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Working Group on Strategies and Review

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Item 2 of the provisional agenda
Progress in the implementation of the 2022–2023 workplan

Report of the Task Force on Reactive Nitrogen

Summary

At its twenty-fifth session (Geneva, 10–13 December 2007), the Executive Body for the Convention on Long-range Transboundary Air Pollution established the Task Force on Reactive Nitrogen. In accordance with its revised mandate set out in the annex to decision 2018/6, the Task Force is required to report on progress in its work to the Working Group on Strategies and Review.

The present report of the Task Force presents an overview of activities of the Task Force covered by its mandate and summarizes the progress in the implementation of the 2022–2023 workplan for the implementation of the Convention (ECE/EB.AIR/148/Add.1).

The 16th meeting of the Task Force took place on 22 November 2022 (on-line), with the 17th meeting of the Task Force taking place in Dessau (hybrid format) on 2–4 May 2023.

I. Introduction

1. The present report summarizes the progress of the Task Force on Reactive Nitrogen in implementing the 2022–2023 workplan for the implementation of the Convention (ECE/EB.AIR.148/Add.1) and provides an overview of activities covered by the mandate of the Task Force (decision 2018/6, annex). During the period after the last reporting for the WGSR-60 meeting in April 2022, the activities in the TFRN expert panels have continued, including status meetings and the activities reported below. The Task Force held its 16th meeting on-line on 22 November 2022, which was attended by 63 experts from 21 countries. The Task Force held its 17th meeting on 2-4 May 2023, in Dessau, Germany (hybrid format) which was attended by 86 participants from 22 countries and international organisations and kindly hosted by the German Environment Agency (Umweltbundesamt, UBA). The Task Force meetings were co-chaired by Mr Tommy Dalgaard (Denmark), Ms Claudia dos Santos (Portugal) and Mr Mark Sutton (United Kingdom).

II. Overview of activities of the Task Force covered by its mandate

2. The work of the Task Force is implemented by the following expert panels, and reports of ongoing activities, presented and discussed during the TFRN-16 and TFRN-17 meetings:

(a) Expert Panel on Mitigation of Agricultural Nitrogen (EPMAN);

(b) Expert Panel on Nitrogen Budgets (EPNB);

(c) Expert Panel on Nitrogen and Food (EPNF);

(d) Expert Panel on Nitrogen in countries of Eastern Europe, the Caucasus and Central Asia (ENP-EECCA).

3. As a short on-line meeting, TFRN-16 provided the opportunity to update members of the Task Force on progress related to the review of the Gothenburg Protocol, followed by short reports from the co-chairs of the Expert Panels, preparation for revision of the UNECE Ammonia Guidance Document, update on progress by Parties in publishing National Ammonia Codes, presentation on progress on a draft guidance document on ammonia-methane interactions, and agreement on updates for the 2022-2023 Workplan. A keynote presentation on progress and draft messages from the Gothenburg Protocol Review Group was delivered by Mr Peter Meulepas followed by questions from members of the Task Force, allowing preparation for input to the 41st session of the Executive Body in December 2022. For efficiency in this report, we incorporate updates on the other matters discussed, directly into the report of the TFRN-17 meeting in Dessau (May 2023), as summarized in the following paragraphs.

Cross-cutting presentations

4. The plenary sessions of TFRN-17 benefited a broad range of presentations:

a) The TFRN-17 meeting was opened by Ms. Lilian Busse, Vice President of the Umweltbundesamt, who highlighted the importance of nitrogen for Germany including the German Nitrogen Budget and hosting of the N2021 International Nitrogen Conference, in Berlin.

b) Mr. Till Spranger (Chair of the Working Group on Strategies and Review) highlighted progress in the review of the Gothenburg Protocol and the importance of the work of TFRN in providing the evidence underpinning needed to inform the next steps.

c) Ms. Isaura Rabago (Chair of the Working Group on Effects) outlined progress in the Working Group relevant to nitrogen including the updating of information on critical loads for nitrogen. She noted that recent review had retained existing values of NH_3 critical levels, and had identified the need for further evidence to allow revision of NO_2 critical levels.

d) Mr. John Salter (Co-chair of the Task Force on International Cooperation on Air Pollution) reported the recent meeting of the Forum for International Cooperation on Air Pollution, which took place in Gothenburg in March 2023 adjacent to the Saltsjobaden 7 Workshop.

e) Mr. Mihai Constantinescu (Co-chair of the UNEP Working Group on Nitrogen) highlighted the challenges for sustainable nitrogen management at a global scale, reporting on the progress of the Working Group in developing National Action Plans for Sustainable Nitrogen Management an on intergovernmental coordination of nitrogen policies.

f) Mr. Adrian Leip (European Commission) highlighted the importance of EU Bioeconomy Policy and its links to the nitrogen cycle.

g) Mr. Tiziano Pignatelli (Co-chair of the Task Force on Technical and Economic Issues) highlighted the importance of preparing guidance on methane-ammonia interactions.

h) Mr. N. Pratt, Ms. C. Robichaud and Mr. K. Moony (Secretariat of the UN Convention on Biological Diversity, online), outlined the progress and implications of the Kunming-Montreal Global Biodiversity Framework.

National focal centre contributions, related projects and issues

5. A wide range of evidence was brought to the TFRN-17 meeting through the following presentations:

a) Mr. Serge Medinets spoke about findings from the Eastern European Demonstration Region of the International Nitrogen Management System (INMS).

b) Mr. Alberto Sanz Cobena spoke about findings from the Western European Demonstration Region of INMS.

c) Mr. Shabtai Bittman spoke about findings from the North American Demonstration Region of INMS.

d) Mr. Filip Moldan described nitrogen budgets and the link to carbon sequestration in Nordic forests.

e) Mr. Deli Chen described work towards a credit system to solve agriculture induced nitrogen pollution globally.

f) Mr. Craig Drury described work from ‘Holes-in-the Pipe’ to ‘Pipes and Valves’: A conceptual approach to achieving Canadian 2030 and 2050 Reactive N targets.

g) Mr. Dimitru Drumea reported on nutrient management in the Republic of Moldova.

h) Mr. Rasmus Einarsson and Ms. Mette Festersen Jensen introduced current developments about expectations and potential of ammonia as a fuel and energy carrier.

Progress through TFRN Expert Panels

6. The Co-Chairs of **Expert Panel on Mitigation of Agricultural Nitrogen** (Mr Shabtai Bittman and Ms Barbara Amon) introduced the process of updating the present Ammonia Guidance Document[1] from 2012, as agreed by the Working Group on Strategies and Review (WGSR). Until now, 34 international experts have volunteered to contribute to the revision of this document. An expert group work meeting is planned, with professor Alberto Sanz-Cobena (Universidad Politécnica de Madrid) coordinating the process together with the EPMAN co-chairs, and while visiting Aarhus University in the autumn of 2024. An informal document[2] has been submitted for the WGSR-61 including a draft Table of Contents of the proposed revised document.

[1] Available from https://www.clrtap-tfrn.org/content/options-ammonia-abatement-guidance-unece-task-force-reactive-nitrogen .

[2] https://unece.org/sites/default/files/2023-07/Agenda%20item%204%20Revision%20of%20Ammonia%20Guidance%20Document_4July2023.pdf

7. The work to revise the Ammonia Guidance Document was presented by Mr Alberto Sanz Cobena, who noted that this will be coordinated with other guidance from the TFRN, where an Integrated Sustainable Nitrogen Management Guidance Document[3] was adopted in 2020, which is not yet due for revision. The discussion noted that the WGSR should consider if there is a need for a Framework Code and National Codes for Integrated Sustainable Nitrogen Management. This could be an option for looking into possibilities for interactions between ammonia, other nutrients and methane. The discussion noted that providing Framework Codes could be an easy way to access the recommendations of the guidance documents and a way to integrate other issues than ammonia.

8. For input to the further EPMAN work, during the TFRN-17 meeting Mr Nick Hutchings (co-chair of the Expert Panel on Agriculture and Nature of the Task Force on Emissions Inventories and Projections) reported a summary of updates on the Emissions Inventory Guidebook. He noted that emission from application of fertilizes is considered to be a function of soil type, soil texture, pH of the soil and timing of application. This information can be applied when using a tier 3 approach.

9. The co-chairs of the **Expert Panel on Nitrogen Budgets** (Mr Wilfried Winiwarter and Mr Markus Geupel) reported collected feedback from users of the "Guidance Document on National Nitrogen Budgets". Feedback received have been updated on the Task Force webpage[4] – and recommend all users to check the material and report back to the panel co-chairs. Further details from the meeting in Dessau are available from the same web site, and it is foreseen according to workplan to complete the update of the "Guidance Document on National Nitrogen Budgets" by end of 2024. The co-chairs noted that the Task Force workplan also contains a call for data, such that we expect to put national nitrogen budgets on a completely new level in the foreseeable future.

10. The co-chairs explained that the work of EPNB continues to support widening of the application of nitrogen budgets among Parties in cooperation with non-parties with support from the project "Towards the International Nitrogen Management System (INMS)" establishing a separate, though compatible guidance document with global relevance[5]. This also results in the development of principles for a platform that could in future be used to support international reporting and communication of national nitrogen budgets. They emphasized that as part of the INMS project, the work extends beyond the UNECE area. Hence the guidance document developed under INMS will not only cover the EPNB approach of National Nitrogen Budgets, but also looks into the needs of developing countries for less data intensive budgeting approaches. Hence sections on the CHANS model and on the use of generic (international) data are being developed. It is estimated that the INMS guidance document will be finalized later in 2023. A link to the EPNB web page will be added once the report becomes available.

11. The co-chairs of the **Expert Panel on Nitrogen and Food** (Mr Adrian Leip, Ms Susanna Kugelberg and Mr Joao Leite) provided an update on the Second Special Report of the European Nitrogen Assessment (on nitrogen and food) entitled "*Appetite for Change: food options for nitrogen, environment and health*". They noted that the new report is due for publication later in 2023. They highlighted the conclusion that a target to reduce nitrogen pollution by 50% is extremely difficult to meet without changing to a more plant-based diet. Their model analysis showed that a combined scenario integrating technical measures in agriculture, dietary change and food-waste reduction estimated to provide the most acceptable approach to achieve such ambitious goals, as now linked to both the EU Farm to Fork Strategy and the Kunming-Montreal Global Biodiversity Framework.

[3] Nitrogen Opportunities for Agriculture Food and Environment. UNECE Guidance Document on Integrated Sustainable Nitrogen Management. INMS Report 2022/2, https://www.clrtap-tfrn.org/content/nitrogen-opportunities-agriculture-food-environment-unece-guidance-document-integrated-0

[4] Expert Panel on Nitrogen Budgets webpage: https://www.clrtap-tfrn.org/epnb

[5] The GEF/UNEP "Towards INMS" project is implemented by the United Nations Environment Programme with funding through the Global Environment Facility and executed by the UK Centre for Ecology & Hydrology.

12. The co-chairs of the Expert Panel proposed a workshop with policy makers for 2024 that could discuss the Appetite for Change report, considering the relative role of technical and non-technical measures, including opportunities from different dietary mixes (Mediterranean diet, organic food etc.). The Task Force agreed to support the option of a thematic session at the next WGSR in June 2024 to flag the subject to policymakers, who might not be aware of (the magnitude of) the impact on air pollution.

13. The discussion noted that earlier results from the Expert Panel[6] showed that halving meat and dairy intake in the European part of the region ('demitarian scenario') would reduce ammonia emissions by around 40 per cent, with co-benefits for health and climate. It was agreed that dietary change has a significant potential to influence nitrogen losses to the environment, including ammonia, nitrous oxide, nitrogen oxides, nitrate and di-nitrogen. The new Appetite for Change report shows how, in the European part of the UNECE region, meat and dairy consumption is excess of dietary needs, and is contributing substantially to pollution and waste of nitrogen resources. A summary of the key emerging messages is included in the annex to the report of the Task Force (ECE/EB.AIR/WG.5/2021/2) to the Working Group at its fifty-ninth session.

Mobilization Activities

14. The **XXI International N Workshop Conference**[7] (Madrid, 4th - 28th October 2022), under the headline "Halving Nitrogen Waste by 2030" included information presented by expert panels under the Task Force, and background material for further work in the **Expert Panel on Nitrogen in Eastern Europe, the Caucasus and Central Asia (EPN-EECCA)**, and the above mentioned GEF/UNEP "Towards INMS" project activities and reporting. Among the work presented at the Dessau meeting of the Task Force, Mr Serge Medinets presented progress on the INMS East European Demonstration Activity, including information on nitrogen flows and impacts focused around the Dniester and Lower Danube catchments.

15. The meeting noted that the next International Nitrogen Workshop is scheduled to be hosted at Aarhus University in June 2024, and will be used as an opportunity to further advance the TFRN Expert Panel activities, and development of guidance documents.

16. Further contributions from the GEF/UNEP Towards INMS project included a presentation from Mr William Brownlie of a **database on mitigation of nitrogen pollution**, that links nitrogen losses linked to air pollution, climate and water pollution (NH_3, NO_x, N_2O, N_2, N_r to water etc). The database has been developed with global scope and consideration on regional relevance, and is due to be reported later in 2023.

17. Activities on **identification of barriers** to the adoption of better nitrogen management practices in agriculture within and outside the UNECE region are ongoing with support from "Towards INMS" project and will also be reported on in 2023.

18. **International cooperation activities mobilized through the Task Force** included provision of inputs to the UNEP Working Group on Nitrogen, established to follow up two Resolutions of the United Nation Environment Assembly on Sustainable Nitrogen Management (UNEP/EA.4/Res.14; UNEP/EA.5/Res.2). At its first meeting in June 2020, the UNEP Working Group on Nitrogen established a Task Team developing terms of reference for an **Inter-convention Nitrogen Coordination Mechanism (INCOM)**. This work was conducted with the support of the GEF/UNEP Towards INMS project and representatives of the secretariats of other multilateral environmental agreements and programmes, including the United Nations Convention on Biological Diversity, the United Nations Framework Convention on Climate Change, the United Nations Environment Programme Ozone

[6] Westhoek *et al.* (2015) *Nitrogen on the Table: The influence of food choices on nitrogen emissions and the European environment.* (European Nitrogen Assessment Special Report on Nitrogen and Food.). Edinburgh, UK: Centre for Ecology & Hydrology. Available at: http://www.clrtap-tfrn.org/sites/clrtap-tfrn.org/files/documents/EPNF Documents/Nitrogen_on_the_Table_Report_WEB.pdf

[7] https://nworkshop.org/

secretariat, and the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities.

19. The Task Team reported its work to the 2nd meeting of the UNEP Working Group on Nitrogen in January 2023, including a comparison of the advantages and disadvantages of four options: 1) Status quo, fragmentation between existing Multi-lateral Environmental Agreements (MEAs), 2) One MEA leads on nitrogen on behalf of the others, 2) A new convention on nitrogen and 4) Some form of coordination mechanism that fosters better cooperation and communication between MEAs and UN Member States on nitrogen. Task Team included several contributions from the Air Convention, including from Ms Anna Engleryd and Mr Till Spranger and was chaired by the TFRN co-chair Mr Mark Sutton.[8]

20. Mr Sutton subsequently contributed to the third meeting of the UNEP Working Group on Nitrogen, hosted by the Government of Romania, in Bucharest (April 2023), where a major focus was given to discussion on National Action Plans.

21. Further input to the INCOM process is being provided through a draft chapter of the International Nitrogen Assessment being prepared by INMS with the support from TFRN experts. Informal feedback from Member States has suggested that some tuning of the INCOM concept might facilitate agreement, including an updated framing as an 'Intergovernmental Nitrogen Co-operation Mechanism', which would necessarily include contributions from both UN Member States and Conventions such as the Air Convention. This topic is the main theme of the **4th Meeting of the UNEP Working Group on Nitrogen scheduled for Nairobi (28-29 September 2023)**.

22. The International Nitrogen Assessment represents a global scale follow up to the International Nitrogen Assessment (published in 2011), and is due for publication in 2024 by Cambridge University Press.

23. **Members of the Working Group on Strategies are invited to express their views** on the opportunity and benefits of strengthening cooperation with other relevant MEAs, and on the possible modalities for intergovernmental coordination on nitrogen policies, in support of the two UNEA Resolutions (UNEP/EA.4/Res.14 and UNEP/EA.5/Res.2) and how this could further the work of the Air Convention, including addressing barriers to change.

24. The Task Force has also contributed to the objectives of the Convention, to the further follow up of the **UNEA Resolutions 4/14, 5/2 and the Colombo Declaration**[9] including by:

(a) Developing a perspective on measures to "halve nitrogen waste" defined as the sum of all reactive nitrogen losses, including denitrification to di-nitrogen, which is equally a waste of resources, [10] as part of mobilizing action in the "Nitrogen Decade" up to 2030, including exploring technical options for calculating and expressing total nitrogen waste. With the emergence of Green Ammonia as a future fuel, was noted that burning of NH_3 to N_2 is not a form of nitrogen waste (as it fulfils its purpose), but that associated emissions of NH_3, NO_x and N_2O to the environment would constitute forms of nitrogen waste.

(b) It was noted by the Task Force that the Kunming-Montreal Global Biodiversity Framework (GBF) Target 7, to at least halve pollution from excess nutrients, represents a major new step in mobilizing actions to halve nitrogen waste. The Task Force emphasized that future activities related to possible revision of the Gothenburg Protocol be seen in the light of this agreement, and that the major challenge ahead was in mobilizing the update of measures that would help achieve this target. Whereas the GBF is focused on biodiversity benefits, the Task Force noted that meeting Target 7 would simultaneously give major benefit for reducing health and ecosystem effects of air pollution.

[8] The report of the Task Team on INCOM and the Group Membership is reported under Agenda Item 3, in two documents here: https://www.unep.org/events/online-event/second-meeting-unep-working-group-nitrogen

[9] Colombo Declaration on Sustainable Nitrogen Management, available at https://web.archive.org/web/20221201000000*/https://apps1.unep.org/resolution/?q=node/286

[10] The Nitrogen Decade: mobilizing global action on nitrogen to 2030 and beyond", *One Earth* 4, 10-14, available at: https://doi.org/10.1016/j.oneear.2020.12.016.

(c) Contributing to a global analysis of the health costs of nitrogen pollution published in the journal *Science*, which showed that, overall, measures to mitigate pollution by fine particulate matter by abating ammonia emissions are estimated as 10 times more cost-effective than further control of nitrogen oxides emissions.[11]

(d) Contributing to a global analysis of the effectiveness of nitrogen mitigation options for cropland, published in the journal Nature, which showed that 11 key measures could reduce nitrogen losses from croplands to air and water by 30–70%, while increasing crop yield and nitrogen use efficiency (NUE) by 10–30% and 10–80%, respectively.[12]

(e) Preparation of an informal document for WGSR-61, discussing science-based definitions of 'extensive livestock', with dual relevance for the European Union Industrial Emissions Directive and possible future revision of Annex IX.[13]

Expert Presentations

25. Further expert presentations contributed substantially to the TFRN-17 Dessau Meeting including:

a) J. Kamp: Latest on slurry acidification.

b) S. Hafner and A Pacholski: ALFAM-I ammonia emission model.

c) A. Sanz Cobena: Cost-effective techniques for on-site measurements.

d) H. Döhler: Recent research in Germany – N-emissions and N-efficiency affected by urease/nitrification inhibitors.

e) A. Pacholski: Mitigation measures for N_2O and NH_3 emissions from synthetic fertilizers.

f) U. Dragosits: The national nitrogen balance sheet for Scotland.

g) I. Djukic: The Austrian national nitrogen budget.

h) K. Hyashi: The Sustai-N-able project (Japan).

i) K. Nishina: Integrated nitrogen management for national nitrogen waste reduction.

j) I. Falconi and S. Carè: Discussion on methane/ammonia guidance.

III. Progress in the implementation of the 2022–2023 workplan for the Convention

26. The present section contains a summary of the activities outlined in the 2022–2023 workplan[14] by workplan item.

Item 2.1.2: Review of the sufficiency and effectiveness of the Gothenburg Protocol as amended

27. As mentioned in the report from 2022, the Task Force prepared a questionnaire to collect information on the implementation of national ammonia codes and other aspects of Annex IX to the Gothenburg Protocol (ECE/EB.AIR/WG.5/126, para 37). The questionnaire was circulated to Convention Parties, and responses examined by the Task Force, taking note of the proposal from the Working Group on Strategies and Review at its fifty-ninth session.

[11] Gu *et al.* (2021) Abating ammonia is more cost-effective than nitrogen oxides for mitigating $PM_{2.5}$ air pollution. *Science* **374** (6568) 758-762. https://www.science.org/doi/10.1126/science.abf8623

[12] Gu *et al.* (2023) Cost-effective mitigation of nitrogen pollution from global croplands. *Nature* **613**, 77–84 https://www.nature.com/articles/s41586-022-05481-8

[13] Available at: https://unece.org/environment/documents/2023/06/informal-documents/agenda-item-3-note-tfrn-extensive-livestock

[14] This section contains information on the Task Force activities carried out in 2022-23 with respect to the review of the Gothenburg Protocol and promotion of the Guidance document on integrated sustainable nitrogen management (corresponding to items 2.1.2 and 2.2.2 in the 2022-2023 workplan).

The Task Force noted that currently many parties still have not established and published a National Ammonia Code, as required under Annex IX to the Gothenburg Protocol.

28. To support the work of the Gothenburg Protocol Review Group, the Task Force contributed to distilling major messages building on the more detailed comments previously reported to Working Group on Strategies and Review.[15]

Item 2.2.1: Analysis of the interactions between emissions of methane and ammonia, and other nitrogen compounds, and the potential for their co-mitigation from agricultural sources

29. A policy brief and guidance document on co-mitigation of methane and ammonia emissions from agricultural sources (ECE/EB.AIR/WG.5/2023/5) was submitted[16] with contributions from an expert working group formed. This includes a synthesized list of guiding principles and important considerations for simultaneous mitigation of methane and ammonia emissions, in line with the Guidance Document on Integrated Sustainable Nitrogen Management, forming the background for further workplan 2024-25 tasks[17], to be coordinated together with the Ammonia Guidance and other Guidance Document development. As mentioned in the 2022 Report of the Task Force on Reactive Nitrogen, the reporting on this topic was subject to funding. The Task Force is grateful for support in the form of background documents from the TFTEI Task Force on Techno-economic Issues, delivered via the Italian Council for Agricultural Research and Economics (CREA).

Item 2.2.2: Promotion of the Guidance Document on integrated sustainable nitrogen management

30. The Guidance Document on Integrated Sustainable Nitrogen Management (ECE/EB.AIR/149) was adopted by the Executive Body at its fortieth session (decision 2020/1). The document was promoted in a wide range of contexts, including globally through the GEF/UNEP "Towards INMS" project, where the publication was prepared to include colour images illustrating mitigation practices and to recognize the contributions from experts internationally. The report is now available via the TFRN web site, and printed copies are available from UKCEH (ISBN 978-1-906698-78-2). The document is simultaneously printed as INMS Report 2022/2.[18]

Item 2.2.3: Development of a Guidance Document on non-technical and structural measures

31. The Task Force has contributed to the document prepared under the lead of the Task Force on Integrated Assessment Modelling[19], and continued collaboration has been discussed.

Item 2.2.4: Promotion of guidance documents, including those recently adopted

32. As an input to the Draft 2024–2025 workplan for the implementation of the Convention: policy-related aspects and elements (ECE/EB.AIR/WG.5/2023/1)[14] The Task Force on Reactive Nitrogen proposed several new initiatives, including the elaboration of

[15] See the informal document for the session entitled "Considerations for ammonia relevant to future review of the Gothenburg Protocol", available at https://unece.org/fileadmin/DAM/env/documents/2020/AIR/WGSR/Ammonia_inf_doc_for_WGSR58__note_from_TFRN__TFIAM_.pdf

[16] ECE/EB.AIR/WG.5/2023/5 - Co-mitigation of methane and ammonia emissions from agricultural sources: policy brief and guidance. https://unece.org/sites/default/files/2023-06/ECE_EB.AIR_WG.5_2023_5_%28E%29.pdf

[17] ECE/EB.AIR/WG.5/2023/1 - Draft 2024–2025 workplan for the implementation of the Convention: policy-related aspects and elements. https://unece.org/sites/default/files/2023-06/ECE_EB.AIR_WG.5_2023_1_Final.pdf

[18] See footnote 3.

[19] See the informal document on non-technical and structural measures prepared for the forty-first session of the Executive Body, available at https://unece.org/sites/default/files/2021-11/Informal%20doc%20on%20non-technical%20measures.pdf.

new framework codes based on guidance documents adapted, as for instance in Integrated Nitrogen Management. As an example for dissemination, “Top Five” priority areas for ammonia mission abatement (ECE/EB.AIR/WG.5/2011/16) have been identified, including: i) Low-emission application of manures and fertilizers to land, ii) Animal feeding strategies to reduce nitrogen excretion, iii) Low emission techniques for all new stores for cattle and pig slurries and poultry manure, iv) Strategies to improve nitrogen use efficiencies and reduce nitrogen surpluses, and v) Low emission techniques in new and largely rebuilt pig and poultry housing.