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**PREPARATORY WORK FOR THE NEGOTIATION OF
A REVISED GOTHENBURG PROTOCOL**

REACTIVE NITROGEN

Report by the Co-Chairs of the Task Force on Reactive Nitrogen¹

INTRODUCTION

1. This report, prepared in cooperation with the secretariat, describes the results of the first meeting of the Task Force on Reactive Nitrogen, held on 21–23 May 2008 in Wageningen, the Netherlands, in accordance with item 1.9 of the 2008 workplan for the implementation of the Convention (ECE/EB.AIR/91/Add.2) adopted by the Executive Body at its twenty-fifth session.

¹ The present document was submitted late due to resource constraints.

The presentations made during the meeting and the reports presented can be accessed at:

www.clrtap-tfrn.org.

2. Eighty-two experts from the following Parties to the Convention attended the meeting of the Task Force: Austria, Canada, Croatia, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, the Netherlands, Norway, Poland, Romania, the Russian Federation, Slovakia, Spain, Sweden, Switzerland, the United Kingdom of Great Britain and Northern Ireland and the United States of America.

3. Also present were representatives from the International Cooperative Programme (ICP) on Vegetation, ICP Integrated Monitoring, ICP Modelling and Mapping and its Coordination Centre for Effects (CCE), the Task Force on Integrated Assessment Modelling, EMEP² Centre for Integrated Assessment Modelling (CIAM) at the International Institute for Applied Systems Analysis (IIASA), the European Community's Directorate-General Eurostat, the European Commission's Joint Research Centre, the European Environment Agency (EEA), the Organization for Economic Cooperation and Development (OECD), the Committee of Professional Agricultural Organisations and the General Committee for Agricultural Cooperation in the European Union (COPA-COGECA), the European Fertilizers Manufacturers Association (EFMA), the European Environmental Bureau (EEB). The Chair of the Working Group on Effects, a Vice-Chair of the Working Group on Strategies and Review and a member of the UNECE secretariat also attended.

4. Mr. O. Oenema (Netherlands) and Mr. M. Sutton (United Kingdom), the Co-Chairs of the Task Force on Reactive Nitrogen, chaired the meeting, which was hosted by Alterra, Wageningen University and Research Centre, with support from the research networking programme "Nitrogen in Europe" (NinE) of the European Science Foundation (ESF) and the European Cooperation in the Field of Scientific and Technical research (COST) Action 729.

5. The Task Force mainly worked in plenary, with an emphasis of relating its work to activities within and outside the Convention linked to nitrogen (N). It also divided into discussion groups to identify activities and tasks both in short and long term. These groups reported their conclusions to the Task Force.

I. INTRODUCTORY REMARKS

6. Mr. Sutton, Mr. Oenema, Mr. M. Johansson (secretariat), Mr. T. Johannessen (Chair of the Working Group on Effects) and Mr. R. Maas (Chair of the Task Force on Integrated Assessment Modelling) provided introductory N-relevant information on the activities of the

² The Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe.

Convention and its workplan. It was stressed that the Task Force had wide scope reaching across the Convention, involving collaboration both within and outside the Convention. Attention was drawn to the 2007 Gothenburg workshop that had identified the need for further work on N issues (EB.AIR/WG.5/2007/9), as well as the Laxenburg workshop on integrated modelling of N (EB.AIR/WG.5/2008/3).

7. The Task Force agreed to define reactive nitrogen (Nr) as all biologically active, photochemically reactive and radiatively active N compounds in the biosphere and atmosphere. This meant, in practice, all N except N₂ gas; for example, nitric oxides, nitrogen dioxide, nitrate (NO₃), organic N compounds, nitrous oxide (N₂O), ammonia (NH₃) and ammonium.

8. Mr. J. Sliggers (Vice-Chair of the Working Group on Strategies and Review) outlined expectations on the short - and long-term work of the Task Force. He noted, inter alia, selected items relating to the work of the former Expert Group on Ammonia Abatement, such as the Guidance document on control techniques and the Framework Code on Good Agricultural Practice for Reducing NH₃, annex IX of the Gothenburg Protocol³ and improvements to the methodologies on the emission inventories.

II. NATIONAL EXPERIENCES ON NITROGEN POLICIES

9. Mr. B. Gimeno (Spain) reported various national programmes and legislation that had been put in place to reduce N emissions. It appeared to be difficult to attain emission ceilings, due to implementation delays and activity increases. He noted that current relevant questions for agriculture were seasonality and management options and that other research concentrated on detecting the effects of N inputs to ecosystems, including critical loads and effects of global and climate changes on ecosystems.

10. Ms. I. D'Elia (Italy) presented work on NH₃ in Italy with an integrated approach. Recent new analyses on emission data and control options had improved the accuracy of estimates of both emissions and impacts of Nr in the environment.

11. Ms. Å. Sjöström (United Kingdom) presented evaluations in the United Kingdom to tackle the N problem through improved nutrient management at the farm level. A systems view of the N and phosphorus cycles, focusing on the efficient use of fertilizers and manures on farms could help avoid pollution swapping. It would also increase the impact and efficiency of policies that aimed to deliver outcomes for air, water, soil, climate change and biodiversity.

12. Mr. T. Iversen (Denmark) presented experiences from Denmark, emphasizing the usefulness of N budgets. Reductions of Danish NH₃ emissions had significantly decreased N

³ The 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone.

deposition onto land and waters, resulting in considerably reduced ecological effects, through these occurred with a delay. The implemented policy measures were not without cost to farmers.

13. Mr. Ø. Kaste (Norway) drew attention to the need to further reduce N deposition in Norway to reduce acidification, which occurred particularly in winter and spring in surface waters. He also mentioned the risk of increased mobilization of soil N when climate changed. The observed differences in reduced N deposition and NO₃ trends indicated that N leaching was the result of several factors.

14. Mr. K. Sanders (Netherlands) presented the change of Dutch policy from a single compound policy into a more integrated assessment. It promoted synergies between policies, action to prevent Nr creation and international exchange of experiences.

15. Mr. M. Dedina (Czech Republic) presented N-related research and policy. He drew attention to the requirements of annex IX of the Gothenburg Protocol and the European Union's (EU) Integrated Pollution Prevention and Control (IPPC) Directive on animal housing for old and new installations. He highlighted inconsistencies between agricultural source sectors and drew attention to the option of considering a farm NH₃ threshold (e.g. 5,000 kg NH₃ per year) as a means for identifying farms of a suitable size for the application of best available techniques.

16. Ms. S. Gardner and Mr J. Lynch (United States) presented the functions of the Department of State, responsible for international agreements and protocols, the Department of Agriculture, having nutrient and soils management programmes, and the Environmental Protection Agency, having regard to implement the clean water and air acts. They summarized the objectives of the "U.S. N emission control programs for air and water", and drew attention to the bilateral agreement between United States and Canada on air. Although several regulatory limits were mentioned, there were no current specific regulatory emission limits for farms. A reporting limit for NH₃ which was applicable to all sources was mentioned. The reporting threshold in place was 100 lb NH₃ per day, i.e. 45.36 kg NH₃ per day, however, sources which exceeded this threshold only had a duty to report the release.

17. The Task Force took note of three important aspects highlighted in the national presentations:

(a) The seasonality of Nr emissions, deposition and transformations should be taken into account in the assessment of effects; for example, NH₃ contributed to secondary particulate matter (PM) formation more in winter than in summer, and springtime NO₃ concentrations in boreal waters were often significantly higher than the annual average, representing an increased threat to aquatic species;

(b) The choice of food diet had considerable effect on the N cycle. Food policies also had links to greenhouse gas emissions and the status of human health. The consequences of changes in diets should be explored further in order to estimate its significance for the N cycle;

(c) National reports on experiences in N could be collected by national focal points, for consideration in the Task Force. Such reports would also complement the work being done in the European Nitrogen Assessment (ENA) and by Eurostat.

III. FIRST RESULTS FROM THE EUROPEAN NITROGEN ASSESSMENT

18. Mr. Sutton presented the ENA activity, supported by the ESF programme Nitrogen in Europe (NinE), drawing on input from the NitroEurope Integrated Project and other research programmes. ENA aimed to review current scientific understanding of N sources, impacts and interactions across Europe, taking account of current policies and the economic costs and benefits, as a basis for informing the development of future policies at local to global scales. The Task Force welcomed the contribution of the ENA process to its work.

19. Mr. J.-W. Erisman (Netherlands) presented the activities and results of the first workshop of ENA on multiple nitrogen problems and the current policy measures, held on 20-21 May 2008 in Wageningen, the Netherlands. He noted that the workshop adopted the overall outline for the ENA reporting and had identified the need to describe clearly the positive effects of Nr, especially in relation to food production.

IV. WORK UNDER OTHER INTERNATIONAL CONVENTIONS AND ACTIVITIES

20. Mr. A. Bleeker (Netherlands) presented the work under the Convention on Biological Diversity. Sets of indicators were developed to assess trends in biodiversity. The pan-European contribution through the EU project “Streamlining European biodiversity indicators for 2010” (SEBI2010) had included the critical load of N as one of 26 specific indicators. The Task Force noted that the representatives of the Convention on Biological Diversity had expressed interest in collaboration, in particular on modelled N deposition, proposals on water quality index for biodiversity and quantification of Nr impacts on terrestrial and aquatic biodiversity.

21. Mr. K. Smith (United Kingdom) presented the methodology of the Intergovernmental Panel on Climate Change (IPCC) for N₂O emissions from agriculture, and its relevance to N₂O mitigation. He drew attention to a recent alternative top-down global budget approach, which was derived in the context of N applied to biofuel crops (but applicable to anthropogenic N use in general). This approach had resulted in a new, average emission factor for all N₂O from terrestrial ecosystems. He noted that, given the uncertainties in data, the sum of the IPCC source terms was not inconsistent with the total derived by the global top-down methodology. The Task Force noted that the IPCC encouraged countries to estimate their emissions from specified areas and sources on the basis of validated country-specific emission factors, and that the IPCC default values were to be utilized only where no such emission factors were available.

22. Ms. A. Lükewille (EEA) presented work on compiling data on air pollution, reporting the results and providing access to information. She drew attention to the core set of indicators for

air pollution, currently being updated, and the collaboration with the Convention. She concluded that Nr was considered a major problem that would require enhanced cross-cutting work and communication outside EEA to summarize the ecosystem impacts more clearly.

23. Ms. R.-L. Knaapi (Eurostat) presented the work on agri-environmental indicators to evaluate agricultural policy. The NO₃-related indicators included N balance with phosphorous, emissions of NH₃ and greenhouse gases, water quality, manure storage and fertilizer use. She noted that N balances were calculated at the regional level (nomenclature of territorial units for statistics - level three, NUTS-3) and, in collaboration with OECD, at the national level. She foresaw possible collaboration with the Task Force on emission factors and on harmonization of input data and methodologies.

24. Mr. N. A. Braathen (OECD) presented recent work of OECD on instrument mixes to address non-point sources of water pollution in agriculture. He emphasized the multi-aspect character of many environmental issues. The case studies had indicated that taxes on N surpluses, especially if calculated at sector levels, could be environmentally effective and economically efficient. Other OECD work had indicated that voluntary approaches for environmental policy tended not to be effective.

25. Mr. J. van Wenum (COPA-COGECA) presented views on behalf of the European farmers organization, drawing particular attention to Dutch farming. He called for an integrated N emission policy that would address the fragmentation and inconsistencies in current legislation. Currently, farmers in Europe had to deal with various and sometimes conflicting policies and legislative measures. He proposed developing a system that would target total N emission from farming systems and allow farmers to choose cost-effective emission reduction tools that were adjusted to the specific conditions at the farm level.

26. Mr. F. Brentrup (EFMA) presented the status and trends in the fertilizer market in Europe and the agricultural contribution to air pollution and climate change. He concluded that fertilizers were essential to sustain optimal crop yields and that integrated farm management would balance productivity and environmental requirements. He supported the development of an integrated approach for Nr, including climate change aspects, more involvement of stakeholders and coordination of N-related policies and conventions.

V. NITROGEN EMISSIONS INVENTORIES AND MITIGATION

27. Mr. N. Hutchings (Denmark) presented the work of the agriculture and nature panel, operating under the Task Force on Emission Inventories and Projections. The natural emission sources included rural, non-agricultural sources, particularly forests. The agricultural emissions covered all on-farm sources, excluding machinery and small-scale waste-burning. Panel meetings had been held annually with the Task Force on Emission Inventories and Projections and with the former Expert Group on Ammonia Abatement. Current activities contributed to the

major revision of Guidebook on emission inventories, and the harmonization of the inventories with those of the IPCC 2006 methodologies. He encouraged the Task Force on Reactive Nitrogen to contribute to the continuous updating of emission-related information through its N emission expertise, with particular emphasis on quality control to enable the completion of N budgets.

28. Mr. M. de Bode (co-chair of the former Expert Group on Ammonia Abatement) summarized the work of the Expert Group in completing the Guidance documents on control techniques for preventing and abating emissions of NH₃ (EB.AIR/WG.5/2007/13). He highlighted the need for future work in updating the Framework Code of Good Agricultural Practice for Reducing NH₃ (EB.AIR/WG.5/2001/7), for ongoing coordination with the development of best available techniques reference methods (BREF) in the pig, poultry and potentially cattle sectors, and the need to obtain more detailed data on farm practices relevant for N emission. He noted that the Expert Group was discontinued and its work merged with that of the new Task Force by decision 2007/1 of the Executive Body. Given the ongoing needs, he proposed that the work be conducted in an expert panel that would be coordinated with the work of the agriculture and nature panel of the Task Force on Emission Inventories and Projections.

29. Mr. W. Winiwarter (CIAM) described how N was described in the GAINS model through a harmonized agricultural model. The N balances that could be derived from the GAINS database improved general understanding and critical issues, for example, the balance between fodder import and food excess at national level. Consistent scenarios for different components could be derived and fed into policy.

30. Mr. Oenema presented integrated measures in agriculture to decrease NH₃ emissions. He proposed to have integrated abatement measures that would simultaneously affect NH₃ emissions and NO₃ leaching. Targets should be formulated for N use efficiency at farm level, with rewards for going beyond set standards.

VI. CONTRIBUTION TO THE REVISION OF THE GOTHENBURG PROTOCOL

31. Mr. Oenema presented proposals to contribute to the revision of the Gothenburg Protocol, mainly with respect to the NH₃ abatement, including:

- (a) Include explicitly synergies and tradeoffs with abatement measures of N₂O emissions and NO₃ leaching;
- (b) Further explore and define integrated measures for reducing nitrogen oxides (NO_x), NH₃ and N₂O emissions to air as well as NO₃ leaching to water simultaneously;
- (c) Include interactions between measures under the Convention and under climate change policies;
- (d) Recognize important roles of managerial measures and structural measures on gaseous N emissions;
- (e) Develop integrative indicators for N use efficiency in agriculture;

(f) Suggest possible economic instruments for effective implementation of policies aimed at decreasing N emissions.

32. In the resulting discussion the Task Force noted that:

(a) Any updates to annex IX of the Gothenburg Protocol or related documentation should take into account the challenges for countries who have not yet ratified the Protocol;

(b) Emphasis should be placed on developing realistic expectations of implementing recommendations by farmers;

(c) Attention be given to explore the most cost-efficient options for the countries in Eastern Europe, the Caucasus and Central Asia, to evaluate emerging new technologies, to consider side-effects of measures and constraints from other policies, to assess main uncertainties, and to contribute to the setting of aspirational 2050 targets for environmental effects and required abatement strategies;

(d) The Framework Code of Good Agricultural Practice for Reducing NH₃ (EB.AIR/WG.5/2001/7) should be updated and consideration be given to future updates of the Guidance document on control techniques for preventing and abating emissions of NH₃ (EB.AIR/WG.5/2007/13);

(e) Options for possible revision of annex IX of the Gothenburg Protocol should be considered. It was recommended to obtain views of national policymakers on the feasibility of current detailed measures and initially, if feasible, offer suggestions for updating the annex in the light of recent technical information, and provide options with different levels of ambition for consideration by the Working Group on Strategies and Review;

(f) The timing of any updates should be coordinated with the updating of IPPC Directive.

VII. NEW PERSPECTIVES ON REACTIVE NITROGEN

33. Mr. K. Hicks (United Kingdom) presented ongoing work, which aimed at a holistic approach to policymaking with focus on maintaining healthy ecosystems and ecosystem services. This ecosystems approach was considered a complementary way forward for the identification of possible priorities in the regulation of NH₃ and other N emissions.

34. Ms. A. Svirejeva-Hopkins (Germany) reported on the expansion of urban areas in the world and on the role of Nr in cities. She noted that urban air and water N pollution were the main drivers of the urban biogeochemistry. She highlighted the challenge of managing N in cities that represented an emerging topic relevant for the Task Force.

35. Mr. S. Bittman (Canada) highlighted the importance of estimating the seasonal variation in NH₃ emissions, particularly as this interacted with atmospheric PM levels. He summarized recent inventory work mapping NH₃ emissions for Canada which included estimated seasonal dynamics.

36. Mr. Sutton presented the summary of the discussion group on the task of the former Expert Group on Ammonia Abatement. The group concluded the priority work items were:

(a) Short-term: Contribute a scientific and technical review to support update of the annex IX of the Gothenburg Protocol; commence revision of the Framework code of good agricultural practice for reducing NH₃ (EB.AIR/WG.5/2001/7), emphasizing the further development of an integrated approach for N;

(b) Medium-term: Update information related to best available techniques (BAT), in coordination with ongoing updates of the BREF documentation, taking into account relevant farm activity data and the importance of seasonal aspects of NH₃ mitigation.

37. The Task Force agreed to establish an expert panel on mitigation of agricultural N. It requested it to aim to meet immediately before the Task Force meetings. It should also link to the relevant work and meetings under the Task Force on Emission Inventories and Projections, potentially to meet with its agriculture and nature panel in November 2008. Results of the panel discussions would be presented to the meetings of the Task Force for their consideration.

38. The importance of NH₃ for the Gothenburg Protocol was highlighted, together with the parallel need to develop the integrated approach for N. A core group of experts on NH₃ already existed, including links with the BREF review process. Additional experts would be invited to the expert panel in order to strengthen analysis of the interactions with NO_x emissions and NO₃ leaching. The scientific and technical work of the expert panel would highlight options of varying ambition, which the Task Force would review and report to Working Group on Strategies and Review, as a basis for informing the negotiations.

39. The Task Force noted that it might not be able to complete the scientific and technical review of annex IX of the Gothenburg Protocol and the Framework code of good agricultural practice for reducing NH₃ by the end of 2009. It agreed to inform the Working Group on Strategies and Review on this and, if necessary, request further advice from it.

40. Mr. Bleeker summarized the results of the discussion group on N budgets, which would cover the whole N cycle. The group considered as priority work items:

(a) Short-term: To define and clarify more clearly the aims for the proposed work on methodologies of N budgets at a range of spatial scales and systems boundaries, and to review currently available methodologies on budgets;

(b) Medium-term: To compile budgets at the national level and upscale them to Europe and other regions, carry out work on validation and uncertainty, identify most important fluxes and sources for budgets between environmental compartments, actively communicate the results.

41. Following discussion, the Task Force took note with respect to N budgets that:

- (a) The national focal points of the Task Force could coordinate with the recently established Network of National Integrated Assessment Modelling, which operated with the Task Force on Integrated Assessment Modelling;
- (b) Developments and experiences of all countries in the UNECE region should be included in the work of the Task Force;
- (c) An expert panel could help in preparing for the reporting of national budgets, first exploring methodologies and providing a reference template for the compilation;
- (d) N budgets would help in developing a view on the N cascade.

42. The Task Force agreed to establish an expert panel on N balances. This would report its findings to the meetings of the Task Force for their consideration.

VIII. FURTHER WORK

43. The Task Force noted the Internet pages at both with the Convention website, aimed mainly for distribution of official documentation, and a dedicated site www.clrtap-tfrn.org. The latter was intended for the dissemination of meeting presentations and related documentation. It also took note of its mandate on forwarding its reports to the Convention's main subsidiary bodies and requested the secretariat to ensure this for the meetings in September 2008.

44. The Task Force concluded that it would fulfil its tasks for this year as set out in Convention's 2008 workplan by developing a workplan in its first meeting and by submitting a meeting report to the Working Group on Strategies and Review as well as making it available to the Working Group on Effects and the EMEP Steering Body.

45. The Task Force noted its objectives as laid in Convention's 2008 workplan and based on the Executive Body decision 2007/1.

46. The Task Force agreed to propose its goals beyond 2008/2009 as follows:

- (a) Develop technical and scientific information for an integrated understanding of Nr, and options which can be used for strategy development across the UNECE region; encourage coordination of air pollution policies on N in the context of the N cycle and which might be used by other bodies outside the Convention in consideration of other control measures;
- (b) Submit the full progress report to the Working Group on Strategies and Review and the Executive Body in 2010;

47. The Task Force noted the N-related activities of ICP Modelling and Mapping:

- (a) Critical loads of N (eutrophication and acidification) had been successfully used as environmental quality targets in assessing sustainable Nr fluxes from the atmosphere to ecosystems, including their use in integrated assessment modelling;
- (b) Critical load exceedances indicated environmental risk of N deposition, e.g. to biodiversity;
- (c) Ongoing work, including the use of critical loads, dynamic modelling results and other data to support European environmental policies, including the development of indicators for multimedia and multi-scale N management;
- (d) Future work would prioritize dynamic modelling of N effects, inter alia, on biodiversity and evaluation of feedbacks to climate change, carbon biogeochemistry and management.

48. The Task Force agreed that it needed to collaborate with the ICP Mapping and Modelling, the Convention on Biological Diversity, and EEA on the development of indicators for effects of Nr, including further refinement of the N deposition indicator being developed by the International Nitrogen Initiative for the Convention on Biological Diversity and the work under SEBI2010.

49. The Task Force agreed that it would collaborate with ENA, which had invited participants also from outside Europe to contribute to its activities.

50. The Task Force agreed on its draft 2009 workplan items:

- (a) Improve coordination of activities across and outside the Convention and, “collaborate with subsidiary bodies under the Convention to complement the work of the subsidiary bodies of the Convention”; in particular via:
 - (i) Providing technical information for the proposed report of the Working Group on Effects on the impacts of airborne N on the environment and human health;
 - (ii) Collaboration with the ICP Modelling and Mapping, in particular on critical loads and dynamic modelling of N effects, including the development of indicators;
 - (iii) Collaboration with the Task Force on Emission Inventories and Projections, and participation in the relevant meetings and contributions to their expert work;
 - (iv) Collaboration with the Task Force on Integrated Assessment Modelling, participation in their relevant meetings, in particular to provide advice to avoid pollutant swapping and to improve N budgets at national level;
- (b) Continue the work of the former Expert Group on Ammonia Abatement, to develop more technical and scientific information on an integrated approach to mitigation of agricultural N emissions with special reference to the revision of the Gothenburg Protocol, in particular to update the Framework Code of Good Agricultural Practice, the Guidance Document

and to inform the Working Group on Strategies and Review's deliberations on revisions to annex IX of the Gothenburg Protocol and to take account of BREF;

(c) Provide technical information on making N balances and estimating N emissions at various spatial scales and for various system boundaries, and to formalize the use and presentation of N balances;

(d) Develop and provide technical and scientific information to support the revision of the Gothenburg Protocol in relation to the whole N cycle;

(e) Request the national focal points to provide national reports on technical and scientific information related to N;

(f) Consider the first results from ENA, in particular to receive the report on the assessment review of N emissions, impacts and policies, relevant to the Task Force as this is developed, and to provide feedback to the ENA process;

(g) To host a workshop on the review of methodologies on N balances, tentatively scheduled in connection with the second Task Force meeting;

(h) Second meeting of the Task Force, tentatively scheduled to be held in April 2009.
