UNITED NATIONS

E

Economic and Social Council

Distr.
GENERAL

ECE/EB.AIR/WG.5/2007/18
6 July 2007

Original: ENGLISH

ECONOMIC COMMISSION FOR EUROPE

EXECUTIVE BODY FOR THE CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION

Working Group on Strategies and Review

Fortieth session
Geneva, 17–20 September 2007
Item 6 of the provisional agenda

PARTICULATE MATTER

Report of the fourth and fifth meetings of the Expert Group on Particulate Matter

Note by the Co-Chairs of the Expert Group

INTRODUCTION

1. The present report was prepared by the Co-Chairs in collaboration with the secretariat. The fourth meeting of the Expert Group on Particulate Matter was held in London on 5 and 6 October 2006, and the fifth meeting was held on 24 and 25 May 2007 in Langen, Germany.

2. Experts from Austria, Azerbaijan, Belgium, Bulgaria, Canada, the Czech Republic, Estonia, Finland, France, Germany, Hungary, Italy, Latvia, the Netherlands, Norway, Poland, the Russian Federation, Serbia, Spain, Sweden, Switzerland, the United Kingdom of Great Britain and Northern Ireland and the United States of America attended at least one of the meetings. Experts from the EMEP Centre for Integrated Assessment Modelling (CIAM)

participated in one of the meetings. The Working Group on Strategies and Review, the Steering Body to EMEP[1], the Task Force on Integrated Assessment Modelling, and the Task Force on Heavy Metals were represented at least at one of the meetings. Representatives of the Union of the Electricity Industry (EURELECTRIC) attended the fourth meeting, and a representative of the Oil Companies' European Organization for Environment, Health and Safety (CONCAWE) attended both meetings. The UNECE secretariat was represented at the fourth meeting.

3. The meetings were chaired by Ms. M. Wichmann-Fiebig (Germany) and Mr. J. Rea (United Kingdom).

4. The Expert Group discussed and finalized its report on particulate matter (PM) in accordance with the agreed outline as presented to the thirty-eighth session of the Working Group (ECE/EB.AIR/WG.5/2006/8, annex 1).

5. The report had five main objectives: (a) to provide information on the transboundary characteristics of PM and its precursors and on the contribution of key economic sectors to ambient concentrations of primary and secondary PM; (b) to summarize the available evidence on health impacts from PM; (c) to assess the degree of control of anthropogenic emissions of PM and its precursors by existing protocols, current national and international legislation and forthcoming strategies; (d) to identify key sectors contributing to primary and secondary PM concentrations for distinct economic regions of the Convention area and assess their abatement potential; and (e) to explore, from a technical point of view, the requirements for potential options to address PM within the Convention. The full report would be made available on the Internet at http://www.unece.org/env/pm/meetings.htm. The main findings of the report, options for addressing particulate matter, and the Expert Group's conclusions are presented below.

I. SUMMARY OF CURRENT EVIDENCE

6. When compiling its report the Expert Group consulted reports and results from several other bodies under the Convention, in particular from CIAM, the EMEP Meteorological Synthesizing Centre-West (MSC-West), the Task Force on Emission Inventories and Projections, the Task Force on the Health Aspects of Air Pollution, and the Task Force on Heavy Metals.

7. From these documents and from further information available to it, the Expert Group considered that the current state of evidence related to PM could be summarized as follows:

[1] The Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe.

(a) The Expert Group adopted the World Health Organization (WHO) finding that PM caused substantial adverse health effects whereby premature deaths could primarily be attributed to the fine fraction PM ($PM_{2.5}$). There were also significant health effects associated with PM_{coarse} ($PM_{2.5\text{-}10}$). No threshold could be identified below which no adverse effects were to be expected. There were some indications that primary particles from combustion sources were particularly important for health, but it was premature to rule out any other of the anthropogenic sources from contributing to adverse health effects;

(b) Characteristics, size distribution and relevant sources of PM showed a wide variation across the Convention area;

(c) In many countries more than half of the $PM_{2.5}$ regional background concentration might be attributed to the transport of long-range transboundary air pollution. Although in urban areas local sources could contribute significantly to the total concentration, long-range transboundary transport was still an issue. For PM_{coarse} concentrations, the long-range transboundary contribution was smaller but still significant;

(d) The transboundary contribution to the PM concentration was mainly due to secondary particulates, which were formed from emission of precursors such as sulphur dioxide (SO_2), nitrogen oxides (NO_x) and ammonia (NH_3) and certain volatile organic compounds (VOCs);

(e) Addressing precursor emissions might reduce the transboundary contribution, but not necessarily the potentially higher risk from local, low-level primary sources in urban areas. Their contribution to exposure in densely populated areas was likely to be underestimated by modelling which averages concentrations over large areas. As such, cost-effective reductions in local PM levels should also address emissions from local low-level sources;

(f) Current assessments of sources and concentrations of PM contained significant uncertainties. Improved inventory, modelling and monitoring methods together with more widespread measurements would help reduce these uncertainties;

(g) Non-industrial combustion, such as domestic heating by solid fuels, was one of the major key sources of primary $PM_{2.5}$ emissions in all parts of the Convention area. Other important sources were production processes and road transport;

(h) Production processes and agriculture were the major sources for PM_{coarse} in the European Union (EU) countries. In the non-EU European countries, in addition, energy industries and non-industrial sources, as well as industrial combustion, added significantly to PM_{coarse} emissions.

(i) Many relevant sources were already subject to control under protocols to the Convention. However, some sources of primary PM emissions, e.g. in non-industrial combustion and in a selection of industrial sectors and agriculture, were not included;

(j) In 2020, total primary $PM_{2.5}$ emissions from the EU-27 were expected to be half the 2000 total due to implementation of current EU legislation as well as the Gothenburg Protocol and the Protocol on Heavy Metals. Total primary PM_{coarse} was expected to decrease by about 25 per cent. For both fractions, no substantial reductions were predicted in European non-EU countries;

(k) With currently available technical measures[2] there existed a potential for further reduction of primary $PM_{2.5}$ emissions of 40 per cent of the projected 2020 total within the EU-27, and of 70 per cent in European non-EU countries. Of the 70 per cent, one third could be achieved by full implementation of current regulations and two thirds by applying further measures. Figures for PM_{coarse} were estimated to be similar;

(l) The potential for further reduction of PM precursor emissions with currently available technical measures was estimated to be in the order of 40 per cent for SO_2, 15 per cent for NO_x and 10 per cent for NH_3 of the projected 2020 total within the EU-27. Figures for European non-EU countries were not available to the Expert Group, but could be expected to be generally higher;

(m) In using a multi-pollutant/multi-effects cost optimization, the European Commission's Thematic Strategy aimed at a further 15 per cent reduction, i.e. beyond that achieved by current legislation, of health effects from $PM_{2.5}$. It was estimated that this additional improvement was equal to a monetized benefit of at least €42 billion. It was found that within the EU-25 an additional investment of €7.1 billion would be needed to achieve this target together with further improvement in acidification, eutrophication and ozone effects. Out of this €0.6 billion would be spent on primary PM reduction, excluding costs of measures on road traffic;

(n) A predominant focus on reduction of secondary PM precursors would disregard the potentially higher risk from local, low-level primary sources in urban areas. The contribution of these urban sources to exposure in densely populated areas was likely to be underestimated by modelling, which averaged concentrations over large areas;

[2] E.g. maximum reduction considered in the RAINS model of CIAM.

(o) There was increasing evidence that there were significant benefits to linking air pollution and climate change policies. Synergies as well as potential trade-offs between air pollution and climate change policies needed to be considered when developing a PM abatement strategy.

8. The Expert Group concluded that $PM_{2.5}$ concentrations could be cost-effectively reduced in the Convention area on the basis of a common harmonized abatement strategy. While most of the technical work under the Convention had focused on $PM_{2.5}$ following the conclusions of WHO on its risk to health, it should be remembered that $PM_{coarse,}$ caused adverse health effects as well, but had a smaller, though still significant, long-range component, and could also be controlled in the same way, should the Executive Body decide to include it.

II. OPTIONS FOR ADDRESSING PM UNDER THE CONVENTION

9. The Expert Group considered options for controlling PM under the Convention. In each case the option is described in broad terms and some of the defining characteristics discussed. Many of these options can be combined. They could be implemented through revision of existing Protocols (Gothenburg or Heavy Metals) or through a new Protocol aimed specifically at PM. Further discussion of the appropriate implementation route was beyond the remit of the Expert Group.

10. The following options, or combinations thereof, might be explored when addressing the additional abatement of primary and precursor PM emissions under the Convention:

(a) Initiatives to increase the number of parties to the protocols;

(b) Technological measures using emission limit values (ELVs), and/or best available techniques (BAT);

(c) Non-technical measures (e.g. economic instruments);

(d) National emission ceilings (NECs) not to be exceeded at a future date (these can be expressed as either absolute numbers or percentage reductions relating to a base year);

(e) Sector targets (national, for subregions, explicit per sector, excluding sectors);

(f) Ambient air standards for PM to be met at a future date (absolute concentration and/or percentage reductions in average concentrations with reference to a base year).

11. Most options involved a variety of trade-offs between different factors. In many cases, there was a balance between the desires for controls to be effects-based and for not distorting competition (i.e. delivering a level playing field). There could also be a trade-off between flexibility in approach (allowing Parties to determine how best to meet their obligations) and regulatory certainty (reducing flexibility, but making compliance more transparent).

A. Increasing the number of parties

12. The previous section demonstrated the potential to reduce PM levels across the Convention area by increasing the degree of implementation of existing protocols. As well as reducing health impacts in the non-Parties concerned, in many cases this would also be more cost-effective to the Convention as a whole than would existing Parties undertaking additional controls.

13. Obviously, in some cases the reason for delay in signature and ratification might be socio-political. It was beyond the remit of the Expert Group to analyse this further. However, there was also anecdotal evidence that the complexity of the annexes to the protocols (particularly those relating to mandatory emission limit values) might have deterred some ratifications, with non-Parties feeling unable to meet all of the detailed requirements despite a willingness to sign up to the national emission ceilings. It was beyond the mandate of the Expert Group to attempt to confirm this.

14. Parties to the protocols might like to consider whether a reduction in either the technical complexity of the annexes or the mandatory nature of some of the obligations in the existing protocols might increase the likelihood of additional ratifications. Such a decision might include the following considerations:

(a) Whether there were specific requirements that had created a disproportionate barrier to ratification compared to the benefit accrued from their inclusion;

(b) The degree to which any changes could result in future additional emissions for existing Parties;

(c) Whether other incentives for ratification could be offered to non-Parties to deliver cost-effective ambient PM concentration reductions in existing Parties;

(d) The likelihood that non-Parties had other socio-political reasons that would continue to prevent their ratification regardless of such changes;

(e) The effect of any changes in reducing the complexity of assessing compliance by Parties;

(f) The degree to which additional ratifications were likely to have a positive impact on the creation of a level playing field for competition throughout the Convention area.

B. Technological measures

15. Such measures could be specified in a protocol primarily in two ways: ELVs and the application of best available techniques (BAT).

16. Protocols could specify ELVs for particular types of installation, e.g. a specific industry or process. These values were generally expressed as concentration limits for stack emissions or emissions per unit of production. They represented a clear limit for regulators. In the Gothenburg Protocol, mandatory ELVs were specified for new installations in specified categories. For existing installations, the same ELVs apply in so far as they were “technically and economically feasible and taking into account the costs and advantages”. Similar provisions existed in the Protocol on Heavy Metals. Flexibility to this approach could be introduced through the use of phase-in dates.

17. Limit values for emissions (or ELVs) were defined in the Gothenburg Protocol as “the quantity of a gaseous substance contained in the waste gases from an installation that is not to be exceeded”. This definition obviously would need to be revised to apply also to primary PM emissions should the ELV approach be adopted.

18. ELVs had the following characteristics:

(a) They ensured equivalent control levels in all countries as they applied independently of location and technology, and were thus “competition-friendly”;

(b) ELVs normally required regular emission monitoring meaning that compliance could be accurately determined;

(c) ELVs were not effect-based in that they did not take the effect of the emissions of any given plant into account, although the magnitude of such effects would vary;

(d) ELVs could only be specified for defined/controllable sources; in general, they were not suitable for fugitive emissions[3], e.g. emissions of primary PM from construction, open burning, storage, handling, the application of fertilizers;

(e) Smaller sources (e.g. mobile sources, wood stoves) could be amenable to a different type of ELV compliance regime, based on type approval of examples of the equipment under controlled conditions;

(f) Revisions to ELVs under the current protocols required amendment of these protocols. The subsequent ratification procedure for the amendments was not a trivial task and could lead to confusion over which Parties had ratified which versions of a protocol. ELVs might thus fix the ambition level to that achievable by techniques readily available at the time of the negotiations. This could be at least be partially overcome if an amendment procedure with an opt-out clause was introduced in any possible revision of current protocols;

(g) The costs and the benefits in individual industrial sectors might differ substantially between distinct economic regions. This was particularly true if they were applied to existing installations, as they did not take plant design into account. What might be easy to achieve for a new installation might not be possible in an older plant on a cramped site;

(h) The Gothenburg Protocol included mandatory ELVs for new installations. Although these also applied to existing installations, there were important caveats which allowed local flexibility for technical and economical feasibility. Such an approach was somewhat similar to BAT, but less easy to update (as the ELVs were specified in the Protocol text);

(i) Some EU directives (e.g. the Large Combustion Plants Directive) also phased-in ELVs for existing plants after a transitional period. This approach allowed more time for investment decisions such as whether to upgrade or replace existing equipment, but it also could potentially delay environmental benefits;

(j) Further flexibility could be introduced by focusing ELVs on particular geographic regions, thus reducing the potential burden in other regions.

19. A different approach to technological measures was through the application of BAT. In this instance, the Gothenburg Protocol and the Protocol on Heavy Metals did not define installation-specific emission limits, but instead conferred a duty to control the emissions from

[3] A European Environment Agency glossary defines these as ”emissions not caught by a capture system which are often due to equipment leaks, evaporative processes and windblown disturbances”.

installations (often through the application of locally determined ELVs) taking into account guidance adopted by the Executive Body. This approach was also widely used in EU legislation, primarily through the application of the Integrated Pollution Prevention and Control (IPPC) Directive.

20. BAT had the following characteristics:

(a) The concept of BAT allowed for different technical standards in existing installations to avoid disproportionate costs. BAT was therefore more flexible than universal ELVs, although arguably less competition friendly as a result;

(b) BAT could lead to the implementation of plant-specific ELVs, set within the bounds of national or sectoral guidance (which could combine technical measures with process management);

(c) BAT did not guarantee a fixed reduction of emissions from a specific source category. To ensure appropriate use of the reduction potential, the corresponding guidance (e.g. the BAT Reference Documents produced by the European Commission’s Joint Research Centre’s IPPC Bureau) had to be sufficiently ambitious;

(d) Updating the guidance need not involve amendment to any protocol and was therefore easier to achieve than altering fixed ELVs. Hence the definition of BAT for any given process could develop over time, responding to advances in technology;

(e) This approach could be at least partially effect-based in that the regulator had discretion to take into account disproportionate costs for the benefit to be accrued within their determination of site-specific BAT;

(f) BAT might be specified for a broader range of sources than ELVs, such as: fugitive emissions of PM, where BAT could include good practice guidance; the imposition of a management regime; or the required use of particular product standards (e.g. low-sulphur fuel);

(g) The flexibility inherent in the BAT approach could make compliance checking more complex, as every plant would have its own unique conditions in its operating permit;

(h) BAT required a higher degree of expertise within the regulator compared to ELVs, and was therefore more administratively costly.

C. Non-technical measures

21. Non-technical measures also had the potential to play a part in reducing direct emissions of PM and its precursors. These measures covered a wide range of possible interventions, and were characterized by being less prescriptive than traditional regulation, or entirely non-regulatory in character. Many of these types of measures were also being actively pursued in climate change policies, so there was the potential for realizing synergies between climate and air pollution policy goals. Examples of non-technical measures included:

(a) Economic instruments (e.g. taxing undesirable activities or providing incentives for beneficial ones);

(b) Market-based instruments (e.g. emission trading);

(c) Infrastructure provision (e.g. improved public transport, access to cleaner fuels);

(d) Planning tools, etc (e.g. land use planning at local and regional level).

22. Some of the characteristics associated with the use of non-technical measures included:

(a) The environmental benefits of such less prescriptive or non-regulatory approaches could be difficult to quantify, although they might be considerable;

(b) The Convention's primary integrated assessment modelling tool (RAINS) could not incorporate non-technical measures, although the new GAINS model could;

(c) While they could represent a light regulatory touch, they also had the potential to be controversial and needed to be carefully implemented to avoid creating barriers to trade and/or discriminatory state intervention that could be challenged in the European Court of Justice or under the World Trade Organization's General Agreement on Trades and Tariffs (GATT).

(d) On the other hand, international approaches to non-technical measures, e.g. emission trading, should be "competition friendly";

(e) Non-technical measures could be targeted directly at particular sources and therefore could be effects-based;

(f) Even where highly effective non-technical measures had been identified, there was a question whether it would be appropriate to incorporate them (particularly in the form of common fiscal measures) in a mandatory provision of a protocol;

(g) The potential of non-technical measures might therefore be more easily realized through good practice guidance in combination with another control approach such as emission ceilings.

D. Geographically defined emission ceilings

23. Specifying emission ceilings was another method of reducing primary PM and PM precursors. This approach could be applied by pollutant (e.g. primary PM and/or individual PM precursors) on a national or regional basis. Annual emission ceilings of a given pollutant would be specified for each area. These ceilings should be attained by a specified target year and each year thereafter.

24. The Gothenburg Protocol set emission ceilings on a national basis for the main precursors of secondary PM (as did the National Emissions Ceilings Directive in the EU). The Protocol also included the concept of Pollutant Emissions Management Areas, allowing the largest Parties to focus their abatement efforts on particular parts of their territories.

25. Negotiations on these instruments were informed by integrated assessment modelling, in particular the RAINS model, covering the EMEP region. Integrated assessment modelling enabled a cost optimization of reduction options to meet any given level of ambition for environmental targets. For the Gothenburg Protocol, RAINS was operated in a multi-pollutant / multi-effects mode, considering emissions of sulphur dioxide, nitrogen oxides, ammonia and VOCs, with environmental gap closure targets set for acidification, eutrophication and ozone effects. The effect of the scenarios of particulate matter was also calculated, but as a co-benefit rather than a driver.

26. Since then, the GAINS model was developed for the EMEP region, extending the pollutants, effects, and types of control measures that could be analysed holistically. CIAM could now explore synergies and trade-offs between the control of local and regional air pollution and the mitigation of global greenhouse gas emissions, although cost data for greenhouse gas reduction measures had yet to be reviewed. GAINS estimated emissions, mitigation potentials and costs for five air pollutants (SO_2, NO_x, PM, NH_3, VOCs) and for the six greenhouse gases included in the Kyoto Protocol.

27. Both the RAINS and the GAINS models could be operated in the “scenario analysis” mode, i.e. following the pathways of the emissions from their sources to their impacts. In this case, the model provided estimates of regional costs and environmental benefits of alternative emission control strategies. An “optimization mode” identified cost-optimal allocations of emission reductions in order to achieve specified deposition and concentration targets.

28. Geographically defined emission ceilings had the following characteristics:

(a) The approach allowed each country or region to determine how to achieve its given emission reduction by whatever mix of technical and non-technical measures it deemed appropriate. This flexibility allowed economically efficient strategies to be implemented to meet environmental goals;

(b) Integrated assessment modelling ensured that the approach was highly effects-based, only imposing measures to meet the stated targets where it was most cost-beneficial to do so;

(c) The size of the area for which emission ceilings were fixed involved a balance between administrative convenience (areas needed to have a distinct governmental identity so someone was responsible for compliance), and the desire to maintain the link to effects (emission reductions in large administrative areas might not occur in the grid squares assumed in the modelling – this provided more flexibility to larger Parties);

(d) In common with all environmental effects-based approaches, an emission ceiling approach could in theory lead to an uneven competitive playing field with sectors in some Parties or regions having significantly larger control costs than competitors in other parts of the Convention area. Results from the EU Clean Air for Europe (CAFE) programme suggested that, while some impact on competition between countries and between sectors was seen, the overall impact on the EU as a whole was not thought to be significant;

(e) Implementation and compliance checking of emission ceilings depended crucially on the availability of accurate and dependable emission inventories for each of the pollutants concerned. These in turn depended on the availability of high-quality emission factors and sufficiently detailed activity data.

29. Emission ceilings targets could be expressed in different ways. The Gothenburg Protocol used annual tonnages. An alternative was to specify the target in terms of a percentage reduction in annual emissions against a base year. Such an approach was more robust to developments in the methods for calculating inventories, as the base year total was also recalculated. Inventory methodologies were more likely to change for some pollutants than others. For instance, inventories of SO_2 and NO_x were less likely to undergo major methodological development than those for ammonia or primary PM.

30. A third option was to retain emission ceilings, but allow adjustments to them in the light of methodological changes to the inventories. This option required explicit emission totals for the base year and the target year. If, for example, a “new” source was discovered that was not

included in the emission inventories and projections when the ceilings were determined and agreed, then there would be a mechanism to adjust both the base and the target year numbers.

31. Negotiated ceilings might not match reality in a number of ways. Inventories might use incorrect emission factors or miss sources entirely. Meteorological year variability could not be accounted for, e.g. emissions were likely to be higher in years of extreme heat or cold. Projections might have significant uncertainties, e.g. variations from predicted economic growth or energy supply mix, or differences between assumed and actual effectiveness of emission control techniques.

32. Although they would not mitigate all of the possible uncertainties in inventories and projections, percentage reductions were likely to result in a closer match between the intended and actual degree of effort required by a Party to meet its obligations. They were also more transparent, showing which Parties had the most reductions. On the other hand, this might discriminate against those Parties which had already made the biggest cuts in emissions prior to the base year. A focus on percentages would make differences between the effort required in different Parties more obvious. This could lead to more difficult negotiations as a result of simplistic comparisons of the percentage reductions required of different Parties and their implications for competitiveness.

33. Targets expressed as percentage reductions might not deliver the expected environmental benefits. They could be more or less than expected, depending on whether original inventories and projections were over- or underestimated.

34. Complete and consistent emissions inventories and reliable air quality modelling were a prerequisite for specifying NECs by integrated assessment modelling as well as for assessment of compliance. Emission inventories of primary PM were not yet considered sufficient to fulfil this condition for all sectors, although work carried out for the European Commission should allow significant improvements in the accuracy and consistency of these inventories over time. Emission inventories of PM precursor substances were in general considered sufficiently reliable but might need improvement in non-EU European countries.

35. Where emissions from a specific sector were not known with the necessary accuracy for integrated assessment modelling, this sector might be excluded from the specification of NECs and regulated by other control measures. This would not apply if amendable annual totals for base and target years were to be specified as targets (which could be recalculated when methodological changes were made).

36. Sources where the emissions showed a large uncertainty and to which no abatement measure could be applied (e.g. natural sources) might be excluded from the emission ceilings.

37. Further flexibilities in implementation could be introduced by allowing emission trading between emitters of primary PM or individual precursors of secondary PM. If this was done within the region or Party, the result should be a more cost-efficient delivery of the emission ceiling targets. However, it would not be possible to trade between different pollutants, as this would not deliver the individual pollutant ceilings. Primary PM might be more difficult to trade than precursors because of the greater uncertainty in inventories.

38. Emission trading between Parties or regions would lead to environmental benefits also being traded effectively at the same time. To avoid unintended environmental outcomes, any such trading might need to be limited in magnitude or geographical scope. Trading between Parties or regions would not necessarily be more cost-efficient if the integrated assessment modelling accurately represented the available options for control. Some of the downsides to "cap and trade" might be lessened if aggressive/stringent ceilings/caps were used.

E. Sectoral emission ceilings

39. A different way to express the results of integrated assessment modelling in a protocol could be in the form of sectoral emission ceilings. These would define targets for a particular industrial sector across more than one Party. Such an approach had the following characteristics:

(a) It was competition-friendly as it left industry sectors to determine how to meet their targets. However, it was not clear how compliance could be ensured;

(b) A sectoral ceiling approach might be less problematic if combined with other approaches to restrict the ability to trade between widely different geographical areas. It might also be restricted to particular sectors, or complemented with other options for sectors without ceilings;

(c) Sectoral emission trading was likely to require a more complex implementation, monitoring and compliance regime than a national ceilings approach, and this should be factored into any decision;

(d) There were several successful examples of sectoral emission trading within individual Parties to the Convention. For example, in the United States, emissions cap-and-trade programmes for the reduction of SO_2 and NO_x by the electric utility industry had been implemented since 1990. Implementation of this kind of sectoral emission trading programme with a declining emissions cap had been effective in reducing $PM_{2.5}$ concentrations.

40. This approach could result in outcomes that were not effects-based, if emission reductions occurred in geographical areas far removed from what was assumed in the integrated assessment modelling. This potential was greater than for that associated with geographically defined emission ceilings as the distances involved could be significantly greater (potentially transferring abatement from one side of the Convention area to the other).

F. Ambient air quality targets

41. If the target was to be expressed in terms of a metric related directly to health, then other possible mechanisms could be explored. In the absence of an agreed threshold, no safe ambient air standard for PM could be specified below for which no adverse impact on human health was to be expected. This meant that similar reductions in exposure generated similar benefits regardless of the absolute starting concentration level (within the range of concentrations found over most of the Convention area, though this might not hold for the cleanest areas, e.g. the northernmost countries).

42. From studies carried out as part of the European Commission’s CAFE programme, it was predicted that, in the year 2020, concentration levels would still be very non-homogeneous across Europe. No common ambient air standard could be defined which was both achievable by all EU Member States and at the same time required improvement by all.

43. A percentage reduction relating to ambient air concentrations in a base year might complement the specification of measures to reduce emissions (e.g. ELVs, BAT, NECs).

44. As exposure was associated with areas where people lived, but not necessarily only with hot spots, a percentage reduction of PM in ambient air should relate to urban background concentrations. There might be social equity issues with such an approach if used in isolation, as lack of progress in areas with particularly poor air quality might be balanced with greater improvements elsewhere. With a view to the transboundary character of PM, such a percentage reduction could be non-binding in character.

45. Existing integrated assessment modelling techniques could be used to devise appropriate exposure reduction targets, using corrections for urban increments. However, the robustness of such an approach would depend on the quality of the modelled urban increments, which in turn would depend on urban scale emission inventories. Parties might like to consider whether inventories were currently of suitable quality and consistency across the Convention area for such an approach to be adopted.

46. The Convention has not previously set Convention-wide ambient concentration targets in its protocols. Parties might like to consider whether such localized within-Party targets would

fall within the Convention's remit. It could be argued there was a parallel with the efforts to reduce exceedence of locally determined critical loads and levels under the Gothenburg Protocol. In both cases, a large proportion of the exposure was derived from long-range transport of air pollution.

47. Implementation of such an approach would need to be accompanied by a considerable expansion of $PM_{2.5}$ monitoring with a view to compliance. To maintain the link to health improvements, this monitoring would need to be focused in the highly populated areas (i.e. urban background). This might be required in any case to check the effectiveness of whatever combination of approaches was used to control PM. But it was worth noting that such an approach would require a major change in the EMEP monitoring strategy, which was currently focused on providing detailed speciated information from a relatively small number of rural background sites.

III. CONCLUSIONS

48. Without any prejudice to the decision of the Working Group on Strategies and Review and the Executive Body of the Convention, the Expert Group was of the opinion that:

(a) A number of potentially complementary options were available to control PM under the Convention: initiatives to increase the number of Parties to the existing protocols; technological measures using ELVs and/or BAT; non-technical measures; national emission ceilings not to be exceeded at a future date; sector targets; and ambient air standards for PM to be met at a future date;

(b) An increase in the number of ratifications to the Gothenburg Protocol and the Protocol on Heavy Metals would be a highly efficient way of reducing PM exposure;

(c) Any assessment of PM abatement strategies should be coordinated with greenhouse gas reduction policies to the extent possible;

(d) The GAINS model provided the EMEP region with a readily usable tool to devise cost-effective strategies for both air pollution and climate change mitigation, although some additional work to review input data would be required;

(e) Any process to negotiate new obligations under the Convention should seek to address PM exposure;

(f) Any process to negotiate new national emission ceilings should consider the reduction of both primary and secondary $PM_{2.5}$ in ambient air as an additional objective besides reduction of acidification, eutrophication and tropospheric ozone;

(g) Certain sources, e.g. small combustion and transport sources in urban areas, were of particular relevance to reduce exposure to primary PM; with this in mind, technical and non-technical measures should be considered;

(h) Assessments using integrated assessment modelling indicated that there was still a significant potential to reduce further the emissions of PM precursors from power generation and industrial combustion in a cost-efficient way; the same held for NH_3 emissions from the agricultural sector;

(i) Abatement of PM_{coarse} emissions not covered by $PM_{2.5}$ abatement measures (e.g. fugitive industrial emissions, construction activities and non-exhaust transport emissions) could be considered using other control options e.g. by indicating BAT that might be applied in the sectors involved. However, the added value of including PM_{coarse} in national emission ceilings seemed limited because of the fugitive character of many of the sources;

(j) Uncertainties in current emission inventories meant that, if emissions ceilings for primary $PM_{2.5}$ were considered as a control option, the possibility of either a provision for adjustments in the light of methodological changes to the inventories, or expressing ceilings relative to a base year should be considered;

(k) Parties to the Convention should be encouraged to improve the measurement and emissions inventory data base on PM;

(l) The EMEP centres should be provided with the resources necessary to improve the modelling of PM, to further develop and implement PM monitoring methods, and to assist Parties in improving their reporting on emission data;

(m) Though there was sufficient evidence for the need to reduce PM exposure, a need was seen for the improvement of understanding of health effects, PM modelling and speciation.

IV. FURTHER WORK

49. The Expert Group considered the mandate given to it had been fulfilled by finalizing its report and submitting it to the Working Group on Strategies and Review. The Working Group might wish to propose further tasks for the Expert Group when considered necessary.

50. The Expert Group noted that it was beyond its current mandate to draft any text, e.g. technical annexes on PM, to be included in any possible future protocol addressing PM.
