UNITED
NATIONS

E

Economic and Social
Council

Distr.
GENERAL

EB.AIR/WG.1/2005/10
21 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)
Item 5 (vi) of the provisional agenda

DEVELOPMENT, MODELLING AND MAPPING OF CRITICAL LOADS AND THEIR INPUT DATA

STATUS REPORT ON THE CALL FOR EUROPEAN CRITICAL LOADS OF ACIDIFICATION AND EUTROPHICATION INCLUDING DYNAMIC MODELLING PARAMETERS FOR USE IN INTEGRATED ASSESSMENT MODELLING

Note prepared by the Coordination Center for Effects (CCE) of the International Cooperative Programme (ICP) on the Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends

Introduction

1. The Executive Body of the Convention, at its seventeenth session, underlined "the importance of ... dynamic modelling of recovery" (ECE/EB.AIR/68, para. 51 (b)) to enable the assessment of time delays of recovery in regions where critical loads stop being exceeded and time delays of damage in regions where critical loads continue to be exceeded.

GE.05-31528

2. The Working Group on Effects, at its twenty-third session, approved the proposal made by the twentieth Task Force meeting of ICP Modelling and Mapping (Laxenburg, Austria, 27–28 May 2004) to issue a call for data on critical loads for acidification and eutrophication, and for data on dynamic modelling of acidification (EB.AIR/WG.1/2004/2, para. 57 (c)).

3. A representative of the Commission of the European Communities emphasized the importance of the response to the call for data, in particular by the European Union (EU) Member States. The data were to be used not only for the support of policy processes under the Convention (possible revision of the 1999 Gothenburg Protocol) but could also support the Clean Air for Europe (CAFE) thematic strategy of the European Commission.

4. The Coordination Center for Effects (CCE) issued the call on 24 November 2004 with the deadline of 28 February 2005. In addition to the information provided in the Mapping Manual of ICP Modelling and Mapping, a detailed instruction document was compiled by CCE, distributed to the national focal centres (NFCs) and made available on the CCE website.

5. The resulting updated database on critical loads and dynamic modelling results would be available for integrated assessment modelling.

I. TERMINOLOGY

6. Target loads may be important dynamic modelling parameters for the Task Force on Integrated Assessment Modelling. A target load is defined as the deposition (path) which ensures that the prescribed chemical criterion (e.g. the ratio of aluminium to base cations, Al/Bc) is met by a given year. If they existed at all, there would be an infinite variety of deposition paths, i.e. target loads.

7. A target load is a deposition path characterized by three numbers (years): (i) the protocol year; (ii) the implementation year; and (iii) the target year (fig. I).

8. The protocol year used for dynamic modelling was the year up to which the deposition path was assumed known and fixed. This could be the current year or a year in the (near) future for which emission reductions have been agreed. Countries were requested to use 2010 as this is the year when the 1999 Gothenburg Protocol is to be fully implemented.

9. The implementation year for dynamic modelling was the year in which all known future reduction measures to reach the final deposition (the target load) were assumed to be implemented. Between the protocol year and the implementation year deposition was assumed

to change linearly (fig.I). The Working Group on Strategies and Review, at its thirty-sixth session, chose 2020 as the implementation year.

10. The target year for dynamic modelling was the year where the chemical criterion was to be met. The Working Group on Strategies and Review, at its thirty-sixth session, requested that 2030 and 2050 be used as target years; 2100 was also used for scientific purposes. NFCs were requested to submit target loads for 2030, 2050 and 2100.

11. The recovery delay time (RDT) was the time required for a critical limit value to be no longer violated. RDT could be computed, for example, in areas where the critical load was no longer exceeded but the critical limit was still violated.

12. The damage delay time (DDT) was the time required for a critical limit value to be violated for the first time. DDT could be computed, for example, in areas where the critical load was exceeded but the critical limit was not yet violated.

13. In addition to providing these dynamic modelling data, NFCs were requested to ensure consistency between critical loads and dynamic modelling. This implied that each record in the critical load database should contain data for computing critical loads and to run the dynamic model.

14. To maintain important statistical information on the (distribution of) sensitivity of ecosystems within an EMEP grid cell, NFCs were requested to also include records where only critical loads data were available, i.e. leaving the dynamic modelling parameters blank.

15. Results of the call for data were presented at the fifteenth CCE workshop and twenty-first Task Force meeting of ICP Modelling and Mapping. These meetings were held at the invitation of German Federal Ministry of the Environment, Nature Conservation and Nuclear Safety (Berlin, 25-29 April 2005).

II. RESULTS OF THE CALL FOR DATA

16. Fourteen NFCs of Parties to the Convention submitted updated data on critical loads of acidity and of nutrient nitrogen. Thirteen of these also provided dynamic modelling data. Annex I shows the latest data update years by all NFCs.

17. Maps of critical loads for acidity and eutrophication that protect 95% of the ecosystems are illustrated in figure II. Ecosystem-specific maps of critical loads could be produced as well.

18. CCE analyzed the development of the variability of national critical load data since 1998 for the robustness of exceedance computations (CCE Status Report 2005). The Task Force meeting noted that the limited differences between the 1998 and the present critical load submissions indicated high data robustness.

19. The Task Force meeting adopted the results of the call for data with announced minor additions to be sent to CCE before 13 May 2005 for inclusion into the European data set.

III. EXCEEDANCES

20. The area-weighted average of exceedances (AAE, accumulated over all ecosystem points in a grid cell) were computed with the latest critical load database. The calculations used critical loads computed with the European background database for countries not submitting data and made use of acidifying and eutrophying deposition for 1980, 1990, 2000 and 2010 computed by the EMEP Meteorological Synthesizing Centre - West. Results are listed in annex II.

21. The last row of the table in annex II shows that the ecosystem area in Europe at risk of acidification to be 9.8% and 6.9% in 2000 and 2010, respectively. The area at risk from excess nutrient nitrogen was 30.1% and 29.4%, respectively.

IV. DYNAMIC MODELLING FOR ACIDIFICATION AND EUTROPHICATION

22. Dynamic modelling for acidification was applied by 14 NFCs on 683,237 km^2 of the European ecosystem area. An area of 168,661 km^2 was calculated to be “not safe” in 2000, i.e. areas where critical loads were exceeded and/or the critical limit was violated.

23. Analyses indicated that for 20% of the area at risk a RDT could be found by 2030, assuming that deposition targets for the 1999 Gothenburg Protocol were met and sustained. An additional 24% would recover in 2030 if target loads were set equal to the critical loads. Target loads lower than critical loads could protect 51% of the area in 2030. In summary, 95% of the area which was not safe in 2000 could become safe by 2030 if acid deposition was sufficiently reduced.

24. Dynamic modelling of the risk of acidification suggested that recovery could occur relatively fast (before 2030) for a majority of areas at risk that showed possibilities for recovery. An additional 2% of the area would become safe by 2050, i.e. 22%, assuming that deposition remained at Gothenburg Protocol implementation levels.

25. Dynamic modelling also revealed that a DDT could be computed for 23% of the area. This showed that the critical limit would be violated before one of the target years if depositions remain at levels determined by the 1999 Gothenburg Protocol.

26. For only 3% of the area (5% in 2030) deposition levels could not be sufficiently reduced to achieve recovery before 2100.

27. The above conclusions complement the critical load approach by providing more in-depth understanding of exceedances. They could support strategies for reducing exceedances that fail to reach critical loads (gap closure).

28. The predicted persisting high exceedances of critical loads for eutrophication have highlighted the need to use dynamic models to improve knowledge on time delays of damage and recovery.

29. As preparatory work CCE organized a one and a half day session on nitrogen during its workshop. Experts from several Parties participated. The session focused on the following six issues:

(a) To establish which are the harmful effects of nitrogen and to present observation trends;
(b) To review currently used critical limits in the computation of critical loads, including proposals for a possible revision;
(c) To establish whether other critical limits could be defined using material from experiments and observations;
(d) How could new limits be used in steady-state and dynamic models for the assessment of effects of air pollution?
(e) How could new limits be used in the assessment of multiple effects (including for example changes in biodiversity)?
(f) How could the interactions between air pollution and climate change (e.g. long-term carbon and nitrogen sequestration, long-term N_2O and CH_4 emissions) be assessed?

30. CCE, in collaboration with Alterra, compiled a draft background document exploring the status of critical limits for nutrient nitrogen and alternatives to assess multiple effects including biodiversity. Experts had been invited to contribute to the document, which could contribute to the nitrogen workshop to be organized by the United Kingdom (Brighton, United Kingdom, 26-28 October 2005).

31. The Task Force meeting recommended using the Alterra-CCE background document in the programme as a starting point to update knowledge for estimates on critical loads of nitrogen. It invited participants to comment on the six issues and on the other material available at the workshop (e.g. the Alterra-CCE background document). It recommended that the nitrogen workshop in Brighton consider this material.

References

CCE Status Report (2005) Posch M, Slootweg J, Hettelingh JP (eds.) Netherlands Environmental Assessment Agency at RIVM, Coordination Center for Effects, www.mnp.nl/cce, Bilthoven, The Netherlands.

Simpson D, Fagerli H, Jonson JE, Tsyro S, Wind P, Tuovinen J-P (2003) Transboundary Acidification, Eutrophication and Ground Level Ozone in Europe, Part 1: Unified EMEP Model Description. EMEP-Report 1/2003, Norwegian Meteorological Institute, Oslo, Norway.

Tarrasón L, Jonson JE, Fagerli H, Benedictow A, Wind P, Simpson D, Klein H (2003) Transboundary Acidification, Eutrophication and Ground Level Ozone in Europe, Part III: Source-receptor relationships. EMEP Report 1/2003, Norwegian Meteorological Institute, Oslo, Norway

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

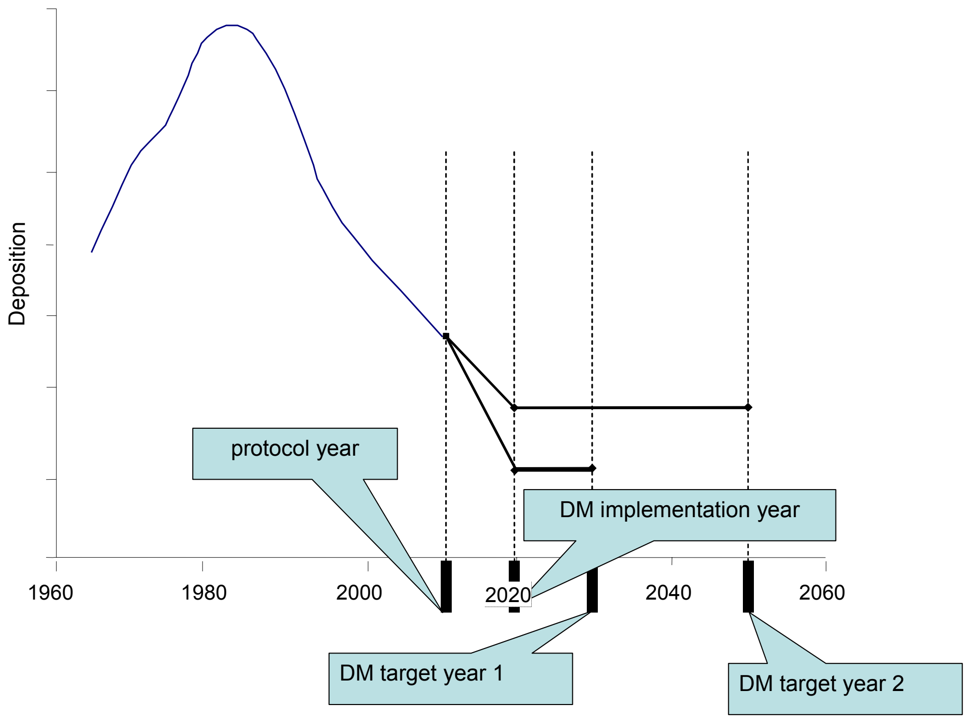

Figure I. Schematic representation of deposition paths leading to target loads by dynamic modelling (DM), characterised by three key years: (i) The year up to which the (historic) deposition is fixed (protocol year); (ii) the year in which the emission reductions leading to a target load are implemented (DM implementation year); and (iii) the years in which the chemical criterion is to be achieved (DM target years).

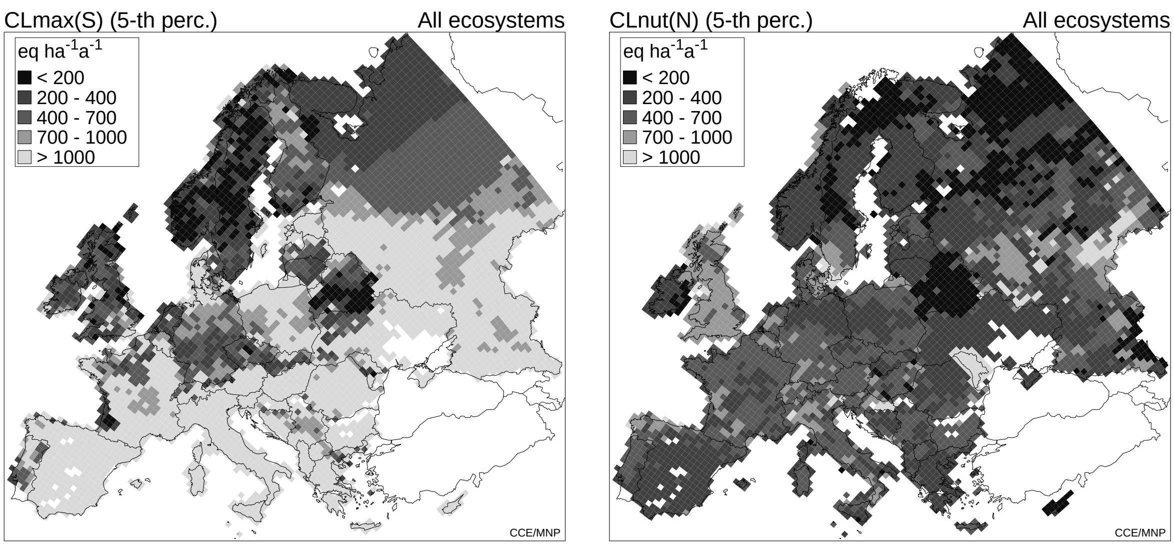

Figure II. Critical loads for acidity (left) and nutrient nitrogen (right) for the protection of 95% of all ecosystems for which data were submitted, including the European background database for ecosystems in countries that have never submitted data.

Annex I

Overview of the latest data update submission year on critical loads of acidification, eutrophication and dynamic modelling

	critical loads of acidification based on data of	critical loads of eutrophication based on data of	dynamic modelling data based on data of:
Austria (AT)	2005	2005	2005
Belgium (BE)	2003	2003	-
Bulgaria (BG)	2005	2005	2005
Belarus (BY)	2005	2005	-
Switzerland (CH)	2005	2005	2005
Cyprus (CY)	2004	2004	-
Czech Rep. (CZ)	2005	2005	2005
Germany (DE)	2005	2005	2005
Denmark (DK)	2004	2004	-
Estonia (EE)	2001	2001	-
Spain (ES)	1997	1997	-
Finland (FI)	2004	2004	-
France (FR)	2005	2005	2005
United Kingd. (GB)	2005	2004	2005
Croatia (HR)	2003	2003	-
Hungary (HU)	2004	2004	2004
Ireland (IE)	2005	2005	2005
Italy (IT)	2005	2005	2005
Moldova (MD)	1998	1998	-
Netherlands (NL)	2005	2005	2005
Norway (NO)	2005	2005	2005
Poland (PL)	2005	2005	[2]2005
Russia (RU)	1998	1998	-
Sweden (SE)	2005	2005	2005
Slovakia (SK)	2003	2003	-
Total number of Parties	11 14	11 14	1 13

Annex II

Exceedances of the critical load for acidification (left) and for eutrophication (right) as % of the European ecosystem area for which critical loads are available (including the CCE background data base). Depositions computed with the EMEP unified model (Simpson et al. 2003, Tarrasón et al. 2003) in 1980–2010 on the basis of the baseline current legislation scenario were used

country	ecosystem area (km^2)	area not protected from acidification (%)			
		1980	1990	2000	2010
AL	6,334	0.9	0.9	0.0	0.0
AT	35,745	35.2	16.7	1.0	0.6
BA	10,241	70.4	65.3	52.7	45.2
BE	7,282	99.2	96.3	52.5	25.0
BG	52,032	0.0	2.7	0.0	0.0
BY	107,841	96.0	91.1	65.5	62.2
CH	11,792	59.4	38.7	20.5	13.2
CY	4,434	-	-	0.0	0.0
CZ	11,178	99.4	99.3	81.3	52.2
DE	104,186	94.6	93.3	62.4	42.9
DK	3,136	98.4	94.8	41.1	15.1
EE	21,416	0.0	0.0	0.0	0.0
ES	85,175	4.3	2.9	0.9	0.1
FI	265,919	39.0	15.6	3.1	1.9
FR	180,102	24.5	21.3	15.1	7.3
GB	77,129	75.4	67.1	31.1	14.4
GR	9,288	11.3	15.2	10.5	6.4
HR	6,931	96.7	80.7	9.2	1.2
HU	10,448	10.0	5.3	0.2	0.0
IE	8,933	41.0	33.6	20.6	10.0
IT	125,477	1.2	0.0	0.0	0.0
LT	17,651	92.5	89.7	77.5	69.4
LU	821	99.9	78.7	63.5	22.2
LV	27,321	56.3	46.8	25.9	16.5
MD	11,985	37.5	22.7	2.7	2.7
MK	5,068	47.4	47.4	41.8	12.2
NL	7,295	87.6	86.7	84.9	82.0
NO	386,692	42.4	33.8	18.9	12.8
PL	88,383	99.9	97.3	62.3	44.2
PT	21,221	10.0	12.4	8.9	4.8
RO	62,807	67.7	49.5	7.4	6.4
RU	3,516,432	46.4	24.3	1.3	1.3
SE	517,818	58.7	45.3	21.9	12.9
SI	5,264	70.1	51.2	12.3	0.0
SK	19,253	80.1	71.5	26.5	14.7
UA	63,600	93.1	82.1	33.0	24.9
YU	21,307	53.6	52.8	41.6	30.2
EU25	1,654,876	48.6	38.7	20.9	13.1
Europe	5,918,115	48.1	31.2	9.8	6.9

country	ecosystem area (km^2)	area not protected from aeutrophication (%)			
		1980	1990	2000	2010
AL	6,334	100.0	100.0	100.0	99.9
AT	3,5745	99.8	99.8	99.5	97.3
BA	10,241	99.9	99.9	99.7	99.6
BE	7,282	97.5	97.1	95.2	94.0
BG	52,032	100.0	100.0	98.1	98.5
BY	107,841	75.8	76.0	60.4	64.1
CH	22,790	91.4	90.9	88.1	78.1
CY	4,434	-	-	87.3	88.4
CZ	11,178	100.0	100.0	99.9	99.1
DE	104,186	99.0	98.7	97.7	96.9
DK	3,136	100.0	100.0	97.5	89.3
EE	22,377	99.9	99.8	74.8	58.2
ES	85,175	72.2	82.3	84.7	78.9
FI	239,507	77.1	74.7	51.6	47.3
FR	180,102	98.4	98.6	98.2	97.2
GB	73,649	40.9	35.9	26.2	23.2
GR	9,288	100.0	100.0	100.0	100.0
HR	7,009	75.3	68.8	49.5	43.8
HU	10,448	100.0	100.0	98.5	88.7
IE	8,933	86.7	86.1	82.2	78.8
IT	125,477	76.9	78.1	72.1	65.2
LT	17,651	100.0	100.0	100.0	100.0
LU	821	100.0	100.0	100.0	100.0
LV	27,321	100.0	100.0	99.5	98.6
MD	11,985	0.2	0.2	0.1	0.1
MK	5,068	100.0	100.0	100.0	100.0
NL	4,334	98.1	98.1	95.6	91.3
NO	317,025	10.5	9.7	5.6	3.1
PL	88,383	99.5	99.3	98.0	97.4
PT	21,221	81.9	92.4	94.2	92.3
RO	62,807	100.0	100.0	99.2	99.4
RU	3,516,432	19.0	21.7	11.2	12.3
SE	223,771	56.6	55.1	34.5	18.9
SI	5,264	100.0	100.0	100.0	100.0
SK	19,253	100.0	100.0	100.0	99.9
UA	63,600	100.0	100.0	100.0	100.0
YU	21,307	100.0	100.0	100.0	100.0
EU25	1,328,936	80.5	80.4	71.2	65.9
Europe	5,533,584	38.2	39.9	30.1	29.4