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

Working Group on Strategies and Review

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Geneva, 12–15 April 2010
Item 3 of the provisional agenda

OPTIONS FOR REVISING THE GOTHENBURG PROTOCOL

DRAFT REVISED ANNEX I ON CRITICAL LOADS AND LEVELS

Note by the secretariat

Summary

At its forty-fifth session in September 2009, the Working Group on Strategies and Review expressed its wish to have technical annex I of the Gothenburg Protocol updated by the Working Group on Effects and to present the proposed amendments to annex I at the forty-sixth session of the Working Group on Strategies and Review in April 2010 (ECE/EB.AIR/WG.5/98, paragraph 46 (k)), a decision which was endorsed by the Executive body at its twenty-seventh session in December 2009.

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Annex I

CRITICAL LOADS AND LEVELS

I. CRITICAL LOADS OF ACIDITY

A. For Parties within the geographical scope of EMEP

1. Critical loads (see definition in article 1) of acidity for ecosystems are determined in accordance with the Convention's *Manual on Methodologies and Criteria for Modelling and Mapping Critical Loads and Levels and Air Pollution Effects, Risks and Trends* (2004) where they are exceeded. They are the maximum amount of acidifying deposition that - in the long term - will not cause adverse effects to an ecosystems structure and function. Critical loads of acidity in terms of nitrogen take into account of within-ecosystem nitrogen removal processes such as uptake by plants. Critical loads of acidity in terms of sulphur do not. A combined sulphur and nitrogen critical load of acidity considers nitrogen only when the nitrogen deposition is greater than the ecosystem nitrogen removal processes. All critical loads reported by Parties are summarized for use in the integrated assessment modelling employed to provide guidance for setting the emission ceilings in annex II.

B. For Parties in North America

2. In Canada, critical acid deposition loads and geographical areas where they are exceeded are determined and mapped for lakes and upland forest ecosystems using scientific methodologies and criteria similar to those on the Convention's 2004 *Manual on methodologies and Criteria for Modelling and Mapping Critical Loads and Levels and Air Pollution Effects, Risks and Trends* (2004). Critical load values for total sulphur plus nitrogen and exceedance levels have been mapped across Canada (south of 60°N latitude) and are expressed in equivalences/ha/yr (2004 Canadian Acid Deposition Science Assessment; 2008 Canadian Council of Ministers of the Environment). The province of Alberta has also adapted the generic critical load classification systems used for soils in Europe for potential acidity to define soils as highly sensitive, moderately sensitive and not sensitive to acidic deposition. Critical, target and monitoring loads are defined for each soil class and management actions are prescribed as per the Alberta Acid Deposition Management Framework as appropriate.

3. For the United States of America, the effects of acidification are evaluated through an assessment of the sensitivity of ecosystems, the total loading within ecosystems of acidifying compounds, and the uncertainty associated with nitrogen removal processes within ecosystems.

4. These loads and effects are used in integrated assessment modelling and provide guidance for setting the emission ceilings and/or reductions for Canada and the United States of America in annex II.

II. CRITICAL LOADS OF NUTRIENT NITROGEN

For Parties within the geographical scope of EMEP

5. Critical loads (see definition in article 1) of nutrient nitrogen (eutrophication) for ecosystems are determined in accordance with the Convention's *Manual on Methodologies and Criteria for Modelling and Mapping Critical Loads and levels and Air Pollution Effects, Risks and Trends* (2004) where they are exceeded. They are the maximum amount of eutrophying nitrogen deposition that - in the long term - will not cause adverse effects to an ecosystem’s structure and function. All critical loads reported by Parties are summarized for use in the integrated assessment modelling employed to provide guidance for setting the emission ceilings in annex II.

III. CRITICAL LEVELS OF OZONE

A. For Parties within the geographical scope of EMEP

6. Critical levels (see definition in article 1) of ozone are determined to protect plants in accordance with the Convention's *Manual on Methodologies and Criteria for Modelling and Mapping Critical Loads and Levels and Air Pollution Effects, Risks and Trends* (2004) where they are exceeded. They are expressed in terms of the cumulative value of ozone uptake by the plant (stomatal fluxes) that is sufficient to damage the plant. This exposure index is referred to as phytotoxic ozone dose, or POD, and may contain receptor-specific thresholds, above which POD is accumulated. This index takes into account the modifying effect of climate, soil and plant factors on the instantaneous uptake of ozone by vegetation.

7. Critical levels have been derived for a number of species of crops, (semi-)natural vegetation and forest trees. These include: agricultural crops [insert: POD], high fertilizer input grasslands and pastures [insert POD], and different forest trees [insert: POD].

8. The long-term critical level of ozone for crops of an AOT40 of 3000 ppb.hours for May to July (used as a typical growing season) and for daylight hours was used to define areas at risk where the critical level is exceeded. A specific reduction of exceedances was targeted in the integrated assessment modelling undertaken for the present Protocol to provide guidance for setting the emission ceilings in annex II.

9. The critical level of ozone for human health is determined to protect human health from high ozone concentration occurring during a day and leading to a wide range of acute health effects, including increased risk of premature death. It is expressed by the cumulative index based on the maximum daily ozone concentration (maximum daily eight-hour mean) integrated over all days in a year, being proportional to the health risks. A specific reduction of this index was targeted in the integrated assessment modeling undertaken for the present Protocol to provide guidance for setting emission ceilings in annex II.

B. For Parties in North America

10. For Canada, it is understood that there is no lower threshold for human health effects from ozone, that is, adverse effects have been observed at all ozone concentrations experienced in Canada. The Canadian standard for ozone was set to aid management efforts nationally, and by jurisdictions, to significantly reduce the effects on human health and the environment.

11. For the United States of America, critical levels of ozone are determined to protect public health with an adequate margin of safety, to protect public welfare from any known or expected adverse effects, and are used to establish a national ambient air quality standard. Integrated assessment modelling and the air quality standard are used in providing guidance for setting the emission ceilings and/or reductions for the United States of America in annex II.

IV. CRITICAL LEVELS OF PARTICULATE MATTER

12. The critical level of particulate matter for human health is determined in accordance with the World Health Organization air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulphur as the mass concentration of PM2.5 (particles with aerodynamic diameter less than 2.5 µm). Attainment of the Guideline level is expected to effectively reduce the health risks. The long term PM2.5 concentration, expressed as an annual average, is proportional to the risk to health, including reduction of life expectancy. This indicator has been used in integrated modelling to provide guidance for emission reduction. In addition to the annual guideline level, a short term (24-hour mean) limit has been recommended. It should protect against peaks of pollution that would lead to substantial excess morbidity or mortality.

V. CRITICAL LEVELS OF AMMONIA

13. Critical levels (see definition in article 1) of ammonia are determined to protect plants in accordance with the *Manual on Methodologies and criteria for Modelling and Mapping Critical Loads and Levels and Air Pollution Effects, Risks and Trends* (2004) where they are exceeded.

VI. ACCEPTABLE LEVELS FOR MATERIALS

14. Acceptable levels (as defined in Article 1) of acidifying pollutants and particulate matter are determined to protect materials and cultural heritage in accordance with the Convention's *Manual on Methodologies and Criteria for Mapping Critical Loads and Levels and Air Pollution Effects, Risks and Trends* (2004) where they are exceeded. The acceptable levels of pollutants are the maximum a material can tolerate in the long term without resulting in damage above specified target corrosion rates. These damages, which can be calculated by available dose-response functions, is the result of several pollutants acting together in different combinations depending on the material: acidity (SO_2, HNO_3), ozone and particulate matter.

VII. RECOVERY OF ECOSYSTEMS

Acidification

15. Recovery from the adverse effects of acidification can be achieved when the critical load is not exceeded. When recovery is required by a specified year (target year) a deposition value (target load) is required to enable the chemical criterion - that links the critical load to the biological effects to attain a non-critical value in the target year.

Eutrophication

16. Recovery from the adverse effects of eutrophication may be achieved when the critical load is not exceeded. When recovery is required by a specified year (target year), a deposition value (target load) is required to enable the chemical criterion that links the critical load to the biological effects to attain a non-critical value in the target year.
