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

(Twenty-ninth session, Geneva, 5-7 September 2005)

Item 4 (f) of the provisional agenda

Working Group on Strategies and Review

(Thirty-seventh session, Geneva, 26-30 September 2005)

Item 4 of the provisional agenda

INTEGRATED ASSESSMENT MODELLING

Progress report prepared by the Chairman of
the Task Force on Integrated Assessment Modelling in collaboration with the secretariat

Introduction

1. This report presents progress in integrated assessment modelling and preparation of model inputs in view of the entry into force and upcoming review of the Gothenburg Protocol. It includes the results of the thirtieth meeting of the Task Force on Integrated Assessment Modelling, held in Berlin from 25 to 27 May 2005, back to back with the first meeting of the Expert Group on Particulate Matter. The presentations made during the meeting and the reports presented can be accessed on the Internet at www.unece.org/env/tfiam.

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2. Experts from Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Spain, Sweden, the United Kingdom and the European Community participated in the meeting. Representatives from the EMEP Centre for Integrated Assessment Modelling (CIAM) at the International Institute for Applied Systems Analysis (IIASA), the Meteorological Synthesizing Centre-West of EMEP (MSC-W), the Coordination Center for Effects (CCE), the European Topic Centre on Air and Climate Change (ETC/ACC), the European Commission's Joint Research Centre as well as from the Oil Companies' European Organization for Environment, Health and Safety (CONCAWE), and the Union of the Electricity Industry (EURELECTRIC) were present. A member of the UNECE secretariat also attended.

3. Mr. R. Maas (Netherlands) chaired the meeting. Mr. B. Schärer welcomed participants on behalf of Germany.

I. OBJECTIVES AND INTRODUCTORY REMARKS

4. Mr. Maas noted the objectives of the meeting and Mr. K. Bull (UNECE secretariat) noted that the review of the Gothenburg Protocol should start in December 2005.

II. SUMMARY OF MAJOR DISCUSSION POINTS

A. Non-optimized RAINS model scenarios

5. Mr. M. Amann (CIAM) presented information on the baseline RAINS model scenario and scope for further emission reductions until 2020. The Task Force noted that the effect of current climate change measures on projected cuts in emissions were relatively small. Emissions of NH₃ would not significantly decrease, but emissions of SO₂, NO_x, VOC and particulate matter (PM) would decrease. This decrease was expected to level out after 2020 but abatement options were still possible, especially when energy system changes were taken into account. The costs of additional measures for these would be different for the different sectors. (Information on the baseline scenario can be found at http://www.iiasa.ac.at/rains/CAFE_files/CAFE-baseline-full.pdf)

6. In the following discussion it was noted that talks with European Union (EU) national experts had resolved discrepancies in energy projections, though further bilateral discussions would be needed. These may lead to changes in the baseline scenario. It was agreed that the issues of transport measures and national inputs to energy projections would need to be addressed.

7. Mr Amann presented results on estimated changes in pollutant effects up to 2020, especially those on health, for the final Clean Air for Europe (CAFE) programme scenario, noting that RAINS had used seven end points. The Task Force noted the improvements and remaining problems. It noted that predicted increases in ozone effects in Norway for 2020 were due to predicted increases in background ozone concentrations.

B. Options for target setting

8. Mr. Amann presented RAINS scenario results that used three different concepts for setting targets for optimization of PM: an uniform limit value for Europe; a gap closure for PM_{2.5} with a percentage cut-off; an Europe-wide least-cost solution taking no account of the geographic distribution of costs and health benefits. The Task Force noted the problems and the advantages of the different approaches, recognizing that there was a trade off between efficiency and equity; policy decisions would be needed to decide on any one approach. The distribution of costs and effects would be important for policy makers. The results are posted at: http://www.iiasa.ac.at/rains/CAFE_files/CAFE-B-full-feb3.pdf

9. Ms. H. Apsimon (United Kingdom) suggested that the new gap closure target setting approach used for the CAFE scenario should be further investigated as it had less relationship with critical loads. In the approach the gap between projected current legislation emissions and maximum feasible reductions was closed. Health and critical loads should be the targets, not the availability of technical possibilities.

10. Mr. Amann described the results of a comprehensive analysis of three ambition level scenarios where acidification, eutrophication, ozone and PM effects had each been optimized separately and together. Benefits were assessed across EU countries. The Task Force noted there were more links between the benefits achieved from controls for acidification, eutrophication and PM than with ozone. The ambition levels were based on a priority ranking of PM>eutrophication> acidification>ozone. The Task Force noted there were no large variations between countries in the abatement costs per capita for the central ambition level. Though country benefits varied for the different effects, all countries gained something. The Task Force stressed that the priority setting used in the analysis may not be shared by all Parties and should be subject to policy decision.

11. Mr. Amann summarized the results of a sensitivity analysis for the CAFE Thematic Strategy scenarios. Six elements of uncertainty had been analysed, among others the assumption that health effects were only caused by primary particulates. The Task Force took note of the results and the associated costs and benefits. Furthermore it was noted that the results were sensitive to the assumed coal use, that agricultural costs were probably overestimated, that deleting road measures would shift

the costs towards industry and agriculture. A report is available at:
<http://www.iiasa.ac.at/rains/cafe.html>.

12. Mr. D. Johnstone presented a costs and benefits analysis according to the three CAFE scenarios, as well as impacts on macroeconomic indicators such as GDP and employment. Changes in the economic competitiveness appeared to be small. Results are available on the CIRCA website: http://forum.europa.eu.int/Members/irc/env/cafe_baseline/library?l=/reference_documents_1/cafe_base_line&vm=detailed&sb=Title and: http://forum.europa.eu.int/Members/irc/env/cafe_baseline/library?l=/cafe_steering_groups/cafe_steering_2005/presentations. Monetized morbidity and mortality caused by ozone seem to be substantially lower than mortality caused by PM. While the focus had been on the health effects, ecosystems had not been ignored. For health, costs were estimated through a willingness to pay approach. The Task Force noted the benefits estimated from the scenarios up to 2020. These suggested that moving from the medium to high-cost scenario might not be cost-effective. The Task Force discussed the limitations of the approach used.

C. Current knowledge and possible systematic biases

13. Ms. M. Wichmann-Fiebig (Germany) Co-Chair of the Expert Group on Particulate Matter, reported on the first meeting of the Expert Group. In line with the recommendation of the Task Force on Health, the Expert Group would focus on PM_{2.5} but not neglect PM₁₀.
14. Mr. J. Schneider (Austria) outlined the work of the Task Force on Health and its work on PM and ozone and noted that reports were being prepared. He suggested health effects were more likely to be underestimated than overestimated. The Task Force understood that the Task Force on Health had suggested the focus should be on PM_{2.5} and mortality. It was recognized that long-term European health studies could provide a better basis for PM assessment.
15. Mr B. Gindroz (France) provided information on the work of the Expert Group on Techno-economic Issues. He noted the contribution that the Expert Group and its database (ECODAT) could make to the work of the Task Force. Mr Gindroz noted that proposals were to be presented to the Working Group on Strategies and Review at its thirty-eighth session. He stressed better input was needed from national experts. The Task Force further noted that systematic biases in cost estimates were of concern since measures may not be effectively implemented as predicted costs could decrease after the introduction of measures.
16. Mr T. Spranger (Germany) Chair of the Task Force of the International Cooperative Programme

(ICP) on Modelling and Mapping provided information on the work of the ICP. It welcomed the work on harmonization of land cover data with EMEP. Mr Spranger provided details of the revised critical loads and dynamic modelling data. Mr Spranger noted future plans of the ICP to develop dynamic modelling of biodiversity at the European scale. It also planned work on climate change interactions and on the nitrogen cycle.

17. Mr J.-P. Hettelingh presented the preliminary 2005 set of European critical loads, target loads and proposals to derive marginal emission coefficients. Dynamic modelling improved understanding of time delays of recovery and damage caused by changes in exceedances of critical loads for acidification. The Task Force noted dynamic modelling results could contribute to the understanding of the gap closure concept and the effects of prolonged critical loads exceedances.

18. Mr R. Derwent (United Kingdom) described the results of a project modelling ozone formation in a single plume travelling across Europe taking into account many sources, many different VOCs and their various chemistries. Reactivities varied by a factor of 30 and using incremental reactivities for different sectors showed differences of about 4 parts per billion (ppb) at maximum with an approach not taking the different reactivities into account. The Task Force noted that while this might provide improved control strategies, the differences were likely to be small.

19. Mr. Derwent, Chair of the Task Force on Measurements and Modelling, provided information on the work of this Task Force. He noted that source-receptor information was made available after the EMEP model review. Comparisons with other models had not yet been completed. For current calculations the model was using Mace Head measurements for background concentrations of ozone. For source-receptor relationships for future years, a 3 ppb increase in this background was assumed.

20. Mr Maas drew attention to issues of emission inventories and the work of the Task Force on Emission Inventories and Projections.

21. Mr F. Wagner (CIAM) presented work on the GAINS model that linked RAINS with a greenhouse gas module to enable linkages and synergies between air pollution and climate change strategies to be explored. For stringent air pollution targets, CO₂ reductions could avoid significant costs. GAINS could be used to assess the sensitivity of RAINS scenarios. Should the Working Group on Strategies and Review decide that greenhouse gas measures be taken into account in the revision of the air pollution strategy, then a review of the GAINS data by Parties would be needed.

D. Other integrated assessment activities

22. Mr S. Reis (Germany) described the work on the MERLIN project where large numbers of model scenario runs had been used to test and assess the full model system. The Task Force took note of the results presented including a case study on transport focusing on PM, in Germany, that had considered technical measures, switches in the car fleet and non-technical measures. Mr Reis outlined future long-term plans including work on heavy metals, web accessibility and dynamic modelling.

23. Mr. P. Grennfelt (Sweden) outlined results of the Swedish NEPAP project that had made comparisons of outputs from the MERLIN and RAINS models for the CAFE baseline scenarios for 2000 and 2010. The results looked at the emission data for several sectors. Mr. H. Eerens (ETC/ACC) described the results of a project exploring air pollution and climate change trends and projections using a linked model approach. Focus on air pollution assessment had considered emissions, effects and costs for 2020 to 2030. Maximum feasible reductions would be larger when abatement options for greenhouse gases, ship emissions and organic farming options would be taken into account. But even then, NO₂ limit values will not be met in each city and street canyon. Local options, such as speed limits, still have to be considered. The Task Force took note of the results of the work.

24. Mr. M. Lutz (Germany) presented information on Berlin's air quality strategy noting the relevance of local, urban background and regional background concentrations of PM. The Task Force took note of the local measures used and those planned to meet targets. Sixty per cent of PM10 in Berlin was estimated to be from outside the city.

25. Ms. ApSimon drew attention to a number of spatial issues that might result in biases. She drew attention to a comparison of national scale assessments of maximum feasible reductions of ammonia and those of RAINS and the significant differences in the geographical distribution of emission reductions when a more precise distribution of the various types of livestock and potential for abatement measures was taken into account. The Task Force noted that this demonstrated the importance of national comparisons with European model results. With reference to primary particulates, she supported the use of targets based on population exposure and illustrated how the relative importance of a country's own emissions was enhanced compared with imported contributions when the correlation between population and urban enhancement of concentrations was taken into account. Moreover any significant imported contributions were generally from neighbouring countries or sea areas, and required more detailed spatial assessment of border regions.

26. Mr. T. Oxley (United Kingdom) further illustrated the UK study of ammonia abatement with a series of maps of the United Kingdom showing how selection of geographically targeted abatement

measures in sensitive areas provided more cost-effective improvements than national scale implementation, levelling off successively as measures had less direct effect. In some areas this gave a greater potential for improvement than assessed by the simplified modelling in RAINS, but it also showed areas where little could be done nationally with identified measures to improve the protection of sensitive ecosystems. The Task Force recognized that such sub-national targeting of measures and the corresponding effect on exceedance of critical loads was important as it could alter the need for measures at the European level to reduce transboundary contributions.

27. Mr. T. Pignatelli (Italy) presented the latest developments in the MINNI project and RAINS-ITALY, as well as a multi-task project aimed at developing a national integrated assessment modelling system. A health impact module was to be included. The Italian model incorporated preliminary estimates of secondary organic aerosols. Improvements envisaged were higher resolution and possible extension to heavy metals and greenhouse gases.

III. FURTHER WORK

28. The Task Force discussed and agreed its future activities, as reflected in the draft workplan of EMEP for 2006 (EB.AIR/GE.1/2005/10). It also drew up a draft action plan for consideration by the Working Group on Strategies and Review (annex).

29. Ms C. Sternhufvud (Sweden) announced Sweden would host a workshop on non-technical measures in association with the next Task Force meeting that would be held in Gothenburg, Sweden from 7 to 9 December 2005. She identified the issues to be considered: the definition of non-technical measures and their connection to market-based instruments; possible measures on the regional and local scale, including their potential and costs; and how to treat non-technical measures and include them in integrated assessment modelling.

IV. CONCLUSIONS AND RECOMMENDATIONS

30. In addition to the points noted by the Task Force during its discussions as indicated above, the Task Force agreed the following conclusions and recommendations:

(a) CIAM's work for the CAFE Thematic Strategy had provided useful information and results for the review of the Gothenburg Protocol and the results should be presented to the Working Group on Strategies and Review. The Task Force recommended that further consideration should be given to target setting and the sensitivity analysis of the approach ensuring that both health and ecosystem effects were addressed and that results covered all Parties to the Convention where possible;

(b) Even in the 2020 model results suggested that further technical measures could still be applied cost-effectively; there was a need to further elaborate methods for calculating the costs of non-technical measures;

(c) Several studies had shown that it was cost-effective to consider air pollution and greenhouse gas emissions together. There may be trade-offs but omitting consideration of greenhouse gases would lead to a bias (over-estimate) of costs;

(d) Several results indicated that ship emissions would make an increasing contribution to European depositions of sulphur and nitrogen; ways of addressing these needed to be considered; sensitivity analysis had shown that ship emission controls were cost effective;

(e) Sensitivity analysis of the CAFE scenarios showed they were driven by both health and ecosystem effects and that multi-effect optimization increased robustness. Results from a plume model for ozone could provide a sensitivity case for RAINS;

(f) Non-EU countries had not yet been consulted on the data held by CIAM. It was recommended this be brought to the attention of the Working Group on Strategies and Review so action could be taken;

(g) The issue of including Eastern Europe, Caucasus and Central Asia (EECCA) countries needed to be addressed. EECCA countries should be encouraged to take part in bilateral discussions with CIAM with respect to data for the region; maps should be extended to include the whole European and Central Asian part of UN ECE;

(h) The EMEP model could be extended eastwards but better measurement and emission data as well as an understanding of the effects of climatic conditions in central Asia would be needed; Southern Europe was EMEP's immediate priority; future trends in background ozone concentrations could be modelled and included in the EMEP model;

(i) Current problems were not solved everywhere in Europe even with maximum feasible reductions; for ecosystem effects higher exceedances of critical loads resulted from the new land cover specific deposition data from the EMEP Unified Model;

(j) The Task Force noted that current critical loads and target loads data were considered robust enough for use in integrated assessment modelling and for review of the Gothenburg Protocol; the robustness of the data, as indicated by comparisons of data submitted over the period 1998-2005,

showed that there would be limited influence of critical loads changes on the changes in exceedances;

(k) The Task Force welcomed the first results of dynamic modelling for acidification. It recommended further development of methods for eutrophication and biodiversity.

(l) The Task Force noted that in the past emission factors had increased, for example for vehicles and agriculture, and new sources had been added; this might indicate that it is more likely that emission sources were systematically underestimated. It requested that the Task Force on Emission Inventories and Projections be invited to consider where systematic biases occur and how they might be dealt with;

(m) The transboundary nature of PM was important to consider in work for the review of the Gothenburg Protocol. The Task Force recognized PM monitoring and emissions data reported under the Convention needed to be improved;

(n) The Task Force welcomed the Expert Group on Techno-economic Issues focusing on priorities for integrated assessment modelling. It requested that the Expert Group be invited to define which measures in its database would be most sensitive. It noted agriculture and transport were not in ECODAT but would be priorities for uncertainty analysis;

(o) It was reiterated that national integrated assessment studies were important for complementing the European scale modelling. Further work in this area was recommended noting that, especially for ammonia, local implementation could have significant benefits and avoid over-estimation of costs;

(p) It was important to address the urban, national and transboundary abatement options to tackle local problems;

(q) The review of the RAINS and MERLIN models had shown similar results but had also highlighted some differences that needed to be further investigated and discussed during the next Task Force meeting;

(r) The Task Force agreed to hold its thirty-first meeting in Gothenburg, Sweden from 7 to 9 December 2005. The first part of the meeting would be a workshop on non-technical measures.

Annex

Proposal for an action plan to involve Eastern Europe, the Caucasus and Central Asia (EECCA) countries in integrated assessment (implementation of Convention and protocols)

1. To create awareness on potential health and environment problems in EECCA, as well as on the nature of transboundary influences and links with other environmental problems, by compiling national and international expert reports (contributions should be invited from: CCE, WHO, UNECE, UNEP, EEA, non-government organizations and national experts).
2. To assure political commitment at ministerial level by agreement on priority air pollution problems, the need for international cooperation, the steps to be taken and whom to involve (action required from the Working Group on Strategies and Review and the Executive Body). Priority could be given to the larger countries (e.g. Russia, Ukraine, Kazakhstan) or those showing a willingness to become involved.
3. To invite nominated experts to task force and expert group meetings and further encourage funding by lead countries for this (action: chairpersons of task forces).
4. To draw up a provisional budget for action (secretariat) taking into account ongoing work (e.g. UNECE CAPACT project) and discuss funding with possible donors such as the World Bank, the European Bank for Reconstruction and Development, the European Commission and Parties (action: Executive Body, secretariat).
5. To consider available EMEP measuring stations, identify requirements and priorities, and plans for improving the EMEP network (action: EMEP Chemical Coordinating Centre, Task Force on Measurements and Modelling and Parties).
6. To develop best emission estimates and scenarios based on energy statistics, agricultural data, etc, and to organize bilateral consultations with EECCA experts (action: CIAM, MSC-W).
7. To extend the source-receptor matrices to include Central Asia and to compare results with available measurement data (action: MSC-W).
8. To develop ecosystem sensitivity maps and organize bilateral consultations (action: CCE).

9. To develop health damage estimates and organize bilateral consultations (action: TF Health, UNECE).
10. To identify abatement options and develop cost curves (action: Expert Group on Techno-economic Issues, CIAM)
11. To carry out a regular review of the action plan (Working Group on Strategies and Review, EMEP Steering Body and the Task Force).