pollutant of interest in the same population; all-cause, and respiratory COPD and acute lower respiratory infections mortality; and prospective and retrospective cohort studies and published journal articles in any language. However, it excluded: occupational exposure settings or as a result of indoor exposure exclusively; less than one year of data available; increment for hazard ratio not given; qualitative studies, case control studies, studies where no original data were analysed, reviews and methodological papers, non-human studies; and insufficient information given to standardize hazard ratio and precision. A total of 46 records (41 for NO_2, 20 for O_3) were chosen for the systematic review with the process of identification, screening and eligibility assessment. RoB assessment for NO_2, O_3 and all-cause mortality was high and moderate in confounding, however, it was low in other domains in general. Age, gender, individual- or area- level socioeconomic status (SES) and smoking became critical potential confounders, and year of enrolment, ethnicity, diet, physical activity, marital status and body mass index (BMI) became additional potential confounders for NO_2 and O_3. GRADE assessment was generally low and moderate for all-cause mortality and respiratory mortality on NO_2, annual O_3 and peak O_3 exposure. The result of meta-analysis for NO_2, O_3 and mortality showed positive association between NO_2 and mortality, and limited evidence between O_3 and mortality. All-cause mortality and NO_2 showed positive association with a RR of 1.02 per 10 $\mu g/m^3$ of NO_2. Positive relationships between NO_2 and respiratory disease, COPD and acute lower respiratory illness (ALRI) mortality were identified, with particularly low heterogeneity in COPD. In relation to O_3 and mortality, O_3 annual exposure and all-cause mortality indicated a RR of 0.97 per 10 $\mu g/m^3$ with high heterogeneity; however, some positive association between O_3 peak exposure and all-cause mortality, and between O_3 peak exposure and respiratory mortality, was found.

9. An expert from the University of Edinburgh (United Kingdom of Great Britain and Northern Ireland) presented a systematic review of the short-term effects of exposure to ambient CO on emergency department visits, hospital admissions or mortality due to myocardial infarction. The systematic review had been performed based on extending

previous review[8] and updating search. PECOS criteria were: all adults over 18 years with no geographical restriction were included, whereas studies that restricted exposure to occupational settings were excluded; all studies that reported short-term exposure to ambient CO (up to lag 7 days) were included; outcome per 1 mg/m^3 increase in concentration of CO was included; emergency department visits or hospital admissions and mortality due to acute myocardial infarction were included; and both time series and case-crossover studies, published peer-reviewed journals were included with no language restrictions. Twenty-six record were left for meta-analysis after screening of duplicates, eligibility assessment, twenty-five of which were mainly performed in 14 different countries, mainly cohorts in the 1980s and 1990s with mean concentration of CO ranged from 0.3 mg/m^3 to 4.6 mg/m^3. The majority gave risk estimates for hospitalization due to myocardial infarction and only three reported mortality due to myocardial infarction. Association between CO and myocardial infarction appeared to be 1.05 of RR per 1 $\mu g/m^3$ of CO. Overall, GRADE assessment did not need downgrading or upgrading based on pre-specified criteria, resulting in moderate quality of evidence on the association between CO and myocardial infarction. Ten studies were assessed to be at high RoB, mainly due to inadequate adjustment for confounding. Subgroup analysis did not demonstrate significant difference in risk estimate between studies at low/moderate RoB versus high RoB. The 80 per cent prediction interval of pooled risk estimates was 0.871–1.271, and this was driven by three studies reporting outlying results, whereas sensitivity analysis excluding these studies had 80 per cent prediction interval of 1.002–1.030. The total number of participants in the included studies was more than 1.5 million, which was a little lower than the sample size calculation.

10. An expert from Guangzhou Institute of Respiratory Health (China) provided a systematic review of short-term exposure to NO_2, SO_2 and O_3 and emergency department visits and hospital admissions due to asthma. The PECOS criteria for inclusion in the systematic review were: general human population, exposure to NO_2, SO_2 and O_3 via inhalation through ambient air predominantly; short-term exposure of less than 7 days to ambient NO_2, SO_2 and O_3 from any source; exposure to lower levels of NO_2, SO_2 and O_3 in the same or in control population; and health outcomes selected for short-term exposure including emergency department visits and hospital admissions due to asthma. In all, 9,059 records were identified through database search and other sources, and, lastly, 67 studies were included for quantitative review of meta-analysis. RoB assessment was performed, showing that missing data consisted of most of the high RoB domain, followed by confounding; however, selection bias and exposure assessment were at a relatively low RoB. The finding for overall analysis for NO_2 and SO_2 was that the increase of 24-hour NO_2 and SO_2 concentrations was significantly correlated with asthma emergency room visits and hospitalizations. Increased 8-hour O_3 concentrations were also significantly correlated with asthma emergency room visits and hospitalizations. However, there was no statistically significant association between 1-hour concentration for three air pollutants (NO_2, SO_2 and O_3) and asthma exacerbations. No substantial heterogeneity among studies for NO_2 and SO_2 (8- or 24-hour) was found. There were no significant differences for three pollutants (O_3, NO_2 and SO_2) and asthma, not only between subgroups stratified by RoB assessment findings, but also between subgroups stratified by the study designs for subgroup analysis. No significant effect of unmeasured confounding factors on outcome assessments was found for three pollutants (O_3, NO_2 and SO_2) and asthma. It was impossible to further evaluate CRFs due to the limited number of studies and nearly half of the studies reported a deviation from linearity. Publication bias have not substantially affected the general conclusions. The associations with single-pollutant models were no longer significant after the inclusion of a second pollutant due to the small number of available articles; almost all studies showed high correlation coefficients between the pollutants.

11. An expert from the National Scientific and Technical Research Council (Argentina) presented the systematic review of short-term exposure to PM_{10}, $PM_{2.5}$, NO_2, SO_2 and O_3, and all-cause and cause-specific mortality. In all, 196 records for PM_{10}, $PM_{2.5}$, NO_2 and O_3 and 6 records for SO_2 had been extracted from databases and other sources. RoB assessment was high in missing data, followed by confounding and outcome measurement domain. A

[8] Hazrije Mustafić and others, "Main air pollutants and myocardial infarction: a systematic review and meta-analysis", *JAMA*, vol. 307, No. 7 (February 2012), pp. 713–721.

high proportion of articles did not mention the number of days with missing data, or the procedures for missing data importation. In confounding domain, a small number of articles did not take into account temperature, seasonality, time trends, day of the week, holidays or influenza outbreak. Moreover, many articles did not use the International Classification of Diseases for listing the cause of mortality in outcome measure domain. The result for meta-analysis showed that increase in ambient concentrations of PM_{10}, $PM_{2.5}$, NO_2 and O_3 increased the risk of all-cause mortality and cardiovascular, cerebrovascular and respiratory mortality, showing RR between 1.0041 and 1.0092, meaning that a 10 $\mu g/m^3$ increase in the concentrations of pollutants was associated with an increase of 0.41 per cent to 0.92 per cent in the number of mortalities in the short term (1 to 7 days). The result for SO_2 was a positive correlation for all-cause and respiratory mortality. Subgroups analysis appeared to show that all-cause mortality for SO_2 (24-hour) was significantly different in all ages and children, although not in gender and continent. In relation to the co-pollutant model, it was found that PM_{10}, $PM_{2.5}$, NO_2 and SO_2 were still significantly associated with all-cause or specific-cause mortality after the adjustment by PM, NO_2 and O_3. The CRFs were, in general, linear for PM, and linear or non-linear for gases. GRADE appeared to be high for all pollutants and mortality outcomes, and for the majority of pollutant-outcome pairs. Wide searches encompassing international and regional databases, grey literature, no restrictions of language and instruments developed to assess RoB and GRADE strengthened the systematic review for the effects of short-term exposure. However, short-term studies on PM_{10}, $PM_{2.5}$, NO_2, SO_2 and O_3 were susceptible to residual or unobserved confounding, in addition to ambient temperature, trends and cycles.

12. A representative of the WHO European Centre for Environment and Health wrapped up the session by providing an overview of the guideline development process and the next steps towards publication of the WHO Global AQGs. The WHO Global AQGs would include: recommendations in the form of numerical concentration values, with an indication of the shape of the CRFs for PM_{10}, $PM_{2.5}$, NO_2 , O_3, SO_2 and CO, for relevant averaging times and in relation to critical health outcomes; good practice statements for black carbon/elemental carbon, ultrafine particles and particles originating from sand and dust storms; and interim targets to support monitoring and implementation of the air quality guideline levels. Four main groups of experts were involved in the process: the Guideline Development Group, in charge of assisting in scoping, providing advice on the methodological issues, and formulating recommendations; the Systematic Review Team, in charge of reviewing the evidence; the External Review Group, composed of 65 external reviewers, including stakeholder organizations; and the Steering Group, in which WHO staff from headquarters and regional offices participated. There were three major phases in the process: planning, development and publishing. As described in the previous presentations, the main steps in the development phase included the systematic review of evidence, grading the evidence, and developing recommendations. Currently, the WHO Global AQGs were at the final stage of publishing, and the goal was to launch the publication in the third of quarter of 2021. However, the systematic reviews and related methodological adaptations – the RoB instrument and the certainty of evidence approach – had already been made publicly available.[9] Once the WHO Global AQGs had been published, WHO would provide materials and initiate activities to support their implementation in the region, including executive summaries in different official languages of WHO, science–policy webinars, a resource package of policy-oriented tools, and communication and dissemination activities.

IV. Communication and public health messages on air pollution

13. A representative of the WHO European Centre for Environment and Health presented an overview of the communications and dissemination plan for the launch of the global WHO AQGs, including planned materials and activities. In relation to the communication package, executive summaries would be made available in all four official languages of the WHO Regional Office for Europe, but also in all global languages of the United Nations to support international and State Member media inquiries. Accompanying the launch of the WHO

[9] Available at https://apps.who.int/iris/handle/10665/341717.
https://ars.els-cdn.com/content/image/1-s2.0-S0160412020318316-mmc4.pdf.

Global AQGs, a global press release and a press information note would be shared with invited press. The press information note would provide an abridged version of the frequently asked questions, background, new developments and implications of AQGs. Additionally, a social media campaign with a few key findings of the Guidelines would be prepared for use on Twitter, Instagram, etc. Op-eds placed in public health journals at the international and European levels would help to increase global awareness of the implications of the WHO Global AQGs from a public health policy perspective. A standardized presentation would support communication and technical teams in disseminating the results. One week before the launch, the press package would be shared with key stakeholders, partners and national focal points, as well as with selected press. One day before the launch, the full press package and the WHO Global AQGs would be provided to registered press under the 24-hour embargo. On the day of the launch, the AQGs would be presented at a WHO press conference, with subsequent media interviews with WHO and external experts. After the launch, ongoing dissemination activities would be needed during the year, together with partners and marking significant international days.

14. A representative of the WHO European Centre for Environment and Health presented an overview of a new project entitled “Sharing Key Air Pollution and Health Information in Europe” (SKAPHIE), aiming at addressing frequent questions from European citizens regarding personal-level interventions such as face masks, air purifiers, or air quality index messages designed to prompt personal protective behaviours. The project was co-funded by the European Commission and intended to build upon the report *Personal Interventions and Risk Communication on Air Pollution*,[10] considering the current context in the European Union and similar settings. The project would consist of three main phases: planning and scoping; rapid review of evidence; and formulation of advice/suggestions. After a mapping exercise that had considered balance of gender, geographical representation and expertise, 10 external experts had been recruited to advise on the project scope and formulate advice/suggestions. Recruitment of some reviewers and peer reviewers had also been considered. The external advisers had first met in April 2021, discussed the report *Personal Interventions and Risk Communication on Air Pollution* and related recent publications by other bodies, and identified relevant issues to be addressed. The next steps of the project would include: finalizing the planning and scoping of the project; deciding on the reviews that might be needed; deciding on the project outputs, their format and target audience (for example, technical report, factsheets, infographics, other communication materials); and considering the possibility of adapting and extending the global and European Union work to other subregions in the WHO European Region not covered in the project. An outline of the possible contents of the planned factsheets was presented, as well as examples of WHO factsheets produced in the region.

15. An expert from the Swiss Tropical and Public Health Institute[11] presented the Swiss Literature Database on Air Pollution and Health (LUDOK) interactive figure to communicate health effects of ambient air pollutants. The expert explained that LUDOK had been an information source for the general public on the scientific literature and reviews published worldwide on the subject of air pollution and health on behalf of the Swiss Federal Office for the Environment (FOEN) since 1985, aiming to be up-to-date with the state of knowledge of the large amount of publications on health effects on air pollution. It also published a bimonthly “newsletter” in German. Through the latest project on the communication of the health effects of air pollution, a clearer picture of what were, or were likely to be, the causal effects of air pollution on health had been prepared. That picture was totally different from the general picture of potential diseases, conditions and biomarkers in the perspective of showing which pollutants were responsible for potential diseases. Review of relevant regulated air pollutants was conducted for PM, O_3, NO_2, CO and SO_2 to develop a multidimensional and slightly more interactive approach to health effects of air pollutants. The selection of effects to be considered was based on the Integrated Science Assessments (ISAs) for CO, NO_2, SO_2, PM and O_3 by the United States Environmental Protection Agency, which showed levels of certainty in the evidence of causal relationships, including, for

[10] WHO, Summary report of a WHO Expert Consultation, 12–14 February 2019, Geneva, Switzerland (Geneva, 2020). Available at https://www.who.int/publications/i/item/9789240000278.

[11] See www.swisstph.ch/ludok.

example, respiratory effects, cardiovascular effects, total mortality on short-term NO_2 exposure. Effects that could be seen in different organs would be shown in an interactive figure, developed jointly with various stakeholders in Switzerland, FOEN, cantonal offices, lung cancer patient and advocacy organizations and blended teaching organizations. The expert highlighted that the interactive figure allowed for the selection of three levels from duration of exposure, pollutant, or organ system, and was available in German, English, French and Italian. Further information on the interactive figure and its use by third parties could be found on the Swiss Tropical and Public Health Institute website.[12]

V. Progress in research on health impacts of air pollution

16. An expert from the Swedish Environmental Protection Agency provided an overview of the progress regarding a report on human health effects of polycyclic aromatic hydrocarbons (PAHs) as ambient air pollutants, which would be published in 2021. The Working Group on PAHs had been established within the 2018–2019 workplan of the Task Force on Health to: select recent epidemiological findings on cancer in humans based on a literature search up to 2019; highlight recent findings on PAH exposure and non-cancer health outcomes; touch upon PAH exposure from different sources and its relation to particulate exposure and health endpoints; and give policy advice based on conclusions from the report. The Working Group on PAHs had not performed a systematic review but had built primarily on ongoing work in member countries and had included a literature search and recent health findings of PAH exposure. Overall, there was suggestive evidence of increased cancer incidence associated with PAHs in ambient air; exposure assessment of PAHs was difficult in the general population because of the long timespan for cancer development and the often-changing exposure conditions for the general population; additional studies, especially of longitudinal design with high temporal and spatial resolution of exposure, and considering the carcinogenic potency of individual PAHs, would be needed; and, some evidence suggested associations between prenatal and early life exposure to PAHs in ambient air and adverse effects on lung development, cognitive or behavioural function in children. In relation to policy implications, for carcinogenic air pollutants, a lowest possible exposure should be acknowledged in view of the acceptance of a no-effect threshold. Among carcinogenic PAHs, individual PAHs might differ in carcinogenic potency by an order of magnitude. Current knowledge did not allow for the establishment of regulatory guidelines either for benzo[a]pyrene or for other PAH species for non-malignant effects. It was not possible to conclude whether current air quality guidelines for benzo[a]pyrene might provide sufficient protection against other diseases than cancer.

17. An expert from Meteorological Synthesizing Centre-East (Russian Federation) presented an assessment of PAH pollution levels, key sources and trends. A progress report on PAHs[13] had been published as a contribution to the analysis of the effectiveness of the Protocol on Persistent Organic Pollutants in cooperation with the Task Force on Techno-economic Issues and the Task Force on Health. For PAH emissions, the report highlighted that: biomass/fossil fuel combustion was the main source of PAH emissions; the largest contribution was made by the residential combustion sector; PAHs were co-emitted with PM from sectors related to combustion; and PAH emissions had not changed significantly over the past 20 years. In relation to long-term changes of benzo[a]pyrene pollution in the EMEP region, modelled benzo[a]pyrene concentrations generally corresponded to EMEP measurements, and no significant decrease of benzo[a]pyrene concentrations in modelling results and measurement had been found. Around 10 per cent of the population in EMEP countries in 2017 had lived in areas that exceeded the European Union target of $1 ng/m^3$, whereas around 70 per cent of population had lived in areas that exceeded the WHO target of $0.12 ng/m.^3$ Recent studies of population exposure to PAHs indicated the need to evaluate joint toxicity of PAHs exposure, because PAHs were emitted to the atmosphere as a mixture of different compounds. Experimental model simulations of 16 PAHs based on expert estimates of emissions showed that benzo[a]pyrene-equivalent concentrations of 16 PAHs exceeded the European Union target value in many countries. In relation to the contribution

[12] See www.swisstph.ch/en/projects/ludok/healtheffects/.

[13] Meteorological Synthesizing Centre-East, “Assessment of PAH pollution levels, key sources and trends: contribution to analysis of the effectiveness of the POPs Protocol: Progress Report”, Technical Report No. 2/2020 (Moscow, 2020). Available at https://en.msceast.org/reports/2_2020_tech.pdf.

of PAHs to adverse effects of PM, air quality assessment for PM was often based on PM mass concentration without considering sources and chemical composition of particles. The impact of PM on human health might be more significant due to the presence of toxic constituents, including organic compounds, heavy metals and other compounds. Ongoing and future EMEP activities on PAHs included: analysis of trends and key sources of PAH pollution in the EMEP region; a case study on benzo[a]pyrene pollution in Poland; analysis and attribution of long-term changes of PAH pollution on the global/regional scale; data exchange with the Task Force on Health on benzo[a]pyrene and PAH concentration and exceedances of target values to assess population exposure; and cooperation with international organizations.

18. An expert from Paul Scherrer Institute (Switzerland) gave a presentation on sources of PM and its Oxidative Potential (OP) in Europe. The standard assessments of the chronic and acute effects of PM on human health had tended to be based on mass concentration until the current time. Nevertheless, it had been recently debated whether the chemical composition of PM might drive health effects. OP, which described the capacity of particles to generate reactive oxygen species that could oxidize molecules in the body, had been put forward as one of the many possible drivers of the acute health effects of PM. An example from an epidemiological study indicated that PM with high OP increased heart attack risk, whereas PM with low OP did not induce any increase of heart attack risk. The OP of PM did not depend only on chemical composition, but also on the emission sources, which necessitated the study focusing on quantifying and identifying the main sources of OP in Europe. Development of a new methodology for the application of atmosphere monitoring services to filter samples was needed for detailed chemical information on PM composition. The contributions of different constituents to PM and their regional variability could be examined, while it was possible to quantify the sources of organic aerosol (OA) using a combination of offline aerosol mass spectrometry and positive matrix factorization. This approach provided quantitative chemical fingerprints of the water-soluble organic particulate fraction, in addition to characterization of metal concentration. Secondary OA was correlated with oxidation products of aromatic precursors arising from incomplete combustion and lignin pyrolysis. In relation to the impact of OP of PM on cell inflammation, OP of PM could be measured by the consumption of specific antioxidants. There was clear correlation for cells between the pro-inflammatory response and the aerosol OP, and cellular inflammatory response increased with OP activity of deposited PM per cell surface. OP sources varied with population density, and urban PM_{10} had higher oxidative potential per mass than rural area PM_{10}. Whether oxidation potential would decrease in the future was not expected during the decrease of the mass concentration of PM. Results suggested that mitigation strategies aimed at reducing the mass concentrations of PM alone might not reduce OP concentration.

19. An expert from Environmental Epidemiology ISGlobal (Spain) provided the findings of a study on premature mortality due to air pollution in European cities, aiming at conducting quantitative health impact assessment to estimate the impact of $PM_{2.5}$ and NO_2 on natural-cause mortality for adult residents of 969 cities and 47 greater cities in Europe. In order to conduct the health impact assessment, data on 168,180,047 adults (≥ 20 years old) who resided in the 969 European cities and 47 greater cities had been retrieved, representing 32 per cent of the population in 31 European countries. Total all-cause mortality counts for 2015 had been available at the city level from Eurostat. For 802 cities and 46 greater cities, annual mean $PM_{2.5}$ and NO_2 estimates had been extracted from the Land Use Regression (LUR) models. Annual mean NO_2 estimates had been retrieved from the Global LUR model for NO_2 developed on a 100 m x 100 m grid cell scale for 2011.[14] The study had concluded by suggesting that compliance with WHO AQGs (2006) could prevent 51,213 annual deaths for $PM_{2.5}$ exposure and 900 annual deaths for NO_2 exposure in European cities. The reduction of air pollution to the lowest measured levels could prevent 124,729 annual deaths for $PM_{2.5}$ exposure and 79,435 annual deaths for NO_2 exposure. A great variability in the preventable mortality burden was observed by city, ranging from 0–205 deaths for $PM_{2.5}$ and 0–79 deaths for NO_2 per 100,000 population when the lowest measured levels were considered. The highest $PM_{2.5}$ mortality burden was estimated for cities in the Po Valley (Italy), Poland and Czechia. The highest NO_2 mortality burden was estimated for the larger and capital cities in Western and Southern Europe. A considerable proportion of premature deaths in European

[14] Andrew Larkin and others, "Global Land Use Regression Model for Nitrogen Dioxide Air Pollution", *Environmental Science & Technology*, vol. 51, No. 12 (2017), pp. 6957–6964.

cities could be avoided annually by lowering air pollution levels, particularly below the WHO AQGs. The mortality burden varied considerably between European cities, indicating where policy actions were more urgently needed to reduce air pollution and achieve sustainable, liveable and healthy communities.

20. An expert from the London School of Hygiene and Tropical Medicine (United Kingdom of Great Britain and Northern Ireland)) gave the study results of mortality caused by air pollution from the Multi-Country Multi-City (MCC) Collaborative Research Network. MCC used data from 753 locations in 43 countries during the period 1972–2019, including 120 million deaths. It used the flexible modelling framework allowing for modelling of complex exposure-response responses, pooling them across locations, assessing effect modification, obtaining impact measures, and projecting them under specific scenarios. The study showed the increase in risk for 10 µg/m^3 in pollutant in 653 cities and 24 countries: 0.44 per cent (PM_{10}), 0.68 per cent ($PM_{2.5}$) for total mortality; 0.36 per cent (PM_{10}) and 0.55 per cent ($PM_{2.5}$) for cardiovascular mortality; and 0.47 per cent (PM_{10}) and 0.74 per cent ($PM_{2.5}$) for respiratory mortality.[15] Short-term exposure of O_3 increased the mortality risk up to 0.18 per cent for 10 µg/m^3 in 406 cities and 20 countries.[16] Short-term exposure of NO_2 in 398 cities showed the increase in risk for a 10 µg/m^3: 0.49 per cent for total mortality; 0.37 per cent for cardiovascular mortality; and 0.47 per cent for respiratory mortality.[17] Mortality effects from CO were an increase in mortality risk of 0.91 per cent for a 10 mg/m^3 increase in 337 cities and 18 countries.[18] Effects from sulfur monoxide were an increase in mortality risk of 0.45 per cent for a 10 µg/m^3 increase in 399 cities and 20 countries. The study highlighted that different components of PM resulted in deeper increase of RR increase, especially when the concentration of ammonium (NH_4^+) increased and the concentration of nitrates (NO_3^-) decreased.

21. An expert from Santé publique France gave a presentation on the findings on air pollution reduction related to the spring 2020 lockdown and new data for total burden of impact for the period 2016–2019 in metropolitan France.[19] Quantitative health impact assessment guidelines on air pollution and health (QHIA-AP)[20] had been used for the study on a new quantitative health impact assessment of air pollution on mortality in metropolitan France. The study showed that the lockdown impacts of air pollution on mortality in France were 2,300 postponed deaths associated with a decrease in the population's exposure to PM, and 1,200 postponed deaths associated with a decrease in the population's exposure to NO_2. The study reconfirmed that public interventions appeared to significantly reduce air pollution levels, population exposure and the resulting impact on health in a rapid, measurable manner. It provided a unique opportunity to rethink sustainable interventions on sources of air pollution emissions. Some lessons could already be leveraged in terms of public action and behavioural changes (teleworking, travel modes, etc.) that would likely be lasting in society. Every year, nearly 40,000 deaths in France could be attributed to population exposure to $PM_{2.5}$ and 7,000 deaths to exposure to NO_2, representing 7 per cent and 1 per cent of total annual mortality in France, respectively. Study results served as a reminder that the total burden of air pollution on health remained significant in France. The lockdown restrictions had also had other consequences for the population's health, both positive (reduction in noise and road accident deaths) and negative (mental health problems, reduced or delayed screening and access to health care, reduced physical activity, increased sedentary behaviour,

[15] M.S. Cong Liu and others, "Ambient particulate air pollution and daily mortality in 652 cities", *New England Journal of Medicine*, vol. 381, No. 8 (August 2019), pp. 705–715.

[16] Ana M. Vicedo-Cabrera and others, "Short-term association between ozone and mortality: global two stage time series study in 406 locations in 20 countries", *British Medical Journal* (Clinical research ed.), vol. 368 (February 2020).

[17] Xia Meng and others, "Short-term associations of ambient nitrogen dioxide with daily total, cardiovascular and respiratory mortality: multilocation analysis in 398 cities", *British Medical Journal*, vol. 372 (March 2021).

[18] Kai Chen and others, "Ambient carbon monoxide and daily mortality: a global time-series study in 337 cities, *The Lancet Planetary Health*, vol. 5, No. 4 (April 2021), pp. e191–e199.

[19] M. Medina and others, "Impact of ambient air pollution on mortality in metropolitan France: reduction related to spring 2020 lockdown and new data for total burden of impact for the period 2016–2019", Summary/Studies and Surveys, Santé publique France, May 2021.

[20] Available at www.santepubliquefrance.fr/determinants-de-sante/pollution-et-sante/air/articles/pollution-atmospherique-evaluations-quantitatives-d-impact-sanitaire-eqis#block-204198.

etc.). These consequences highlighted the need to conduct more integrated assessments of health impacts that included the multisectoral consequences of interventions, particularly in terms of population compliance, behaviour, mental health and climate change.

22. A representative of the Netherlands provided an overview of a soon-to-be-published WHO report on dietary and inhalation exposure to nano- and microplastic particles and potential implications for human health. The representative highlighted that the report was expected to be finalized before summer 2021, concluding that: characterization and quantification of plastics in air were raising awareness about the importance of the atmospheric fate and transport of plastics and human exposure by inhalation; only a few studies had provided data on concentrations of microplastic particles in air, resulting in only a crude estimate of human exposure; the available data could not be used for a quantitative assessment of total human exposure; and the adverse effects of inhalation of plastics included oxidative stress, inflammation, lipid peroxidation, deoxyribonucleic acid (DNA) damage and aggravation of underlying effects, such as asthma and COPD. The expert also mentioned the key findings on air quality during the strict lockdown period until April 30, 2020. As compared with business-as-usual periods on a global scale, during lockdown there had been a 34 per cent reduction in NO_2, a 15 per cent reduction in $PM_{2.5}$ and an 86 per cent increase in O_3. NO_2 had been the pollutant most affected during the coronavirus disease (COVID-19) pandemic.[21] The representative also announced a webinar symposium on ultrafine particles, to be held on 18 May 2021.[22]

VI. Tools on air quality and health

23. A representative of the WHO European Centre for Environment and Health presented progress in the recent development of the WHO AirQ+ software. AirQ+ was a user-friendly software programme for estimating the magnitude of the most important and best recognized effects of air pollution in a given population. An updated and improved version of the WHO AirQ+ software had been used for more than 15 years. AirQ+ was designed for public health or environmental specialists with minimum knowledge of atmospheric modelling, statistical methods, epidemiology or geographic information systems (GIS). It could also be used for calculating: how much of a particular health effect was attributable to selected air pollutants; and, compared to the current scenario, what the change in health effects would be if air pollution levels changed in the future. Users could also change default RR or load their own data for pollutants not included in AirQ+ if RR was available. The software was downloadable online,[23] which allowed for statistical data to be gathered on its usage. A voluntary online survey had gathered 474 responses from 282 cities and 100 countries for the past five years, with a majority from academia, followed by national authorities and research institutes. There were more participants from the environment sector compared to the health sector. Its usage was mainly research-based, followed by health impact assessment and consultancy. The geographical level of analysis was local rather than regional and national level. Pollutants with the most interest were $PM_{2.5,}$ followed by PM_{10} and others. More than 80 per cent of participants in the online survey were interested in joining a forum for AirQ+ users. Internet search was the primary source for learning about AirQ+, followed by WHO presentations and scientific publication. There were ongoing efforts on update the software for users of the English-, French-, German- and Russian-language versions, ensuring that all bugs would be identified and fixed by May 2021. Future work included: receiving feedback on AirQ+ 2.1; developing AirQ+ 2.1.1-pol (Polish), AirQ+ 2.2 (English, French, German and Russian), AirQ+ 2.2.1-esp (Spanish), AirQ+2.3 (Economic module, only in English); identifying priority updates and improvements with a variety of experts; producing additional supporting documentation; harmonizing with other WHO tools; and carrying out dissemination activities.

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[21] Mehdi Amouei Torkmahalleh and others, "Global air quality and COVID-19 pandemic: Do we breathe cleaner air?", *Aerosol and Air Quality Research*, vol. 21, No. 4 (April 2021). Available at https://aaqr.org/articles/aaqr-20-09-covid-0567.

[22] See www.efca.net/files/UFP-Program_2021.pdf.

[23] Available at www.euro.who.int/en/health-topics/environment-and-health/air-quality/activities/airq-software-tool-for-health-risk-assessment-of-air-pollution.

24. An expert from Spadaro Environmental Research Consultants (United States of America) presented the WHO Carbon Reduction Benefits on Health (CaRBonH) calculation tool and illustrated it with a case study. CaRBonH was a decision-support tool developed to evaluate the health and economic co-benefits of climate change policies, with intended users including government planners and decision-makers at the local, national and regional levels engaged in coordinated climate policy intervention efforts. The time horizon of CaRBonH was 2030, which had been chosen to coincide with the first period of the Nationally Determined Contributions (NDCs). CaRBonH had two different modes of operations: basic analysis mode, where only emission information was needed; and advanced analysis mode, which might include, for example, population composition by age or gender, mortality data by illness or by age group, local economic data, source sect emission data, and also the option to include modelled exposures. The output from CaRBonH was population exposure changes at the national and regional levels, physical health benefits in terms of avoided premature mortality, as well as prevented incidences of illness in children and adults, and, lastly, economic assessment from monetized health benefits. For example, full implementation of the NDC commitments across countries in the WHO European Region could postpone annually 74,000 premature deaths, in addition to preventing 49,000 hospital admissions, 17 million lost workdays, and 1.9 million asthma attacks and 350,000 cases of bronchitis in young children. The economic benefit would amount to between $120 billion and $280 billion (2011 prices), which was equivalent to 0.5–1.2 per cent of the projected gross domestic product (GDP) of the region. A case study demonstrated the health co-benefits of carbon reductions linked to the NDC target of Pakistan. Using two scenarios of carbon reductions in Pakistan, 18,300 deaths or 74,500 deaths could be prevented, with associated economic benefits of $2,630 million and $10,650 million, respectively.

VII. Current activities and workplan of the Task Force on Health for 2022–2023

25. An expert from Ecometrics Research and Consulting (United Kingdom of Great Britain and Northern Ireland) shared views on the rationale for the update of 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* (the HRAPIE project),[24] with the questions: how best the Task Force on Health could address the review of the Gothenburg Protocol; and whether WHO had to retain the recommendations of the HRAPIE project. Many developments in health impact assessment had occurred since the publication of the HRAPIE project, including systematic reviews for the update of WHO Global AQGs, investigations into some particle fractions, investigations at lower concentrations, expansion of epidemiology to cover morbidity effects, and use of a broader range of concentration-response functions in policy studies. For mortality, the systematic review for WHO Global AQGs gave information on RR of 1.08 per cent per 10 µg/m^3 of $PM_{2.5}$, and NO_2 effect at the rate lower than in the previous studies. Nevertheless, further questions associated with mortality came up with the shape of CRFs at low concentrations and cut-off points for analysis. The expert highlighted that morbidity was a different issue. Examples of different results for morbidity assessment were provided for three countries: Sweden, United Kingdom of Great Britain and Northern Ireland and United States of America. Morbidity effects were set relative to mortality, with mortality valued using a consistent estimate of the value of a life year. In the United States of America, morbidity was added little to the mortality estimate; in Sweden, stroke was equivalent in economic value to about 40 per cent of the mortality burden; and, in the United Kingdom of Great Britain and Northern Ireland, morbidity of coronary heart disease, stroke, asthma and diabetes made a substantial impact in overall mortality estimate. Additionally, in relation to morbidity, the economic assessments in European countries and the United States of America included different sets of impacts for $PM_{2.5}$ and different valuations for common effects, hence different positions taken on response and valuation could have strong potential to change the conclusions of policy assessments. Far more effort in describing CRFs than in

[24] WHO Regional Office for Europe (Copenhagen, 2013). Available at https://apps.who.int/iris/handle/10665/153692.

defining impacts would be needed. The main issue with updating the HRAPIE project would be whether mortality and morbidity would be split into discrete packages to be reported on separately.

26. A representative of the WHO European Centre for Environment and Health provided suggestions for the next biennial workplan for 2022–2023, building on the main activities under the current Task Force on Health workplan. The proposed Task Force on Health workplan for 2022–2023 included the following activities:

(a) Consolidation of existing evidence on the health outcomes of exposure to air pollution, with the emphasis on promoting uptake and implementation of the updated WHO AQGs; the work on emerging issues and methods for health risk/impact assessment of air pollution and cost-benefit analysis, as a follow-up to the HRAPIE project;

(b) Capacity-building for the health impact assessment of air pollution at regional and subregional levels, including the development and implementation of capacity-building curricula to address different needs;

(c) Further development of methodologies for assessment of direct and indirect impacts of long-range transboundary air pollution on human health, through the updating of AirQ+ and CaRBonH;

(d) Development of communication strategies for health messages related to air pollution in Europe, through regional input to the global activity coordinated by WHO headquarters and workshops on communication strategies/risk communication;

(e) Review of the Gothenburg Protocol, through the preparation of a preparatory document in relation to the Task Force on Health.

27. In addition, the following activities were suggested by participants for consideration:

(a) Analysis and quantification of air pollution risk in the context of the COVID-19 pandemic;

(b) Collaboration with existing national-level projects for health risk/impact assessment of air pollution and cost-benefit analysis;

(c) Development of methodologies for the joint health impact assessment of air pollutants and some chemicals;

(d) Analysis of co-benefits and conflicting goals between climate change and air pollution effects on human health, including new sources such as forest fires and Saharan dust, building of secondary pollutants, atmospheric transport of pollutants, change in emissions.

28. In addition, a proposal was made to develop guidance for the medical community on how and what to communicate to the public at an individual level during episodes of increased air pollution, as well as to explore synergies and trade-offs between climate and the clean air agenda. After further discussion with the Parties, the draft version of the workplan for 2022–2023, including specific deliverables, would be submitted to the Convention secretariat.