AIR CONVENTION

(CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION)

Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP)

TASK FORCE ON INTEGRATED ASSESSMENT MODELLING (TFIAM)

49th session, 20 - 22 April 2020
Online meeting

Informal chairs report [DRAFT 2020-04-30]

I. INTRODUCTION

1. This report describes the results of the 49th session of TFIAM, held online from the 20th to the 22rd of April 2020. The presentations made during the meeting and the reports presented are available at: http://www.iiasa.ac.at/web/home/research/researchPrograms/air/policy/past_meetings.html.

2. Around 100 experts participated, representing the following Parties to the Convention: Canada, Croatia, Cyprus, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Poland, Portugal, Serbia, Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom of Great Britain and Northern Ireland, and the European Union. Other bodies represented were the EMEP Centre for Integrated Assessment Modelling (CIAM), the Task Force on Techno-Economic Issues (TFTEI), the Task Force on Hemispheric Transport of Air Pollution, the Task Force on Emission Inventories and Projections, the Task Force on Reactive Nitrogen, the World Health Organization/Task Force on Health, the Integrative Collaborative Program (ICP) on Vegetation, the Meteorological Synthesizing Centre-West (MSC-West), the Joint Research Centre of the European Commission (JRC), the European Environment Agency (EEA), WMO Global Atmospheric Watch Urban Research Meteorology and Environment (WMO/GURME), the European Environment Bureau (EEB) and CONCAWE.

3. Mr. R. Maas (Netherlands) and Mr. S. Åström (Sweden) chaired the meeting.

II. NEWS FROM OTHER BODIES AND OBJECTIVES OF THE MEETING

4. Mr. Maas and Mr. Åström summarized the recent activities under the Task Force, including the TFIAM-contribution to the 40 years anniversary of the Air Convention. They defined the purposes of the 49th TFIAM meeting (TFIAM 49): to assess the current status of integrated assessment models, to learn from national and local assessments and to prepare for the review of the Gothenburg Protocol.

5. Anna Engleryd, chair of the Executive Body of the Air Convention, presented the latest developments within the Air Convention and other air pollution policy arenas, and highlighted the decision to start the review process of the Gothenburg Protocol.

Bodies under the convention were requested to develop a work schedule to identify gaps in the current protocol and options for further steps, if needed. An assessment is needed of the policy consequences of reporting condensables emissions. She reminded the celebration of the 40-year anniversary in December 2019 and the decision to set up a global forum on air quality.

6. Stefan Åström introduced the work plan of the Task Force for 2020-2021, that was approved by the Executive Body (see annex 1).

III. UPDATES ON EUROPEAN SCIENTIFIC ASSESSMENTS

7. TFIAM took note of the presentation by Markus Amann, the head of CIAM, on the GAINS analysis of European air quality futures. With new regulation agreed after the revision of the EU Directive on National Emission Ceilings, and the new energy and climate measures, in many countries an overachievement is expected for the emission ceilings for SO_2, NO_x, PM2.5 and NMVOC by 2030. But, for ammonia current policy is not sufficient to meet the European emission reduction targets. To meet the 2030-targets, additional measures would be needed, with a total cost of around 0.5 billion euro per year. In wide areas of Northern Italy and Poland PM2.5 concentrations as calculated with the GAINS model will remain higher than the current WHO air quality guideline values for PM2.5 (10µg/m_3 in ambient air). This exceedance is due to high secondary inorganic aerosols (related to ammonia emissions) and domestic solid fuel burning. With current policies 50% of the ecosystems will remain at risk due to nitrogen deposition. Also in this case, ammonia is the main culprit. For NO_x, shipping emissions in the seas around the continent still are increasing and will exceed the EU28 emissions on land. Abatement measures for shipping are cost-effective.

8. Enrico Pisoni (JRC) introduced work planned under the Forum for air quality modelling in Europe (FAIRMODE) and mentioned three topics for possible cooperation with TFIAM and the Expert Panel on Clean Air in Cities (EPCAC): source apportionment approaches, guidelines for local air quality plans, and modelling intercomparison activities. Furthermore, it was mentioned that the work to address the 'Covenant of Mayors' impact on air quality is still going on. New results will soon be published and will address trade-offs between local climate measures and air quality. An integrated approach, including energy and traffic policies is recommended.

9. Mike Holland (EMRC) presented an overview of health impact assessment and valuation in several countries. WHO-Europe provided extensive review of health response functions in the 2013 REVIHAAP and HRAPIE studies, a major initiative, funded by the European Commission, involving over 100 experts from Europe and North America. However, those recommendations are now becoming outdated given the publication of new epidemiological studies in the years since. These studies provide new insight on the slope of response functions and link to additional health endpoints, some of which have high prevalence in the population and cause long term and serious effects on impacted individuals (including stroke, dementia and diabetes). The valuations used previously appear likely to underestimate damage. Review undertaken as preparatory work for the EC's Second Clean Air Outlook concludes that the new findings could lead to a significant increase in damage costs of air pollution. However, the review also found no consistency in the response functions adopted by different European authors. The paper, that will be published this

summer, recommends that for future European analysis the HRAPIE functions are retained to provide a consistent baseline until further detailed review is undertaken, with sensitivity analysis carried out to bring in additional impacts such as stroke, that may add significantly to damage estimates. An update of mortality valuation can be achieved by reference to OECD recommendations. updates of some other valuations is also appropriate, e.g. on hospital admissions. Labour productivity impacts are still uncertain.

10. Simone Schucht (INERIS) and Mike Holland (EMRC) presented ongoing work by the EEA's Topic Centre on Air Pollution, Transport, Noise and Industrial pollution. Based on a review in 2019 of the approaches applied to quantify damage cost per tonne of pollutant calculations suggestions were done for the update of earlier EEA-work in 2020. For the main air pollutants (NH_3, NO_x, SO_2, NMVOCs, PM2.5) it is recommended to include health impacts from NO_2 and mortality valuation in line with the OECD 2012 meta-analysis, to include impacts on buildings also from PM2.5, and to include ecosystems impacts from eutrophication. For toxic metals, including mortality impacts will increase estimated damage significantly. For greenhouse gases, including methane and nitrous oxide and using the marginal abatement cost used in DG MOVE's 2019 Transport cost handbook was recommended. The 2020 report is due in December with results on damage costs per tonne of pollutant and externalities of industrial facilities in EU28.

11. Felicity Hayes (ICP Vegetation) presented activities and achievements of the ICP Vegetation, that can be used for review of the Gothenburg Protocol. The ozone damage to crops is still significant. In 2010 more than 7% of the global wheat yield was lost due to ozone damage. With current ozone trends, the yield loss will be 6.5% in 2030. Reductions of ozone precursors in UNECE countries were partly nullified by increasing emissions of methane and of nitrogen oxides in the northern hemisphere.

12. Simone Schucht (INERIS) presented conclusions from the French research project APollO assessing the economic impacts of ozone on crops and forests in the period from 1990 to 2030, calculated for the stomatal ozone flux concept. Contrary to the AOT40 metric that shows a decreasing trend between 1990 and 2010 everywhere across EU28, results for Phytotoxic Ozone Dose metric (POD) are region and crop species dependent. Results show a trend towards reduced ozone impacts also for POD when aggregated over France and EU28, but a more disaggregated view indicates increases in ozone impacts in certain regions, depending on the crop species. Despite an overall decreasing trend in France between 1990 and 2030, impacts in terms of yield losses and economic damage remain significant. Consulted experts from the agricultural chambers in France consider strategies to adapt to ozone pollution, as suggested in the literature, unfeasible. This would suggest that, in order to limit ozone damage on crops and forests, international strategies to reduce ozone precursor emissions might be more appropriate than adaptation strategies by the sector.

13. Markus Amann (CIAM) presented a global assessment of air quality. Policy interventions were instrumental in decoupling energy-related air pollution from economic growth in the past, and further interventions will determine future air quality. At the global scale, even full implementation and enforcement of current policies are unlikely to reduce present exposure (and health burden) from air pollution in the next 20 years. Improvements in North America, Europe and East Asia will be compensated by further deterioration in South Asia, Africa and the Middle East. Theoretically, a portfolio of ambitious policy interventions could bring ambient

PM2.5 concentrations below the WHO air quality guideline in most parts of the world, except in areas where natural sources (e.g., soil dust) contribute major shares to or even exceed the current guideline value. Such a portfolio needs to integrate over multiple policy domains: environmental policies focusing on pollution controls; energy and climate policies; policies to transform the agricultural production system; and policies to modify human food consumption patterns. None of these policy areas alone can deliver clean air, and interventions need to be coordinated across sectors. These policy interventions would require fundamental transformations of today's practices in many sectors. They are visionary but considered likely to be technically achievable in the future. Political will could emerge from a solid understanding of the full range of benefits, including their contributions to the UN Sustainable Development Goals. Lowering emissions from agricultural activities and meat production will be critical for achieving clean air worldwide.

14. Tiziano Gallo Cassarino (University College London) presented results of a ESTIMO-model scenario with low CO_2-emissions in Europe based on renewable energy and an optimal interconnection of the European energy network. Energy systems with a high share of heat pumps with heat storage can meet heat demand without emissions, even in case of weather extreme events. Heat storage is efficient, cheap, and can meet seasonal demand, so it is a critical component for net-zero energy systems. Benefits of heat storage are present also when the share of district heating or consumer heat pumps is small. A high share of hydrogen requires much more electricity than other architectures, due to the lower efficiency of hydrogen systems compared to heat pumps. A high interconnection capacity among the European countries can reduce storage needs by at least 30% and eliminate the consumption of polluting energy sources (biomass and natural gas). ESTIMO could provide additional energy scenarios as input to integrated assessment models.

15. Elias Giannakis (The Cyprus Institute) presented a cost-benefit assessment of ammonia emission abatement options. The costs of compliance of the agricultural sector with the commitments of the European air quality regulatory framework are much lower than the economic benefits. More ambitious reduction commitments for ammonia emissions could be applied by EU-28 countries with relatively low costs. The exceedance of economic benefits over farmers' abatement costs may indicate the need of transferring part of the societal benefit of reduced ammonia emissions back to the farmers in the form of investment support for the abatement measures. The Common Agricultural Policy through rural development policy measures could contribute to meeting those emission reduction commitments. A better integration of agricultural and air quality policies could further lead to reduced air pollution and health impacts in Europe.

IV. UPDATES ON NATIONAL SCIENTIFIC ASSESSMENTS

16. Stefan Reis (Centre for Ecology and Hydrology) presented a recently started research project, funded by the UK National Institute for Health Research (AMPHoRA - Assessing Mitigation Pathways to Realise Public Health Benefits of Air Pollutant Emission Reductions from Agriculture). The project aims to quantify the impact of past and future actions aimed at emissions reductions. It will examine how these actions can best be aligned with the steps needed to achieve vital objectives for greenhouse gas reductions in the agriculture sector, and improve diets for human

health and well-being, as emphasised e.g. by the Lancet Commission on Food, Planet, Health.

17. Guus Velders (RIVM) presented an assessment of the health impacts in the Netherlands of European air quality policy over the past decades. Policies implemented since the 1970s to improve the air quality have resulted in decreases in emissions in many countries with corresponding reductions in concentrations of sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and particulate matter (PM). The effects of emission reduction policies is estimated by comparing two scenarios. A Baseline scenario with actually reported emissions and a World Avoided scenario which assumed that no air quality policies were adopted from 1980 onwards and which would result in the growth in emissions of air pollutants. In 2015, the avoided concentrations of air pollutants correspond to about 700,000 avoided years of life lost in the Netherlands per year, with an associated number of avoided attributable deaths of about 66,000 per year, and an increase in average life expectancy of about 6 years. The corresponding avoided monetary health damage amounts to between € 35 and € 77 billion per year in 2015.

18. Francesco Ferreira (Universidade Nova de Lisboa) presented the air quality effects of the 2050 carbon neutrality roadmap for Portugal. Most air pollutants and greenhouse gases have common sources, which mainly arise from fuel combustion and industrial processes, and the benefits from a greenhouse gases emissions driven strategy will have a considerable impact on lowering several pollutant emissions. In the case of Portugal it is technological feasible to achieve carbon neutrality by 2050 using technologies and processes known today (with varying degree of maturity). All sectors of the economy contribute to the trajectories of carbon neutrality, although with different intensities. The strategy will reduce NOx-emissions significantly, even without additional air pollution abatement measures. There are indications that it is not possible to achieve a significant reductions in industrial process emissions, such as cement, paper and glass. Biomass burning also makes it difficult to comply with PM2.5 national emissions ceilings in the case of Portugal. Ammonia emissions will not be influenced by the roadmap.

19. Helen Apsimon (Imperial College) reminded that modelling with UKIAM showed a big improvement in total PM2.5 concentrations in the UK by 2030 assuming international and UK compliance with the NECD, but that still exceedances of the WHO air quality guidelines were expected in city areas due to local primary PM2.5 emissions. The UK government is committed to setting a target for annual mean PM2.5 in the Environment Bill. She explored approaches that avoid a focus on hot-spots solely, as with limit values for NO_2. Alternatives aim to combine reducing the average exposure based on population weighted mean concentrations (PWMC), as an indicator of overall exposure and health benefit, and reducing exposure locally where the WHO guideline is exceeded, using the population weighted mean exceedance (PWME), as a second indicator. These twin indicators have proved informative and relatively robust in comparing "What if" scenarios. However there are many modelling uncertainties with emissions, atmospheric dispersion, and issues of scale. For a legally binding target there needs to be a robust protocol for monitoring progress and compliance which raises the issue of how measurements and modelling can best complement each other.

20. Marta Garcia Vivanco (CIEMAT) presented results of the Spanish National Air Pollution Control Programme for air quality and health. Meeting the VOC-emission

ceiling will remain a challenge. Paint and solvent use are the main sources. In spite of a decrease in the number of non-compliant zones, ozone concentrations will remain too high over some areas, even with additional measures to reduce VOC-emissions in Spain. The envisaged reduction of NOx-emissions will reduce health risks from NO2-exposure and, for most of the country, from O3 exposure. Nevertheless, due to the titration effect, the health risks from ozone exposure could increase over cities such as Madrid and Barcelona. It should be noted that there are still many uncertainties related to the emissions, meteorology, boundary conditions and spatial resolution used.

21. Dušan Todorović (University of Belgrade) presented experiences with the development of national emission reduction scenario's for Serbia using the GAINS model, in preparation for negotiation on the accession process to EU, and supported and funded by The Environmental Accession Project (ENVAP3). Data from Serbian institutes and from international organizations were compared. Results obtained, so far, represent a good basis for further calculations and defining the negotiating position in relation to the NECD. This capacity building project raised the awareness of the considerable emission reduction potential in Serbia.

22. Joanna Strużewska (Institute for Environmental Protection Poland) presented assessments of the impacts of local air quality plans in Poland and the impacts of the National Emissions Ceiling Directive. Local emission reduction strategies proved to be insufficient to meet air quality targets. The transboundary impacts requires bilateral cooperation and information exchange. The impacts of ammonia reductions were not yet considered.

23. Stefan Åström (IVL) presented damage due to shipping emissions on the Baltic to health and ecosystem on land and the Baltic sea itself. Both damage categories seemed to be equal. Other (preliminary) work indicated that more abatement measures become cost-efficient when transboundary health benefits would be included. If all countries would only look at the benefits within their own country the European result would be suboptimal, compared to a co-operative approach.

V. EXPERT PANEL ON CLEAN AIR IN CITIES

24. Guus Velders (Netherlands) presented the results of the first meeting on 27 November in Bratislava[1]. Significant local sources in the most polluted cities are traffic and residential heating. The import of pollution from surrounding areas and countries is also important. WHO guidelines cannot be achieved unless these sources are also addressed, emphasizing the need for multi-scale modelling. Cities are net exporters of pollution. Advanced approaches combining local models and regional models that take into account chemical and meteorological processes on various scales are becoming available and offer possibilities for more robust analysis for formulating effective measures and policies. A variety of models were presented dealing with this issue, some complex requiring expert use, and some less complex are openly available. Both types of model have roles to play in effective air quality management: there is a need to better define how the findings of complex modelling can be integrated with local decision making. Estimation of local exceedances of air quality limit values requires other model characteristics (and measurement strategies) than estimation of the average exposure of the population in a city and the associated

[11] https://iiasa.ac.at/web/home/research/researchPrograms/air/policy/Report_Expert_Panel_on_Clean_Air_in_Cities_27-11-2019.pdf

health impacts. There is limited data availability on the costs, air quality benefits and co-benefits of local measures, particularly those involving behavioral change (e.g. modal shift in transport). Further work should be undertaken to fill this gap to improve efficiency of future air quality action planning.

25. EPCAC will now move into the next phase of initiating expert discussion and examination of current and emerging solutions to improve air quality in cities, including aspects that need to be strengthened e.g. monitoring, modelling assessments, technological and nature-based solutions, as well as air quality management options and public engagement. TFIAM and EPCAC have already brought together a large section of the science and city governance communities via the workshop in Bratislava and has started to review and highlight some of the latest developments through invited experts. This it has done very effectively. The success of EPCAC depends on it coming up with concrete recommendations and guidance for cities which has to include a regional context. Within the wider TFIAM framework, it will start to define a work programme in cooperation with other international groups such as WMO/GURME, WHO, CCAC, C40, etc.

26. TFIAM took note of the report and recommended to increase efforts to involve more experts from cities, both from UNECE countries as well as from outside the UNECE-region, as clean air in cities is a universal issue. Several suggestions were made for the EPCAC work plan, including improved local emission inventories, including health benefits of local action outside the city, and use of artificial intelligence models. TFIAM recommends to focus cost-effective measures to reduce average population exposure, but also look at the cost-effectiveness of measures to protect highly exposed groups.

27. Ranjeet Sokhi (World Meteorological Organization) presented developments in air quality modelling to support initiatives on clean air in cities on the basis of linked global and regional atmospheric models as applied in GURME, the Global Urban Research Meteorological and Environment project. Air quality in cities is determined by a range of contributions from local to regional sources. The mix of these contributions, for example, to PM2.5 concentrations in a city will depend on a number of factors, including the geophysical characteristics of the city, local and regional emission sources, prevailing meteorology, as well as atmospheric chemistry. Analysis with a combination of complex regional and urban scale models supported by observations reveals that that PM2.5 levels within a city can be due to local contributions (30% to 60%) and up to 70-80% due to long range transport. In addition, these relative contributions vary spatially within the urban area. This heterogeneity coupled with movement of people can dramatically affect population exposure to air pollutants such as PM2.5. It is important to arrive at a mix of simple and complex tools to support cities to implement effective air quality management strategies.

28. Mark Barrett (University College London) presented the linkages between (near) zero greenhouse gas emissions energy systems and air pollution, based on the ESTIMO-model. Renewable energy, apart from biomass burning, will have low air pollution emissions. The reduction of PM-concentrations will also depend on ammonia emission reductions in agriculture. Most energy demands in the stationary sectors and land transport can be electrified, with consequent low city emissions except for PM from vehicle tyres etc. New processes will be required. E.g., electrofuels (electrolytic hydrogen, ammonia) are required for fuelling ships and for

energy storage; and synthetic kerosene made from carbon and hydrogen is required for aircrafts. The carbon could come from waste biomass or biocrops, or possibly direct air capture. New emissions could arise from these processes. A significant and complex issue will be the impacts of biomass sourcing and processing. Further research into these processes and their emission factors would improve the calculation of air pollutant emissions arising from low greenhouse gas energy scenarios as input to integrated assessment models or city models.

VI. PROGRESS OF THE TFIAM WORK PLAN (annex 1)

Assessment of the costs of inaction

29. Katarina Yaramenka and Stefan Åström (IVL) presented the progress of the report on the costs of inaction. The report is sponsored by Norway. Estimates showed that the costs of implementing the amended Protocol's emission reduction measures would be equivalent to less than 0.01% of GDP for the EU. Given that the costs of healthcare and lost workdays due to air pollution are estimated at between 2.5% and 7% of GDP per year in Western Europe and at or above 10% of GDP per year for 10 countries in the pan-European region, this makes the agreement a highly cost-effective policy solution. The costs of additional abatement (the costs of taking action) are significantly lower than the costs of inaction.

30. With respect to the update of GAINS control cost data, TFTEI continues to regularly update cost data and is currently focussing on the costs to reduce emissions from the aluminium and cement industry, shipping emissions and methane emissions from municipal waste and gas distribution networks which they would be able to present by the end of 2020.

Ammonia Assessment report

31. Rob Maas (RIVM) introduced the draft ammonia assessment report[2]. Its' goal is to raise more policy attention for ammonia abatement. The report describes the damage of ammonia to public health and biodiversity. The abatement costs are around ten times lower than the costs on inaction. Meat and milk would be 40-50% higher if the damage would be included in its true price. Expert from several bodies under the convention were invited to react and add to this draft.

32. TFIAM took note of the report. Suggestions were made to emphasize uncertainties in emissions and in damage estimates, as well as to include the suggestion to use the investment support schemes of the European Common Agricultural Policy to meet the ammonia emission reduction commitments and maintain the competitiveness of the European agriculture.

Preparation of the review of the Amended Gothenburg Protocol

33. Stefan Åström presented the following questions that TFIAM could answer in support of the review of the amended Gothenburg protocol:

- What will emissions and environmental impacts be in 2030 and beyond following a full implementation of the annexes of the Amended Gothenburg

[2] https://iiasa.ac.at/web/home/research/researchPrograms/air/policy/Assessment_Report_on_Ammonia_20200410.pdf

Protocol? (How far away will we be from environmental targets? What will be the costs of inaction?)

- What is the potential for further emission reductions in 2030? (Alignment with a 'OC/BC-optimal' control strategy? (OC including condensables); what if EECCA were to sign up to the technical annexes (ELVs)?)
- Gaps: what does the Gothenburg protocol pay insufficient attention to? (Ammonia and biodiversity? Short-lived climate forcers? Shipping? Ozone precursors (incl. methane) outside European UNECE? Impacts of air pollution on the marine environment?
- What are the low-hanging fruits for further emission control?
- What is the socio-economically efficient emission reduction in the European UNECE region in 2030 (where marginal costs are equal to the marginal benefits)?

34. The list covers to a large extent the questions defined by the by the Working Group on Strategies and Review in May 2019. Participants stressed that some elements were not yet covered by the proposed questions, e.g. the impacts of adjustment procedures, local air quality, and potential measures not only in the UNECE-region, e.g. related to methane and shipping emissions. It is expected that trends in air quality and effects will be taken up by other bodies, e.g. the Task Force on Measurement and Modelling and the working group on effects (including metrics for health impacts, and the combined impacts of climate change, ozone damage and nitrogen on biodiversity). Improvement of emission inventories is the core business of the Task Force on Emission Inventories and Projections. Identification of bottlenecks in implementation and benefits of flexibilities remains the responsibility of the Working Group of Strategies and Review.

35. Other items of concern relate to the review of the amended Gothenburg protocol is to what extent the questions suitable for analysis by TFIAM and CIAM should be extended so as to also incorporate analysis by other bodies of the Air Convention (such as ICP Forests, ICP Vegetation etc.). Here guidance from WGRS is sought. The challenges of reviewing the effect of the amended Gothenburg protocol in EECCA countries as well as challenges with financing benefit assessments was also brought up.

Other workplan items

36. For the other workplan items in which TFIAM/CIAM is a leading or contributing group there are several that could benefit from input by TFIAM participants. WP item 1.1.1.2 is already initiated inter alia with ongoing discussions between CIAM and other expert groups in Europe. Further, related research in Poland is ongoing and is beginning in the UK. Also other groups under the Air Convention are working with improving the representation of condensables in their fields, and there is a need for coordination of the efforts by the groups.

37. Regarding assessment of observed trends of air pollution, assessment of long-range contribution to urban air pollution and linkages between global and regional air pollution (WP 1.1.3.2) there will come useful input from Ciemat in Spain, hopefully by 2021, as well as more long-term input from research in the UK. The EPCAC road

map (WP 1.1.4.1) is under development and a draft will be presented to the EMEP Steering Body in September 2020. The opportunities to launch investigations on global scenarios and assessment of global sectorial mitigation measures (WP 1.1.4.4) will be discussed via an online meeting between the chairs of TFIAM and TFHTAP sometime during the first half of 2020 and the status of the item will be presented at the EMEP Steering Body (S. Åström coordinates). There are already today methane scenarios and shipping scenarios available, but it is important to discuss if the scenario setups will allow for guidance on policy priorities between local/regional NO_x abatement versus global CH_4 abatement. A similar item covering control strategies to be used by TFHTAP (WP 2.1.3) would at this stage benefit from an initial comparison of existing knowledge produced within TFHTAP and the policy questions asked by the report of the Air Convention policy response group in 2017.

38. The proposed review of the GAINS model control costs (WP 2.1.6) can benefit from the numerous technical reports on emission control technologies and costs in aluminium industries, cement industries, shipping, municipal waste, gas distribution networks, large combustion plants and medium-sized combustion plants already produced by TFTEI. There are however still no plans for a new assessment of ammonia control costs, and here TFRN should be asked for input. There is to this date no group or organisation volunteering to lead or funds available for reviewing the costs in the GAINS model database. The development of guidance on which PM2.5 control measures that should be prioritized to maximise effect on BC emissions (WP 2.1.7) will be financed by contribution from the EU-funded EUABCA project, and support from TFTEI. Polish experts might contribute with input. A draft guidance document will be presented to the EMEP Steering Body in September.

Overall conclusions

39. There was no focus on the 2020 emission levels at TFIAM 49. But based on the presentations of emission scenarios during the meeting, TFIAM concluded that for most countries emissions in the current decade should become much lower than the emission targets set in the amended Gothenburg protocol and for the EU countries the targets set in the NEC Directive, given the assumption that the emission limit values in the protocol annexes and current climate policies are fully implemented. This suggests that any future revision of emission targets easily can be more ambitious than the targets in the amended Gothenburg protocol. The exception from the analysis is, yet again, ammonia, where the outlook is that more measures will be needed to reach existing targets. Additional reductions would occur when the use of fossil fuels is further reduced. However – due to the limited reduction of ammonia emissions, nitrogen depositions will remain too high in 50% of the ecosystems. In 2030 the contributions to PM2.5 concentrations which are modelled with GAINS exceed 10 $\mu g/m^3$ (the current WHO guideline values for PM2.5) in wide areas of Northern Italy and parts of Poland due to the high share of secondary inorganic aerosols and primary emissions from solid fuel domestic heating. Health risks and crop damage due to ozone will also remain a problem with increased emissions of NO_x and methane in the Northern hemisphere. In Europe, NO_x emissions from ships will exceed the NO_x emissions on land before 2030. Trade-offs between policy areas call for an integrated approach of air quality management, climate and energy policy, as well as agriculture and food.

VII. ANY OTHER BUSINESS

40. The 50th session of TFIAM will take place in April 2021. One suggested topic for focus is to discuss what lessons that can be learned from the current COVID19 pandemic with respect to behavioural change measures to reduce emissions, and how these measures affects emission scenarios. The second EPCAC will take place on the 29th of September 2020.

41. Several participants suggested that there is a need for more (online) meetings than one per year and that a virtual forum could help interactions between national integrated assessment modellers to exchange experiences, to consult each other (e.g. on missing sources) and to improve the modelling of (projected) transboundary pollution. Experts from Sweden, the UK, Serbia and Germany offered to develop a first plan for such a forum. One topic to address will be on how to interpret exceedance of the WHO air quality guidelines.

42. Several participants suggested to improve estimates of health risks based on the actual exposure of the population and include indoor air pollution. Indoor air quality can be worse than outdoor air quality due to internal pollution sources such as smoking, cooking, solid fuel burning and volatile compounds from materials and solvents use. Experts were invited to present available knowledge in future meetings of TFIAM or EPCAC.

Annex 1: 2020-2021 Workplan items

Decided at the 39th Executive Body of the Air Convention
(https://www.unece.org/fileadmin/DAM/env/documents/2019/AIR/EB/ECE_EB.AIR_144_Add.2-2001545E.pdf)

WP item	Activity	Outcome	Lead Body(ies)	Resources
1.1.1.2	Harmonize PM inventory emissions and modelling, accounting for condensables	Expert workshop(s) on condensables (2020-2021, as needed) + Reporting to EMEP Steering Body	MSC-W and other relevant bodies, notably CEIP, TFMM, TFEIP, TFIAM, TFTEI	Nordic Council of Ministers/other sources
1.1.3.1	IAM-Framework for the review of the amended Gothenburg Protocol (AGP), Assessment of extent to which long-term targets will be met (in 2020–2030–2050)	Position paper for the review of AGP (2020) Data and scenario analyses (2021)	TFIAM and CIAM	In-kind + EMEP mandatory contribution
1.1.3.2	Assessing observed trends in air pollution at the various scales Follow-up on the measurement (twin-sites) and modelling approaches to assess the long-range contribution to urban air pollution. Linkages between global and regional air pollution	Note to the review of the Gothenburg Protocol (2020)	TFMM, TFHTAP, TFIAM, MSC-W	In-kind
1.1.3.3	Ammonia: Contribute to improve understanding of expected benefit of ammonia mitigation	Ammonia assessment report in 2020	TFIAM with support from TFMM, TFRN and national experts	In-kind
1.1.4.1	EPCAC road map	Position paper on multiscale interactions (2020) Two annual meeting of EPCAC (2020 and 2021)	TFIAM with nominated experts	In-kind
1.1.4.4	Investigations on global scenarios and assessment of global	Report (2021)	TFIAM and TFHTAP	In-kind

WP item	Activity	Outcome	Lead Body(ies)	Resources
	sectoral mitigation measures			
2.1.3	Discuss control strategies to recommend for use by the TFHTAP of air pollution in future scenarios	Development of policy questions + recommendations on priority sectors	WGSR, TFIAM,TFHTAP	
2.1.6	Undertake a review of the control costs currently used with a view to improving –on an ongoing basis – the cost-effectiveness analyses produced by the GAINS model	Review of control costs currently used and update	TFTEI, TFIAM	Funding needed
2.1.7	Produce a report for policymakers that clearly sets out the costs of controls versus the costs of inaction	Report for policymakers	TFTEI, TFIAM	Norway has kindly contributed
2.2.1	Development of guidance in relation to prioritizing reductions of particulate matter from sources that are also significant sources of black carbon	Draft guidance document submitted for adoption by the Executive Body at its 40th session	TFTEI, TFIAM	Currently the project EUABCA will contribute, but more in-kind is welcome