UNITED
NATIONS

E

Economic and Social Council

Distr.
GENERAL

EB.AIR/WG.1/2005/3
20 June 2005

Original: ENGLISH

ECONOMIC COMMISSION FOR EUROPE

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

Working Group on Effects
(Twenty-fourth session, Geneva, 31 August–2 September 2005)
Items 4 and 5 of the provisional agenda

2005 JOINT REPORT OF THE INTERNATIONAL COOPERATIVE PROGRAMMES AND THE TASK FORCE ON THE HEALTH ASPECTS OF AIR POLLUTION

Report compiled by the secretariat in collaboration with the Extended Bureau of the Working Group on Effects

1. The Executive Body, at its twenty-second session, decided that the secretariat was to prepare the annual review of the activities and results of the International Cooperative Programmes (ICPs) and the Task Force on the Health Aspects of Air Pollution based on the information provided by the lead countries and the programme coordinating centres (ECE/EB.AIR/83/Add.2, item 3.1).

GE.05-31488

2. At its meeting, held in Geneva on 23–25 February 2005, the Extended Bureau of the Working Group on Effects (the Bureau of the Working Group, the Chairs of the Task Forces, and the representatives of the programme centres of the ICPs) noted that the substantive report (EB.AIR/WG.1/2004/14) provided an in-depth view on the status and trends of the results of the effect-oriented work in a programme-oriented manner. The Extended Bureau expressed its concern on the sustainability of funding to maintain programme activities. It agreed that the presentations in the session of the Working Group would continue to be given under pollutant-specific themes. The Extended Bureau also agreed that the 2005 joint report should reflect the achievements reflecting the 2005 workplan according to pollutant-specific themes.

3. This report reviews the main accomplishments of the ICPs and the Task Force on Health under seven themes and following the 2005 workplan items of the Working Group. Details of the general activities of the programmes and the relevant literature are reported in the addendum (EB.AIR/WG.1/2005/3/Add.1) to this document.

I. ACIDIFICATION

4. ICP Forests continued dynamic modelling of air pollution effects on its level II plots. Dynamic models VSD and SAFE were applied using the level II data for a limited number of plots. Simulations showed that in Germany and Spain the soil solution pH remained below the critical limit, even though there was a slight recovery following the anticipated emission reductions of the 1999 Gothenburg Protocol. In Sweden the pH remained above critical limits from 2050 onwards. The results confirmed national evaluations, based on an inquiry of the national focal centres (NFCs) and were in line with previous evaluations of the programme. The latter showed that, in general, the recovery of acidified soils was largely dependent on mineral weathering, acid and base cation deposition and nutrient uptakes of the trees. Emission reductions based on the 1999 Gothenburg Protocol and other international agreements resulted in some soil recovery at most plots. Further emission reductions were deemed necessary to ensure long-term ecosystem stability in soils.

5. ICP Forests cooperated with the United States Department of Agriculture Forest Service, which established nine demonstration sites where methods of ICP Forests were tested. The assessment of critical loads for nitrogen and sulphur depositions was initiated at two sites.

6. Methods were developed for the survey of epiphytic lichens, an extended ground vegetation survey, the stand structural and deadwood assessments as well as for a forest type classification by ICP Forests. They were available from the ForestBiota project website (www.forestbiota.org).

7. ICP Forests selected 169 plots with complete data sets for bulk and throughfall depositions of sulphate, nitrate and ammonium for the period 1996–2001 from 500 level II plots with deposition monitoring. Mean annual open field sulphate depositions decreased from 7.4 to 5.9 kg ha^{-1} y^{-1}. Mean annual sulphate throughfall decreased from 16.1 to 9.5 kg ha^{-1} y^{-1}. Nitrogen throughfall also decreased, whereas the open-field deposition fluctuated rather than decreased. The higher inputs below the forest canopy confirmed the air filtering function of the forests.

8. A regional analysis of chemical trends in acid-sensitive surface waters of Europe and North America by ICP Waters showed that rates of sulphate decline were smaller in surface waters than in deposition for all regions in North America and most regions in Europe, thus indicating a lagged response. This might reflect the desorption of sulphur, which accumulated in catchment soils over the past century due to atmospheric deposition. The trend analysis was not carried out for nitrogen, as there were no significant changes detected in surface water.

9. ICP Waters updated its data set on critical loads of sulphur and nitrogen for surface waters.

10. ICP Waters reviewed biological response models for possible use for recovery of acidified water bodies. Three dynamic biological response models under development were presented: the model from Yan and colleagues, MIRACLE and FIB.

11. Widespread improvement in surface water acid-base chemistry in response to emissions controls programmes and decreasing acidic deposition was reported by ICP Waters. Regional-scale biological data were not available, but limited site-specific data did suggest, however, that continued improvement in the chemical status of acid-sensitive lakes and streams would lead to biological recovery in the future.

12. The programme centre of ICP Waters was involved in modelling lake chemistry in the Tatra mountains in Poland using the MAGIC model. The calibration year was 1996 and the simulation period was 1880–2030. The implementation of the 1999 Gothenburg Protocol did not seem to guarantee a recovery to pre-acidification chemistry in the lakes.

13. The programme centre of ICP Waters also developed a methodology for quantifying uncertainties in predictions from dynamic models. The methodology was applied using the MAGIC model to illustrate differences between scenarios for future fish status in Norway. The results showed that the probability of having sustainable trout populations was significantly higher with the "maximum feasible emission reductions" scenario than with the "current legislation" scenario.

14. Statistical evaluation of results from the multi-pollutant exposure programme of ICP Materials resulted in candidates for models, which describe corrosion due to pollutants.

15. Dose-response functions based on the multi-pollutant exposure programme and the one-year extension programme of ICP Materials were further developed. The work resulted in final selection of dose-response functions for carbon steel, zinc, copper, bronze, limestone and glass materials representative of medieval stained glass windows. The new trend exposure programme would be initiated in the end of 2005.

16. Statistical trend analysis on concentrations and fluxes of sulphur and nitrogen compounds, base cations and acidity parameters was carried out on data from open field and throughfall deposition and runoff/soil water quality by ICP Integrated Monitoring. The first results indicated that statistically significant decreasing trends of sulphate concentrations could be observed at most sites in both deposition and soil/surface waters. Nitrate concentrations and acidity were also decreasing in deposition at many sites. In surface waters fewer statistically significant trends for these compounds were observed.

17. The scientific paper on the calculations of proton budgets described the relative significance of different acidifying processes at ICP Integrated Monitoring sites. The calculations suggested a clear relationship between the net acidifying effect of nitrogen processes and the amount of nitrogen deposition. With increasing deposition, nitrogen processes became increasingly important as net sources of acidity.

18. Dynamic modelling on climate change impacts on acidification recovery was carried out by ICP Integrated Monitoring in cooperation with ICP Waters and related to the European Union (EU) project EURO-LIMPACS. Data from 14 key sites, located in acid-sensitive regions, were used for the assessment. Climate/global change induced changes might have a large impact on future acidification recovery patterns, and needed to be addressed if reliable future predictions were required (decadal time scale). However, the relative significance of the different scenarios was to a large extent determined by site-specific characteristics.

19. Updated critical loads and preliminary dynamic modelling data were provided to the Coordination Center for Effects (CCE) of ICP Modelling and Mapping by 16 and 11, respectively, NFCs. Updated critical loads maps, with status as of 2004, showed ranges relatively similar to 1998 data. Maps on exceedances of ecosystem-specific critical loads for acidification and eutrophication in 50x50 km^2 grid cells were computed with new deposition data in collaboration with EMEP Meteorological Synthesizing Centre - West (MSC-W). Critical load

exceedances increased considerably, mostly due to the use of high-resolution and land cover specific deposition data.

20. Preliminary target load maps, derived from dynamic modelling parameters, were derived for the first time by ICP Modelling and Mapping. Their use in integrated assessment was recommended for testing purposes only.

21. CCE compiled its 2004 progress report, which included contributions from NFCs in 2003/2004, descriptions of the data, maps of critical loads and their exceedances and preliminary dynamic modelling results. The robustness of critical load and preliminary dynamic modelling data was also explored in depth.

22. The updated European critical load maps were provided to the Centre for Integrated Assessment Modelling (CIAM). The data were used for preliminary applications to support activities of the Task Force on Integrated Assessment Modelling as well as the Clean Air for Europe (CAFE) programme of the European Commission.

II. NUTRIENT NITROGEN

23. The impact of nitrogen deposition on forest soils in central and northern Europe was analyzed on 121 level II plots of ICP Forests and on additional plots investigated in the EU projects DYNAMIC and CNTER. Nitrogen deposition was shown to be positively correlated with nitrogen leaching, especially in nitrogen enriched soils. At sites with a lower nitrogen status (i.e. carbon to nitrogen ratios equal to or smaller than 22), mean annual temperature was an important factor. Leaching was highest at a mean annual temperature of 7.5 °C.

24. The assessment of ICP Vegetation found no significant temporal trends in the total nitrogen concentration in mosses in Norway (1977–2000), Sweden (1980–2000), Finland (1990–2000) and Germany (1995–2000). First results indicated a significant linear relationship between the nitrogen concentration in mosses and NH_y, NO_x and total nitrogen depositions.

25. Accumulated total nitrogen deposition for the years 1880-2000 was calculated at ICP Integrated Monitoring sites and other sites in the CNTER project database in cooperation with CCE. Accumulated total nitrogen deposition at the integrated monitoring sites ranged from 400 to 2000 kg nitrogen ha^{-1}.

26. The statistical trend analysis carried out on the data from ICP Integrated Monitoring sites provided information on the long-term retention and release of nitrogen compounds in the catchment area. The results showed that nitrogen leaching into the groundwater or surface waters

was strongly related to atmospheric nitrogen inputs. This was particularly true for sites that were already nitrogen enriched. For sites with a lower nitrogen status, mean annual temperature played an additional important role. The derived model showed the highest leaching at a mean annual temperature of 7.5 °C. At lower and higher mean annual temperatures, lower leaching rates were observed, probably due to enhanced uptake of nitrogen by the vegetation at higher temperatures, and extreme nitrogen limitation at lower temperatures.

27. Data on critical loads of nutrient nitrogen were provided to CCE by 16 NFCs. Updated critical loads maps, with status as of 2004, showed ranges relatively similar to 1998 data. Maps of critical load exceedances, using new deposition data, showed considerably higher estimates than 1998, mostly due to the use of high resolution and land cover specific deposition data.

III. OZONE

28. Measurements of ozone (O_3) concentrations mainly using passive samplers on 100 level II plots of ICP Forests were continued; measurements had started in 2000. Measurements showed that ozone concentrations in 2003 were distinctly higher than in 2002 due to extreme solar radiation and heat in summer 2003 in many parts of Europe. A system for the identification of visible ozone injuries on plants was successfully implemented. Visible injury occurred on beech on 13 plots and on ash on 8 plots. The increased ozone concentrations did not always lead to higher injury because the summer drought reduced the gas exchange and consequently also the ozone uptake by leaves.

29. ICP Materials included ozone in the dose-response function for copper. In addition, HNO_3 was included in the dose-response functions for zinc and limestone. A relationship to calculate HNO_3 levels from NO_2, O_3, temperature and relative humidity was derived.

30. ICP Vegetation compiled preliminary maps of exceedance of the critical levels of ozone for crops and trees. They indicated that the gradient across Europe was approximately five times lower for the flux-based compared with the concentration-based critical levels. The uncertainty of exceedance maps increased with increasing critical thresholds.

31. ICP Vegetation found that visible leaf injury on white clover (Trifolium repens cv Regal) and brown knapweed (Centaurea jacea) was widespread across European sites as in previous years.

32. The assessment of health impacts of O_3 was included in the integrated assessment models, according to the methodological recommendations from the meetings of the Task Force

on Health in 2003 and 2004. The cost benefit analysis conducted for the CAFE programme also used the methodologies and recommendations of the Task Force.

33. The Task Force on Health introduced the SOMO35 (sum of maximum daily 8-hour means over 35 parts per billion) indicator to analyze impacts of ozone on health. The impacts of ozone could be illustrated by the increased daily number of premature deaths and increase in incidence of symptoms requiring medical attention (hospital admission, medication use). More than 20,000 deaths per year could be attributed to the ozone exposure in 25 EU member states. The effects were not expected to change much in the next decades. This corresponded with the observed average O_3 levels, which did not change significantly in the last years.

34. Estimates of effects of ozone exposure on morbidity were calculated along with the impacts on mortality and life expectancy. The morbidity estimates were based on fewer studies and a less solid database and therefore were probably less precise than those for mortality. The estimates provided some initial insight into the magnitude of the non-fatal effects of exposure in the European population. Tens of thousands of hospital admissions and tens of millions of restricted activity days and medication use could be attributed to ozone exposure annually in the 25 EU member states.

IV. PARTICULATE MATTER

35. Threshold levels for effects of coarse particulate matter (PM10) on materials were identified for soiling of materials based on dose-response functions developed by ICP Materials. Particulate matter was included in dose-response functions for corrosion.

36. The assessment of health impacts of particulate matter (PM) was included in integrated assessment models according to the methodological recommendations from the meetings of the Task Force on Health in 2003 and 2004. The Task Force methodologies and recommendations were also used in the cost benefit analysis conducted for the CAFE programme.

37. An analysis by the Task Force on Health indicated that life expectancy was currently reduced by, on average, 8.6 months in the EU countries due to anthropogenic fine particulate matter (PM2.5). Similar reductions of life expectancy were also estimated for other countries in the EMEP modelling domain. Current policies to reduce PM emission and precursor gases should reduce population exposure, and its health effects, by about 50% in the next decade in EU member states (to about 6.3 months of life expectancy lost). In the eastern parts of the EMEP modelling domain, the expected reduction of the exposure and health impacts was much smaller. Analysis of the air quality monitoring data indicated that after a significant decrease in PM10 concentration levels in the 1990s, further reductions, if any, were slow. Rural (regional)

component of PM dominated the urban (background) concentrations. This emphasized the importance of the long-range transport of pollution as the source of population exposure to PM and its health effects.

38. Estimates of effects on morbidity were calculated along with the impacts on mortality and life expectancy. These estimates were based on fewer studies and a less solid database, and therefore probably were less precise than those for mortality. However, the estimates provided some insight into the magnitude of the non-fatal effects of exposure. Around 100,000 cases of chronic bronchitis and hospital admissions for respiratory cardiovascular causes were attributed to PM exposure, as well as hundreds of millions of episodes of respiratory symptoms in adults and children.

V. HEAVY METALS

39. ICP Vegetation produced a new monitoring manual for the 2005/2006 European heavy metals in mosses survey. The majority of 32 countries in the programme confirmed their participation in the 2005/2006 moss survey.

40. The white clover biomonitoring network for ozone of ICP Vegetation was also used to monitor the bulk deposition rate of heavy metals for selected sites in Europe. In white clover the normal background concentration for lead (Pb) was 0.15 µg g^{-1} dry matter (DM) and for copper (Cu) 3.5 µg g^{-1} DM. The pollution threshold was 0.36 µg Pb g^{-1} DM and 4.15 µg Cu g^{-1} DM. For cadmium (Cd) there was no significant linear relationship between the bulk deposition of cadmium and its concentration in white clover, as cadmium uptake form the soil substrate was a confounding factor.

41. Work on heavy metal pools and fluxes at ICP Integrated Monitoring sites continued. Three heavy metals (Pb, Cd and mercury (Hg)) were still accumulating in the catchment soils. Quantitative determinations of deposition (mainly throughfall), litterfall and runoff were deemed important to achieve reliable catchment budgets. The work provided good background data for assessing critical load calculations.

42. CCE conducted a call for data on critical loads of heavy metals (Pb, Cd and Cu). Maps of exceedance of critical loads of these heavy metals were prepared in collaboration with EMEP Meteorological Synthesizing Centre - East.

43. The Task Force on Health concluded, based on the expert review of the 2002 draft report on health risks of heavy metals from long-range transport of air pollutants, that new scientific

information had become available. This would allow reviewing the assessment of health risks of heavy metals in the near future.

VI. PERSISTENT ORGANIC POLLUTANTS

44. ICP Waters carried out its first assessment of persistent organic pollutants (POPs) in surface water based on a literature survey. The results showed that there was a lack of coordinated surveys on the fate of POPs in the freshwater environment in spite of efforts in emission reductions, monitoring and atmospheric dispersion modelling. Such surveys were required to provide comprehensive scientific documentation of the effects for the international agreements on POPs. A common framework for such surveys was to be considered.

45. The assessment of ICP Waters showed generally decreasing levels of classical POPs (pentachlorophenols (PCB), dichlorodiphenyltrichloroethane (DDT), dioxins, etc.) although there were very few sites with trend data available. The levels of some new POPs, such as brominated flame retardants (PBDE) and perflourinated alkylated substances (PFAs), were probably rising.

46. The Task Force on Health received no requests from the Working Group on Strategies and Review for revising the health risk assessment of POPs. Therefore, no work on health hazard evaluation was initiated.

VII. CROSS-CUTTING ISSUES

47. More than 24 % of the trees assessed in 2004 were classified as damaged according to the level I data of ICP Forests. European and sessile oak had the highest and Scots pine the lowest defoliation. As of last year, most of the main tree species showed a clear worsening of crown condition as compared to the previous year. This effect was particularly pronounced for common beech. Plausible explanations were delayed effects of the extreme heat and drought in summer 2003. While defoliation of several main species increased since 1990, defoliation of Scots pine was now clearly lower than in the mid-1990s.

48. The programme centre of ICP Forests was setting up a new level II database, which would also include level I data.

49. The activities of the sub-centre on cultural heritage and stock at risk of ICP Materials were developed. The share of responsibilities between the programme Co-Chairs from Italy and Sweden was agreed.

50. ICP Materials applied its results for assessing areas with increased risk of corrosion. World Heritage sites of UNESCO were mapped in risk classes.

51. In brown knapweed (Centaurea jacea) no interaction between nitrogen supply and visible leaf injury due to ozone was found by ICP Vegetation. As brown knapweed appeared to be insensitive to nitrogen, experimental work on the interactive impacts of ozone and nitrogen on this ozone biomonitoring species would not continue in the future.

52. A modelled base cation deposition map for Europe was compiled by MSC-W in collaboration with ICP Modelling and Mapping and other organizations. They also harmonized European land cover data. Both maps improved the quality and applicability of critical loads maps. They were also made available for other activities under the Convention.