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

Working Group on Effects
(Twenty-second session, Geneva, 3-5 September 2003)
Items 4 of the provisional agenda

**REVIEW OF RECENT RESULTS AND SHORT-TERM GOALS
OF THE EFFECT-ORIENTED ACTIVITIES**

2003 joint report of the International Cooperative Programmes
and the Task Force on the Health Aspects of Air Pollution

1. Pursuant to the decision taken by the Executive Body at its twentieth session (ECE/EB.AIR/77/Add.2, section 3.1.1), the secretariat compiled 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. Information on the achievements of ICPs and the Task Force since the twenty-first session of the Working Group on Effects, their plans for the coming year and the most important recent publication(s) of their results are summarized in annexes I to VII below.
2. Based on the contributions provided by the International Cooperative Programmes and the Task Force on the Health Aspects of Air Pollution, the Bureau with the assistance of a consultant prepared for submission to the Working Group a draft of the 2004 substantive report on the review and assessment of present air pollution effects and their recorded trends (in English only). The progress made and the main results achieved in preparing the 2004 substantive report are summarized in document EB.AIR/WG.1/2003/3/Add.1.

Documents prepared under the auspices or at the request of the Executive Body for the Convention on Long-range Transboundary Air Pollution for GENERAL circulation should be considered provisional unless APPROVED by the Executive Body.

Annex I

REVIEW OF THE ACTIVITIES AND ACCOMPLISHMENTS OF THE INTERNATIONAL
COOPERATIVE PROGRAMME ON ASSESSMENT AND MONITORING OF AIR
POLLUTION EFFECTS ON FORESTS (ICP FORESTS)

I. ACTIVITIES SINCE THE TWENTY-FIRST SESSION OF THE WORKING GROUP
ON EFFECTS

1. The nineteenth meeting of the Task Force of ICP Forests took place from 25 to 28 May 2003 in Zagreb and was attended by 80 experts. The Meeting addressed the following main topics:

- (a) The implementation and the evaluation of intensive monitoring (level II);
- (b) Evaluations of large-scale data (level I);
- (c) Dynamic modelling of past and future soil solution concentrations of nitrate, sulphate and aluminium in cooperation with ICP Modelling and Mapping;
- (d) Assessment of ozone concentrations in forests;
- (e) Assessment of carbon sequestration in forests;
- (f) Assessment of forest biodiversity in relation to air pollution and other environmental stress factors;
- (g) Cooperation with other international organizations and programmes, e.g. the United Nations Forum on Forests (UNFF) and the Acid Deposition Monitoring Network in East Asia (EANET).

2. Evaluations of level II data focused on: (i) present deposition; (ii) dynamic modelling of past and future soil solution concentrations of nitrate, sulphate and aluminium; (iii) carbon sequestration in forests; and (iv) ground vegetation diversity and its relation to environmental stress factors. Evaluations of level I data focused on statistical models as well as on the spatial and temporal variation in defoliation mainly of Picea abies and Quercus robur/petraea in relation to nitrogen and sulphur deposition and to other factors.

3. The programme's working group on ambient air quality evaluated the data of the two-year test phase of ozone passive sampling and ozone visible injury assessment. In order to clarify several open questions and to involve more countries the Task Force agreed to extend the test phase until 2005. All countries were encouraged to participate.

4. The Task Force at its nineteenth meeting took note of a feasibility study prepared for the future assessments of forest biodiversity. It reiterated its previous decision to launch a test phase of biodiversity assessments in 2003 based on the methods developed by the responsible working group (epiphytic lichens, stand structure, deadwood, forest stratification, ground vegetation) and recommended all countries to join the test phase activities, which should continue until 2005.

5. As part of the test phase for a new design of the international cross-calibration courses (ICCs) for crown condition assessments the results of last year's courses in Norway and Spain

were evaluated. Based on these evaluations and the previous results the new ICC concept was developed.

6. ICP Forests and EANET organized a joint workshop in December 2002 in Seremban, Malaysia. The workshop focused on monitoring methods and the exchange of know-how at an expert level. ICP Forests had also drafted a report on forest health and productivity presented by the Secretary-General at the third session of the United Nations Forum on Forests in May/June 2003 in Geneva.

II. ACTIVITIES AND TASKS PLANNED FOR 2003/2004

A. Activities/tasks related to the programme's present objectives

- (a) ICC on crown condition of Scots pine and silver/white birch (Estonia);
- (b) ICC on crown condition of common beech and Norway spruce (Germany);
- (c) ICC on crown condition of Aleppo pine and black pine (Greece, to be confirmed);
- (d) International intercalibration course on ozone injury (Italy and Switzerland);
- (e) Meeting of the expert panel on deposition (Italy);
- (f) Meeting of the expert panel on foliage analysis (Czech Republic);
- (g) Meeting of the expert panel on meteorology and phenology (Greece);
- (h) Publication of the 2003 Executive Report;
- (i) Publication of the 2003 Technical Report Level I;
- (j) Publication of the 2003 Technical Report Level II;
- (k) Submission of level I and level II data by National Focal Centres (NFCs) to the Programme Coordination Centre (PCC);
- (l) Preparation of the presentation of the 2004 results on the Internet;
- (m) Drafting of the 2004 Executive Report;
- (n) Finalizing programme's contribution to the 2004 Substantive Report.

B. Activities/tasks aimed at further developing the programme

- (a) Launching the test phase of the forests biodiversity assessments;
- (b) Quality assurance of crown condition data by means of international cross-calibration courses and application of digital photography;
- (c) Upscaling of results from level II to level I.

C. Activities/tasks to be carried out in close cooperation with other ICPs

- (a) Calculation of critical loads and levels in cooperation with ICP Modelling and Mapping;
- (b) Dynamic modelling based on level II data in cooperation with ICP Modelling and Mapping;
- (c) Further development of methods for and intercalibration of, assessments of ozone damage to trees in cooperation with ICP Vegetation;
- (d) Intercalibration exercises.

III. RELEVANT DOCUMENTS AND REPORTS

- (a) Forest Condition in Europe 2003 (Executive Report);
- (b) Forest Condition in Europe 2003 (Technical Report Level I);
- (c) Intensive Monitoring on Forest Ecosystems in Europe 2003 (Technical Report Level II).

Annex IIREVIEW OF THE ACTIVITIES AND ACCOMPLISHMENTS OF THE INTERNATIONAL
COOPERATIVE PROGRAMME ON ASSESSMENT AND MONITORING OF
ACIDIFICATION OF RIVERS AND LAKES (ICP WATERS)I. ACTIVITIES SINCE THE TWENTY-FIRST SESSION OF THE WORKING GROUP
ON EFFECTS

1. The eighteenth meeting of the Programme Task Force, held in Moscow from 7 to 9 October 2002, was attended by 30 experts from 16 Parties to the Convention. At present 20 countries actively participate in the ICP Waters activities.
2. The Task Force considered five reports: (i) the draft fifteen-year report; (ii) the draft report on dynamic modelling of surface waters; (iii) the draft report from the workshop on models for biological recovery from acidification in a changing climate; (iv) the report on the seventh intercalibration of invertebrates; and (v) the report on the 2002 chemical intercomparison. The Task Force also considered a brochure on nitrogen in surface waters.
3. The draft fifteen-year report provides an overall synthesis and assessment of information on water chemistry and biology that has been accumulated by ICP Waters over recent years (1999-2001) including an in-depth evaluation of recovery from acidification for water chemistry and biology, possibilities and limitations of dynamic modelling of surface waters, and an assessment of heavy metals within the ICP Waters database.
4. The draft report on dynamic modelling of surface waters is a background document reviewing the plausibility of applications of dynamic models. Dynamic models provide an extension to critical loads by predicting the timescale of chemical recovery resulting from emission reductions. They can also be used to determine the deposition levels required to achieve a prescribed target chemistry within a given timescale and thus provide a valuable tool for formulating further emission reduction policies.
5. The workshop on models for biological recovery from acidification in a changing climate (Grimstad (Norway), September 2002) organized in collaboration with other research programmes reviewed the evidence for biological recovery, as well as confounding factors, reference conditions and possibilities to predict future recovery. The workshop was attended by 31 experts from 8 countries.
6. Six laboratories participated in the 2002 biological intercalibration. The results of the test were among the best since the intercalibration exercise started and improvements were observed among laboratories that have participated several times.
7. In the 2002 chemical intercomparison two sets of samples were used for the determination of (i) major ions and (ii) heavy metals. Seventy-five laboratories in 27 countries participated in the

intercomparison exercise. Based on the general target accuracy of " 20%, 68% of results were considered acceptable.

8. Representatives of the ICP Waters Programme Centre actively participated in the meetings of the Task Forces on ICP Integrated Monitoring, ICP Modelling and Mapping and ICP Forests.

II. ACTIVITIES AND TASKS PLANNED FOR 2003/2004

A. Activities/task related to the programme's present objectives

- (a) Collection and processing of 2002 data, and continuing management of the ICP Waters database;
- (b) Reports to be produced in 2003:
 - (i) The fifteen-year report;
 - (ii) Draft report on the in-depth evaluation of biological recovery;
 - (iii) Biological intercalibration;
 - (iv) Chemical intercomparison;
 - (v) Proceedings from the national presentations at the seventeenth Task Force meeting in Moscow;
- (c) Chemical intercalibration, including heavy metals;
- (d) Biological intercalibration;
- (e) Updating programme manual;
- (f) Maintaining the ICP Waters Internet home page;
- (g) Participation in the forthcoming meetings of the Task Forces for ICP Integrated Monitoring and ICP Modelling and Mapping, and in relevant workshops and technical meetings.

B. Activities/tasks aimed at further developing the programme

- (a) Further consideration of problems related to the regional lake and river database, including, for instance, the development of an international network to secure the necessary cover of relevant areas;
- (b) Assessment of prospects for further development in monitoring heavy metals in surface waters;
- (c) Follow up the recommendations from the workshop on biological assessment and monitoring, evaluation and models;
- (d) Follow up the recommendations from the workshop on heavy metals (Pb, Cd and Hg) in surface waters; monitoring and biological impacts;
- (e) Assessment of possibilities for using dynamic modelling in the ICP Waters network;
- (f) Further exploring possibilities for developing biological response models for use in assessing recovery from acidification;
- (g) Planning and preparation of specific contributions in support of the future review and/or possible revision of protocols.

C. Activities/tasks to be carried out in close cooperation with other ICPs

- (a) Participation in developing guidelines for applying dynamic modelling in activities of ICPs;
- (b) Cooperation with other ICPs in carrying out chemical and biological interlaboratory comparisons;
- (c) Evaluation of trends in sulphate and nitrogen in surface waters in cooperation with EMEP.

III. LIST OF PUBLISHED DOCUMENTS AND REPORTS

Skjelkvåle, B.L. and Ulstein, M. 2002. Proceedings from the Workshop on Heavy Metals (Pb, Cd and Hg) in Surface Waters; Monitoring and Biological Impact. March 18-20, 2002, Lillehammer, Norway. NIVA-report SNO-4563-2002, ICP Waters report 67/2002. ISBN 82-577-4219-8.

Hovind, H. 2002. Intercomparison 0216. pH, K₂S, HCO₃, NO₃ + NO₂, Cl, SO₄, Ca, Mg, Na, K, total aluminium, aluminium - reactive and nonlabile, TOC, COD-Mn. Fe, Mn, Cd, Pb, Cu, Ni and Zn. NIVA-Report SNO 4558-2002, ICP Waters Report 68/2002. ISBN 82-577-4213-9.

Halvorsen, G.A, Heergaard, E. and Raddum, G.G. 2002. Tracing recovery from acidification - a multivariate approach. NIVA-report SNO 4564-2002, ICP Waters report 69/2002. ISBN 82-577-4220-1

Jenkins, A. Larssen, Th., Moldan, F., Posch, M. and Wrigth R.F. 2002. Dynamic Modelling of Surface Waters: Impact of emission reduction - possibilities and limitations. NIVA-report SNO 4598-2002, ICP Waters report 70/2002. ISBN 82-577-4258-9

Skjelkvåle, B.L. (ed.). 2003. Proceedings of the 18th meeting of the ICP Waters Programme Task Force in Moscow, October 7-9, 2002. NIVA-report SNO 4658-2003, ICP Waters report 71/2002. ISBN 82-577-4323-2.

Raddum, G.G. 2003. Intercalibration 0307: Invertebrate fauna. NIVA-report SNO-4659-2003, ICP Waters report 72/2003. ISBN 82-577-4324-0.

Brochure on nitrogen: Nitrogen in surface waters - contribution to acidification

Note: The references have been reproduced as received by the secretariat.

Annex III

REVIEW OF THE ACTIVITIES AND ACCOMPLISHMENTS OF THE INTERNATIONAL COOPERATIVE PROGRAMME ON EFFECTS OF AIR POLLUTION ON MATERIALS, INCLUDING HISTORIC AND CULTURAL MONUMENTS (ICP MATERIALS)

I. ACTIVITIES SINCE THE TWENTY-FIRST SESSION OF THE WORKING GROUP ON EFFECTS

1. A one-year extension of the multi-pollutant exposure programme including measurements of the additional parameters (particulate matter and nitric acid) was started in November/December 2002.
2. The results from the four-year exposure in the multi-pollutant programme have been reported.
3. The programme further developed activities towards using obtained dose-response functions for:
 - (a) Mapping of areas with elevated risk for corrosion of materials;
 - (b) Calculating the cost of corrosion damage.
4. The MULTI-ASSESS project of the European Union's fifth framework programme was extended to the newly associated States Poland and Latvia, which enabled exposure of additional stone materials and concrete and constituted an important geographical expansion of the programme.
5. The nineteenth meeting of the Programme Task Force was held from 8 to 10 May 2003 in Munich, Germany. The Meeting considered in particular the following:
 - (a) The evaluation of the four-year results from the multi-pollutant exposure programme;
 - (b) The progress of the joint efforts of ICP Materials and the MULTI-ASSESS project, including the start of the additional one-year exposure;
 - (c) The contribution to the 2004 substantive report on the review and assessment of present air pollution effects and their recorded trends;
 - (d) The preparation of the ICP Materials contribution to the workshop on the release of heavy metals due to corrosion of materials.
6. A new programme sub-centre on stock at risk and cultural heritage was established in Italy and will be located in the Italian National Agency for New Technologies, Energy and the Environment (ENEA).

7. The workshop on the release of heavy metals due to corrosion of materials was held on 12-14 May 2003 in Munich. It was organized by Umweltbundesamt, Berlin, Bayerisches Landesamt für Denkmalpflege, Munich and the Swedish Corrosion Institute, Stockholm.

II. ACTIVITIES AND TASKS PLANNED FOR 2003/2004

A. Activities/tasks related to the programme's present objectives

- (a) Coordination of the programme including preparation for the twentieth meeting of the Programme Task Force in 2004;
- (b) Withdrawal and evaluation of specimens from the extension of the multi-pollutant exposure programme;
- (c) Preparation of a database based on the multi-pollutant exposure programme and the one-year extension of exposure coordinated with the MULTI-ASSESS project;
- (d) Analysis of trends in results for the 1987-2001 period;
- (e) Publishing proceedings from the workshop on the release of heavy metals;
- (f) Commence developing dose-response functions based on the results of the multi-pollutant and MULTI-ASSESS programmes.

B. Activities/tasks aimed at further developing the programme

- (a) Start activities of the programme sub-centre on cultural heritage and stock at risk;
- (b) Application of the programme's results for mapping areas with increased risk of corrosion with special consideration of objects of cultural heritage;
- (c) Inventory of needs for, and planning of, the activities on the release of heavy metals due to corrosion;
- (d) Preparations for a workshop for the assessment of costs caused by air pollutants on materials including cultural heritage.

C. Activities/tasks to be carried out in close collaboration with other ICPs

Finalize contribution to the 2004 substantive report on the review and assessment of present air pollution effects and their recorded trends.

III. LIST OF PUBLISHED DOCUMENTS AND REPORTS

Kucera, V., Tidblad, J., Mikhailov, A. A., Doktor, A. and Faller, M.: "Heavy metals release by corrosion of structural materials: results from UN/ECE ICP Materials". Paper no 28, 15th International Corrosion Congress, Granada (Spain),), 22 to 27 September 2002.

Report No 40. Environmental data report November 1998 to October 1999.

Report No 41. Final Environmental data report for the multipollutant programme: November 1997 to October 2001, draft.

Report No 42. Results from the multipollutant programme: Corrosion attack on carbon steel after 1, 2 and 4 years of exposure (1997-2001), draft.

Report No 43. Results from the multipollutant programme: Corrosion attack on zinc after 1, 2 and 4 years of exposure (1997-2001), draft.

Report No 44. Results from the multipollutant programme: Corrosion attack on copper and bronze after 1, 2 and 4 years of exposure (1997-2001), draft.

Report No 45. Results from the multipollutant programme: Corrosion attack on limestone after 1, 2 and 4 years of exposure (1997-2001), draft.

Report No 46. Results from the multipollutant programme: Corrosion attack on painted steel after 1, 2 and 4 years of exposure (1997-2001), draft.

Report No 47. Trends of corrosivity based on corrosion rates and pollution data. Part 3, draft.

Report No 48. Results from the multipollutant programme: Evaluation of the decay to glass samples after 3 and 4 years exposure (1997-2001), draft.

Note: The references have been reproduced as received by the secretariat.

Annex IVREVIEW OF THE ACTIVITIES AND ACCOMPLISHMENTS OF THE INTERNATIONAL
COOPERATIVE PROGRAMME ON EFFECTS OF AIR POLLUTION ON NATURAL
VEGETATION AND CROPS (ICP VEGETATION)I. ACTIVITIES SINCE THE TWENTY-FIRST SESSION OF THE WORKING GROUP
ON EFFECTS

1. The sixteenth Task Force Meeting of ICP Vegetation was held in Velenje, Slovenia, from 27 to 30 January 2003. Forty-five participants attended the meeting, representing 15 Parties to the Convention and the Bureau of the Working Group on Effects. Presentations, poster sessions and working group discussions addressed the following topics: establishing flux-based ozone critical levels, modelling and mapping ozone deposition, and biomonitoring/bioindication of heavy metals and other air pollutants using (semi-)natural vegetation. The short and medium-term objectives of ICP Vegetation were revised. Two discussion groups separately reviewed the ozone biomonitoring programme and the results of the 2000/2001 heavy metals in mosses survey.
2. The effects of ambient ozone were monitored on ICP Vegetation sites by recording incidences of ozone injury on white clover and selected species of semi-natural vegetation and by determining the impacts on biomass. Poor weather conditions during the summer of 2002 in several areas of Europe meant that there were fewer ozone episodes. Nevertheless, injury assessments on ozone-sensitive white clover revealed that ozone injury occurred throughout the summer at many sites in central Europe, Italy and Greece and significant biomass reductions occurred in southern Europe. The new ozone monitoring system being developed with *Centaurea jacea* (brown knapweed) showed promising results.
3. The Coordination Centre collated and checked for quality the data on the stomatal conductance of selected leaves of white clover from nine sites across Europe representing seven countries. Three approaches have been used to model these data with the aim of developing a simplistic model of ozone flux for white clover. Compared with the concentration-based approach, ozone fluxes calculated using artificial neural networks or multi-variate regression resulted in only a slight improvement of the correlation with visible injury or biomass reductions. However, when applying the multiplicative flux algorithm approach, there was a significantly higher correlation with biomass reductions than with the concentration-based approach.
4. ICP Vegetation actively participated in organizing the workshop on establishing ozone critical levels II (November 2002, Gothenburg, Sweden). Recent progress with ozone exposure-response relationships for agricultural crops, semi-natural vegetation and forest trees, and ozone exposure modelling and mapping were reviewed. Substantial progress was made in the development of new ozone critical levels for agricultural crops, semi-natural vegetation and forest trees. However, final suggestions for changes in the text of the Mapping Manual were not completed at the workshop and different working groups were formed to continue this work.

5. Following the Gothenburg workshop, ICP Vegetation organized an expert panel meeting (May 2003, Manchester, United Kingdom) to review changes to the text of chapter 3 ('Mapping critical levels for vegetation') of the Mapping Manual. This meeting brought together invited experts on critical levels with representatives of ICP Vegetation, ICP Forests, ICP Modelling and Mapping, EMEP and the UNECE secretariat. The purpose of this chapter of the Manual is to give guidance to the participating countries in generating maps showing areas of exceedance of the critical levels for sulphur dioxide, nitrogen oxides, ammonia and ozone for sensitive receptors and individual species. Concentration-based critical levels for agricultural crops, semi-natural vegetation and forest trees were revised and flux-based critical levels of ozone for wheat, potato and sensitive forest trees were introduced. Although no flux-based critical levels were identified for semi-natural vegetation, the development of flux-based critical levels for this vegetation type was strongly recommended and significant progress is expected within the next five years. Final suggestions for changes to the text of chapter 3 of the Mapping Manual were agreed, and submitted to ICP Modelling and Mapping for circulation to NFCs, and for discussion at its forthcoming Task Force meeting (May 2003, Tartu, Estonia).

6. The Coordination Centre has continued to collate data from published and unpublished information on the responses of (semi-)natural vegetation to ozone. The data were used in the revision of chapter 3 of the Mapping Manual to identify species and plant communities that might be at risk from ozone pollution.

7. The Coordination Centre collated, analysed and mapped all data from the 'Heavy metals in European mosses: 2000/2001 survey'. Two mapping approaches were used: (i) 'dot maps' to indicate the concentration of each heavy metal at individual sampling sites; and (ii) maps on an EMEP 50 km x 50 km grid which show the mean concentration of each metal within individual grid squares. There was an east/west decrease in heavy metal concentrations in mosses, related in particular to industry. Former industrial sites and old mines account for the location of some high concentrations in areas currently without industries. Transboundary transport appears to account for elevated concentrations of heavy metals in areas without emission sources. Further information can be found in EB.AIR/WG.1/2003/8. Data from the 1995 survey were organized in the same standard format as data from the 2000/2001 survey, in order to analyse temporal trends in the heavy metal concentrations in mosses. Preliminary comparison with the 1995 survey indicates that there has been a Europe-wide decline in arsenic and cadmium concentrations.

II. ACTIVITIES AND TASKS PLANNED FOR 2003/2004

A. Continuation of present (already planned) activities

(a) The responses of white clover and selected semi-natural vegetation species, such as *Centaurea jacea*, to ozone will be monitored at sites across Europe and North America. These data will be used to validate the anticipated new flux-based critical levels for ozone and to identify areas where exceedance of the revised critical levels corresponds with effects on biomass and the development of leaf injury. Trends in injury and biomass reductions in white clover and semi-natural vegetation due to ozone exposure will be analysed using the ICP Vegetation database;

(b) Flux-effect models for white clover will be further parameterized and new flux models will be developed for crop species other than wheat, potato and clover, using experimental data held by ICP Vegetation participants and available in the literature. To identify and further develop methods for mapping semi-natural plant species and communities at risk from ozone, the ICP Vegetation database will be further updated;

(c) Sensitivity and uncertainty analyses will be performed to indicate the range in yield reductions and consequent economic losses that might be expected with exceedance of both concentration- and flux-based critical levels. In addition, sensitivity analyses of the economic methodologies will be performed to calculate the economic losses associated with exceedance of both concentration- and flux-based critical levels;

(d) In order to analyse spatial and temporal trends in the heavy metal concentrations in mosses between 1980 and 2000/2001, selected data from surveys prior to 1995 will be organized in the same standard format as data from 1995 and 2000/2001. Environmental factors influencing the heavy metal concentrations in mosses will be determined for the 2000/2001 data applying artificial neural networks. Preparations will be started for the heavy metals in mosses survey in 2005.

B. Activities/tasks aimed at further developing the programme

(a) Nationally funded ozone exposure experiments will be conducted at selected sites to provide information for further developing the flux-based critical levels for ozone;

(b) The impacts of nitrogen deposition on the responses of a semi-natural vegetation species to ozone will be studied further using ozone exposure facilities available at some of the ICP Vegetation sites;

(c) Within its remit CP Vegetation will incorporate further the effects of nitrogen deposition by analysing the nitrogen concentration of a selection of archived dried moss material from the heavy metals in mosses surveys. The feasibility of collecting samples from herbaria will be investigated.

C. Activities carried out in cooperation with other programmes/bodies inside as well as outside the Convention

(a) Ozone flux-effect relationships will be developed for tree species in collaboration with ICP Forests. Methods for mapping the exceedance of the revised critical levels for ozone will be developed in collaboration with the Coordination Center for Effects (CCE) and ICP Modelling and Mapping, and maps will be produced;

(b) Data on the concentrations of ozone across Europe, ozone injury assessment methods and ozone-sensitive species will be shared with ICP Forests and EMEP;

(c) ICP Vegetation will work with EMEP, ICP Modelling and Mapping and ICP Forests on methods for mapping the deposition of heavy metals to vegetation;

(d) There will be a further exchange of information on nitrogen impacts on natural ecosystems with ICP Integrated Monitoring, and on heavy metal deposition to, and accumulation by, crops with the Task Force on the Health Aspects of Air Pollution.

III. LIST OF PUBLISHED DOCUMENTS AND REPORTS

Buse, A., Harmens, H., Büker, P., Hayes, F., Mills, G. 2003. Air Pollution and Vegetation: the UNECE ICP Vegetation Annual Report 2002/3. Prepared for the 22nd Session on the Working Group on Effects, September 2003.

Buse, A., Norris, D., Harmens, H., Büker, P., Ashenden, T., Mills, G. Heavy metals in European mosses. UNECE ICP Vegetation Report, March 2003.

Fuhrer J., Ashmore M.R., Mills G., Hayes F., Davison A.W. (2003). Critical levels for semi-natural vegetation. Establishing Ozone Critical Levels II. UN-ECE Workshop Report. IVL Report B 1523. IVL Swedish Environmental Research Institute, Gothenburg, Sweden, in press.

Fumagalli, I., Mignanego, L., Mills, G. 2003. Ozone biomonitoring with clover clones: yield loss and carry over effect under high ambient ozone levels in northern Italy. Agriculture, Ecosystem and Environment 95, 119-128.

Harmens, H., Mills, G., Buse, A., Norris, D., Büker, P., Ashenden, T. 2003. Results of the heavy metals in mosses survey 2000/2001. Technical Report prepared for the 22nd Session of the Working Group on Effects, September 2003. (EB.AIR/WG.1/2003/8).

Karlsson, P.E., Selldén, G., Pleijel, H. (2003). Establishing Ozone Critical Levels II. UNECE Workshop Report. IVL report B 1523. IVL Swedish Environmental Research Institute, Gothenburg, Sweden.

Mills, G., Büker, P., Harmens, H., Hayes, F. 2003. ICP Vegetation Experimental Protocol for 2003. ICP Vegetation Coordination Centre, Centre for Ecology and Hydrology, Bangor, United Kingdom.

Mills, G., Büker, P., Hayes, F., Emberson, L., Werner W., Gimeno, B., Fumagalli, I., Köllner, B., Manes, F., Pihl Karlsson, G., Soja, G., Vandermeiren, K., and other participants of the ICP Vegetation. Developing ozone flux-effect models for white clover from the ICP Vegetation ambient air monitoring experiment. Establishing Ozone Critical Levels II. UN-ECE Workshop Report. IVL Report B 1523. IVL Swedish Environmental Research Institute, Gothenburg, Sweden, in press.

Mills, G., Hayes, F., Buse, A., Harmens, H., Büker, P., Emberson, L., Cambridge, H., Cinderby, S., Terry, A., Ashmore, M. & Holland, M. 2003. The UNECE International Cooperative Programme on Vegetation. Final report to DEFRA (April 2000 – March 2003).

Mills, G., Holland, M., Buse, A., Cinderby, S., Hayes, F., Emberson, L., Cambridge, H., Ashmore, M., Terry, A. (2003). Introducing response modifying factors into a risk assessment for ozone effects on crops in Europe. Establishing Ozone Critical Levels II. UN-ECE Workshop Report. IVL Report B 1523. IVL Swedish Environmental Research Institute, Gothenburg, Sweden, in press.

Note: The references have been reproduced as received by the secretariat.

Annex V

REVIEW OF THE ACTIVITIES AND ACCOMPLISHMENTS OF THE INTERNATIONAL
COOPERATIVE PROGRAMME ON INTEGRATED MONITORING OF AIR POLLUTION
EFFECTS ON ECOSYSTEMS (ICP INTEGRATED MONITORING)

I. ACTIVITIES SINCE THE TWENTY-FIRST SESSION OF THE WORKING GROUP ON
EFFECTS

1. The eleventh meeting of the Task Force on ICP Integrated Monitoring was held in Helsinki on 9 May 2003. It was preceded by one-day workshop on the assessment of ICP Integrated Monitoring on 8 May.

2. Twenty-one countries currently participate in the integrated monitoring activities and most of them reported their 2001 results to the Programme Centre in December 2002 and early in 2003. The Programme Centre carried out standard checks of submitted data from some 50, mostly European, sites and incorporated them into the new integrated monitoring database.

3. Scientific work regarding the Programme's four priority topics has continued:

(a) Calculation of pools and fluxes of heavy metals (at selected sites) and their relation to critical limits and risk assessment (led by Sweden). A scientific paper will be finalized in 2003;

(b) Assessment of cause-effects relationships for biological data, particularly vegetation (led by the Netherlands). Based on the ICP Integrated Monitoring data, a scientific paper on the effects of nitrogen from long-range air pollution on lichens in Europe has been prepared and submitted for publication. A joint assessment of EU/ICP Forests intensive monitoring programme and ICP Integrated Monitoring data is currently being carried out;

(c) Dynamic modelling (led by Centre for Ecology and Hydrology, United Kingdom, in cooperation with the Programme Centre and the Norwegian Institute for Water Research (NIVA). This work is closely related to projects financed by the Nordic Council of Ministers and the European Union (EU). ICP Integrated Monitoring, together with other ICPs, participates in cooperative activities on dynamic modeling coordinated by the Joint Expert Group on Dynamic Modelling. The priority of ICP Integrated Monitoring is site-specific modelling. A technical report on the first results will be presented at the Working Group on Effects in 2003;

(d) Calculation of fluxes and trends of S and N compounds and base cations (led by the Programme Centre of ICP Integrated Monitoring). Priority is given to the calculation of proton budgets, N leaching and C/N interactions. This work has strong links to carbon and nitrogen interactions in forest ecosystems (CINTER) project financed by the European Union. A manuscript of a scientific paper on proton budgets is ready, and a second paper on the effects of cumulative N deposition is being prepared.

4. Laboratories participating in ICP Integrated Monitoring took part in the intercomparison test (Ring Test 2002) organized by ICP Forests/EU Level II programmes and in the intercomparison 0216

5. The joint report by ICP Forests and ICP Integrated Monitoring on cause-effect relationships in forest ecosystems was finalized and published in 2002.
6. The Programme Centres of ICP Integrated Monitoring and EU/ICP Forests Intensive Monitoring Programme continue to be represented in the CNTER project and provide data for its evaluations. The project has great importance as its use of ICP Integrated Monitoring data represents a direct link between the programme's activities and global changes.
7. Data from ICP Integrated Monitoring have continued to be used by the project on climate-induced variation of dissolved organic carbon in Nordic surface waters (NMDTOC) (financed by the Nordic Council of Ministers), to evaluate processes affecting the leaching of carbon. Activities of this project are closely related to the ongoing effect-oriented activities under the Convention.
8. A representative of ICP Integrated Monitoring and/or its Programme Centre participated, inter alia, in:
 - (a) The annual meeting of EU/ ICP Forest intensive monitoring programme (October/November 2002, Heerenveen, Netherlands);
 - (b) The third meeting of the Joint Expert Group on Dynamic Modelling (November 2002, Sitges, Spain);
 - (c) The workshop on empirical critical loads for nitrogen deposition on (semi-) natural ecosystems (November 2003, Bern);
 - (d) A meeting organized by the European Environment Agency regarding possibilities for developing a European network for long-term ecosystem research and monitoring (January 2003, Copenhagen);
 - (e) A meeting of the ICP Forests Soil Expert Panel (March 2003, Ghent, Belgium).

II. ACTIVITIES AND TASKS PLANNED FOR 2003/2004

A. Activities/tasks related to the programme's present objectives

- (a) Maintenance and further development of a central ICP Integrated Monitoring database at the Programme Centre;
- (b) Participation in interlaboratory comparisons organized by other ICPs;
- (c) Inclusion of quality-controlled national data for 2002 in the programme's database;
- (d) Processing of additional information (background information, site descriptions) for detailed assessments (e.g. dynamic modelling);
- (e) Continuation of scientific work in the following four areas according to agreed scientific strategies and the medium-term work-plan:
 - (i) Calculation of concentrations, pools and fluxes of heavy metals at selected sites;
 - (ii) Assessment of cause-effect relationships for biological data (particularly vegetation);
 - (iii) Assessment of pools, fluxes and trends of S and N compounds, base

cations, and H^+ and of C/N interactions;

(iv) Site-specific dynamic modelling and impact scenario assessment.

B. Activities/tasks aimed at further developing the programme

(a) Participation in the activities of external organizations, particularly the Global Terrestrial Observing System (GTOS) and the International Long-Term Ecological Research Network (ILTER);

(b) Participation in CINTER and NMDTOC;

(c) Development of new assessment activities regarding air pollution and climate change in relation to carbon, nitrogen and C/N ratios in ecosystems.

C. Activities/tasks to be carried out in close collaboration with other ICPs

(a) Finalization of a contribution to the 2004 substantive report;

(b) Preparation of a scientific paper on the calculation of cumulative nitrogen deposition and its effects (in cooperation with CCE);

(c) Participation in CINTER (together with EU/ICP Forests intensive monitoring programme);

(d) Dynamic modelling work according to the strategy and plans agreed at the third meeting of the Joint Expert Group on Dynamic Modelling;

(e) Assessment of EU/ICP Forests intensive monitoring and ICP Integrated Monitoring vegetation data (in cooperation with ICP Forests).

III. PUBLISHED DOCUMENTS AND REPORTS

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MacDonald, J.A., Dise, N.B., Matzner, E., Armbruster, M., Gundersen, P., Forsius, M. 2002. Nitrogen input together with ecosystem nitrogen enrichment predict nitrate leaching from European forests Global Change Biology 8, 1028-1033. ISSN 1354-1013.

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Note: The references have been reproduced as received by the secretariat.

Annex VI

REVIEW OF THE ACTIVITIES AND ACCOMPLISHMENTS OF THE INTERNATIONAL
COOPERATIVE PROGRAMME ON MODELLING AND MAPPING OF CRITICAL LEVELS
AND LOADS AND AIR POLLUTION EFFECTS, RISKS AND TRENDS
(ICP MODELLING AND MAPPING)

I. ACTIVITIES SINCE THE TWENTY-FIRST SESSION OF THE WORKING GROUP ON
EFFECTS

1. The nineteenth meeting of the Task Force of ICP Modelling and Mapping was held from 22 to 23 May 2003 in Tartu, Estonia, back to back with the thirteenth Coordination Center for Effects (CCE) training session and workshop (19 to 21 May 2003). The Task Force meeting, attended by 58 experts from 22 countries, dealt with (i) the update of the European database on critical loads of sulphur and nitrogen and additional data needed for dynamic modelling; (ii) the further development of methodologies for land cover data, dynamic modelling, critical loads of heavy metals, and critical levels of ozone; and (iii) the revision of the programme's Manual. The preceding CCE training session aimed at assisting NFCs to apply their data in dynamic models. Also the CCE workshop focused on dynamic modelling, while also assessing the response of NFCs to the call for data (see below and EB.AIR/WG.1/2003/10).
2. Nineteen countries responded to the CCE call for revised data on critical loads of sulphur and nitrogen. Ten of them provided additional data needed for dynamic modelling. Several NFCs announced that they were actively aiming at providing data in response to the next call for data in 2003/2004. This will most likely further improve the effect-related basis for the review of the 1999 Gothenburg Protocol. It was agreed that increased multilateral cooperation of NFCs was needed in further developing and harmonizing methods and data.
3. The expert workshop on empirical critical loads for nitrogen deposition on (semi-) natural ecosystems took place in November 2002 in Bern (see EB.AIR/WG.1/2003/14). The results of the workshop were adopted by the Task Force and included into the programme's Manual.
4. The third meeting of the Joint Expert Group on Dynamic Modelling was held in November 2002 in Sitges, Spain (see EB.AIR/WG.1/2003/13). The Task Force took note of the conclusions and recommendations of this meeting (e.g. on availability of models; their calibration/validation, input data derivation, and uncertainties; application of dynamic models on national and UNECE scales; definition and use of target load functions). The Task Force also noted the conclusion of the Joint Expert Group that models of nutrient N needed further development and the current medium-term timetable was not likely to be achieved. This has been reflected in the proposed 2003 update of the medium-term work-plan for the effect-oriented activities (EB.AIR/WG.1/2003/4).
5. The Task Force appreciated the considerable progress achieved by the Expert Panel on Critical Loads of Heavy Metals operating within ICP Modelling and Mapping in developing effect-oriented methods for heavy metals. It approved the progress report, including the methodological changes in the critical load approach for heavy metals as proposed at the expert

meeting in December 2002 in Berlin, for submission to the Working Group on Effects (EB.AIR/WG.1/2003/10/Add.1). In particular, the Task Force confirmed the definition of the critical load of heavy metals as laid down in the "Guidance Document" (2001), i.e. to be related to total anthropogenic inputs. Keeping in mind the implications of this definition for the further work programme of ICP Modelling and Mapping, the Task Force requested the Working Group to consider how fertilizer inputs might be addressed. The Task Force also adopted the timetable proposed by the Expert Panel (as presented in EB.AIR/WG.1/2003/10/Add.1). Based on the further development of methods and the results of an expert workshop to be held in early spring 2004, the Task Force will recommend to the Working Group on Effects in 2004 how effects-based methodologies for heavy metals may be used, e.g. in integrated assessment models. It is planned to initiate a CCE call for data on critical loads of heavy metals in autumn 2004, aiming at the provision of advanced maps of steady-state critical loads for lead and cadmium (and possibly for mercury) by spring 2005.

6. The Manual of the programme was thoroughly revised. Most chapters and annexes have been restructured or revised and some are new. A final draft of the manual on dynamic modelling was prepared following the third meeting of the Joint Expert Group and has been included into the Manual. The Task Force approved the completed parts of the revised Manual and decided on guidelines for the finalization of those chapters that were not adopted in their final form. Most importantly, the methodology forming the necessary basis for the next update of the critical loads and dynamic model parameter database (call for data 2003/2004) was adopted. This will ensure that the integrated assessment modelling can be carried with the updated data based on the harmonized adopted methodology as envisaged in the medium-term work-plan. The revision process will be finalized in 2004 with the adoption of a chapter on critical loads of heavy metals.

II. ACTIVITIES AND TASKS PLANNED FOR 2003/2004

A. Activities related to the programme's present objectives

- (a) Further update of critical loads and related data for dynamic modelling on a European scale (CCE call for data 2003/2004);
- (b) Further development, harmonization and application of methods and procedures (including dynamic modelling) to assess recovery and risk of future damage;
- (c) Further development of effects-based critical loads of heavy metals; organization of a workshop (tentatively spring 2004), finalizing the methodology development as a basis for a future call for data;
- (d) Encouragement and support of subregional workshops to increase participation of countries in mapping activities and to share technical experience.

B. Activities/tasks aimed at further developing the programme

- (a) Further development of the programme's activities aiming at, but not limited to,
 - (i) improving and harmonizing calculation methods and databases;
 - (ii) identifying trends in air pollution and its effects;
 - (iii) contributing substantially to the regional and subregional assessment

of environmental damage and recovery; (iv) further developing methods to link dynamic modelling to integrated assessment modelling; and (v) investigating uncertainties;

(b) Further development of the effect-based approach, including the elaboration of risk assessment methodologies;

(c) Maintenance of the programme's coherence considering (i) varying national priorities among different work-plan elements due to national budget restrictions; and (ii) varying participation of NFCs.

C. Activities/tasks to be carried out in close cooperation or jointly with other programmes

(a) Collaboration with EMEP and other international and national bodies/organizations in harmonizing as far as possible land cover data/maps;

(b) Intensified cooperation between ICPs in the development and application of dynamic modelling, especially at forest sites (in collaboration with ICP Forests and ICP Integrated Monitoring);

(c) The use in dynamic models of EMEP historic deposition fields of sulphur and nitrogen species and of basic cations;

(d) Support of the further development of critical levels for ozone (concentration-based and flux-based) (in cooperation with ICP Vegetation and EMEP);

(f) Finalization of a contribution to the 2004 substantive report on the review and assessment of present air pollution effects and their recorded trends.

III. LIST OF PUBLISHED DOCUMENTS AND REPORTS

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Alcamo J, Mayerhofer P, Guardans R, Van Harmelen T, Van Minnen J, Onigkeit J, Posch M, De Vries B (2002) An integrated assessment of regional air pollution and climate change in Europe: Findings of the AIR-CLIM project. *Environmental Science and Policy* 5(4): 257-272.

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Hettelingh J-P, Slootweg J, Posch M, Dutchak S, Ilyin I (eds) (2002) Preliminary modelling and mapping of critical loads for cadmium and lead in Europe. Report 259101011, National Institute for Public Health and the Environment (RIVM), Bilthoven, Netherlands, 127 pp. (www.rivm.nl/cce)

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Schmiedeman E, De Vries W, Hordijk L, Kroeze C, Posch M, Reinds GJ, Van Ierland E (2002) Dynamic cost-effective reduction strategies for acidification in Europe: An application to Ireland and the United Kingdom. *Environmental Modeling and Assessment* 7: 163-178.

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Annex VII

REVIEW OF THE ACTIVITIES AND ACCOMPLISHMENTS OF THE TASK FORCE ON THE HEALTH ASPECTS OF AIR POLLUTION

I. ACTIVITIES SINCE THE TWENTY-FIRST SESSION OF THE WORKING GROUP ON EFFECTS

1. The sixth meeting of the Task Force on the Health Aspects of Air Pollution, held in Bonn (Germany) from 22 to 23 May 2003, was attended by 21 experts. They represented 12 Parties to the Convention, the European Commission, the EMEP Meteorological Synthesizing Centre-West (MSC-W), the Centre for Integrated Assessment Modelling (CIAM) and the World Health Organization's European Centre for Environment and Health in Bonn (WHO/ECEH). The Meeting focused on the assessment of the health impacts of particulate matter and ozone.

2. Considering the recent findings of the WHO project "Systematic review of health aspects of air pollution in Europe" (see <http://www.euro.who.int/document/e79097.pdf>), the Task Force reviewed the availability of methods for health impact assessments of ozone and particulate matter from long-range transboundary air pollution which might be used in the forthcoming review of the Gothenburg Protocol. The Meeting also formulated recommendations concerning the processes of the health impact assessment and its details (see EB.AIR/WG.1/2003/11).

3. The review of the health aspects of air pollution with particulate matter, ozone and nitrogen oxide, produced by the WHO project, recommended to use fine particulate matter (PM_{2.5}) as the indicator for health effects induced by particulate pollution, such as increased risk of mortality in Europe, to supplement the commonly used PM₁₀ (which includes fine and coarse particles). It also acknowledged the evidence that ozone produces short-term effects on mortality and respiratory morbidity, even at the low ozone concentrations experienced in many cities in Europe. Based on these findings it was also recommended to update exposure-response relationships for the most severe health outcomes induced by particulate matter and ozone presented in the WHO Air Quality Guidelines. The meta-analysis of the time series studies is now being conducted and will be used in the quantification of the health impacts of particulate matter and ozone.

4. The full technical report on "Health risks of persistent organic pollutants from long-range transboundary air pollution" has been finalized, edited and printed as a WHO document.

II. ACTIVITIES AND TASKS PLANNED FOR 2003/2004

A. Activities/tasks related to the Task Force's present objectives

Further development of the scientific basis and methods of health impact assessment of particulate matter and ozone, including estimation of risk functions for mortality.

B. Activities/tasks aimed at further developing the Task Force's work

Development of a methodology to include morbidity estimates in the quantification of health impacts of particulate matter and ozone.

C. Activities/tasks to be carried out in close cooperation or jointly with other programmes

Assessment of impacts on health of particulate matter and ozone based on exposure estimates produced by the RAINS model (in collaboration with EMEP and CIAM).

III. LIST OF PUBLISHED DOCUMENTS AND REPORTS

Joint WHO/Convention Task Force on the Health Aspects of Air Pollution. *Health Risks of Persistent Organic Pollutants from Long-Range Transboundary Air Pollution*. World Health Organization, Copenhagen 2003 (E78963) (252 p.)

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