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Options for revising annex IX to the Gothenburg Protocol

Reactive nitrogen

Report by the co-Chairs of the Task Force on Reactive Nitrogen

I. Introductory remarks

1. This report describes the results of the fifth meeting of the Task Force on Reactive Nitrogen, held on 27 October 2010 in Paris, France, in accordance with item 1.9 of the 2010 workplan for the implementation of the Convention on Long-range Transboundary Air Pollution (as amended by the Bureau to the Executive Body in September 2010)¹. It also summarizes the results of a workshop on “Costs of ammonia abatement and the climate co-benefits”, held on 25 and 26 October 2010, which were presented at the Task Force meeting.²

A. Attendance

2. Fifty experts from the following Parties to the Convention attended the workshop and meeting of the Task Force: Austria, Belgium, Canada, Czech Republic, Denmark, France, Germany, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Russian Federation, Spain, Sweden, Switzerland and United Kingdom of Great Britain and Northern Ireland.

¹ ECE/EB.AIR/2010/3, para. 4.

² The background documents and presentations made during the meeting and the reports presented can be accessed at: www.clrtap-tfrn.org.

3. Also present were representatives from the Working Group on Strategies and Review and the Working Group on Effects, as well as experts from the International Cooperative Programme (ICP) on Modelling and Mapping of Critical Loads and Levels and Air Pollution Effects, Risks and Trends (ICP Modelling and Mapping); the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) Centre for Integrated Assessment Modelling (CIAM) at the International Institute for Applied Systems Analysis (IIASA); the Expert Group on Techno-economic Issues; the European Commission Directorate-General for the Environment; Fertilizers Europe (EFMA) and the Union of European Farmers and European Agri-Cooperatives (COPA-COGECA).

B. Organization of work

4. Mr. O. Oenema (Netherlands) and Mr. M. Sutton (United Kingdom) co-chaired the meeting. It was hosted by France, with support from the French Agency for Environment and Energy Management.

5. The Task Force regretted that, due to resource constraints, the secretariat was not in a position to attend the meeting.

6. A representative of the French Ministry of Ecology, Energy, Sustainable Development and the Sea opened the meeting and outlined the air pollution abatement challenges in France and the links to the work of the Task Force.

7. The Task Force worked in plenary session, discussing feedback from the forty-seventh session of the Working Group on Strategies and Review, in September 2010; the output of the workshop on “Costs of ammonia abatement and climate co-benefits”; and the reporting to the forty-eighth session of the Working Group, in April 2011.

II. Activities related to revision of the 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone

A. Guidance document on control techniques for preventing and abating emissions of ammonia

8. The British co-Chair of the Task Force provided information on the conclusions of the Working Group on Strategies and Review in September 2010 of relevance to the Task Force, including on the revision of annex IX to the 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol). He drew attention to the request to the Task Force to provide further information about the cost of ammonia emissions abatement measures for inclusion into the guidance document on control techniques for preventing and abating emissions of ammonia (ECE/EB.AIR/WG.5/2007/13; hereinafter, the Guidance Document).

9. The Task Force agreed to develop an informal summary document to accompany annex IX to outline information on measures to achieve the reductions set out in annex IX, which would be more accessible than the full Guidance Document. In parallel, based on further information on costs, work would continue on the draft revised Guidance Document prepared by the Task Force (informal document No. 4, Draft guidance document for

preventing and abating ammonia emissions from agricultural sources, made available to the Working Group in September 2010).³

10. The Task Force agreed that the next version of the Guidance Document would be submitted by March 2011 for the Working Group's forty-eight session as an informal document (in English only). Based on comments from the Working Group, that version would be revised and finalized by July 2011 with a view to its submission as an official document to the Working Group at its forty-ninth session in September 2011.

B. Costs of ammonia abatement and the climate co-benefits

11. Based on the workshop on "Cost of ammonia abatement and climate co-benefits", the Task Force agreed that many of the measures to abate ammonia emissions were cheaper than had previously been estimated under the Convention, including in the Greenhouse Gas and Air Pollution Interactions and Synergies (GAINS) model. The main reason for the lower costs estimated by the Task Force was that there was now much more experience in implementing those methods, and that a wider choice of abatement techniques was now available.

12. As a starting point, costs were estimated regarding the different reference techniques described in the current Guidance Document and the draft revised Guidance Document (as presented in informal document No. 4 of September 2010). The estimates focused on the difference in cost between the reference method and the various low emission techniques. The differential costs of techniques were estimated, for example, in euros per animal place per year or in euros per cubic metre of manure applied to land. Such inputs could be used directly in the GAINS model. However, in order to ensure comparability, the Task Force ensured that costs were also expressed as far as possible as euros per kg ammonia-nitrogen (NH₃-N) abated, i.e., saved, in the farming system.

13. For many of the measures to reduce ammonia emissions in agriculture, costs were in the range of 0–5 euros per kg NH₃-N abated. An overview of these cost estimates would be included in the informal summary document to be provided to the Working Group's forty-eighth session in April 2010 (see para. 9 above).

14. In reducing ammonia emissions, the Task Force agreed that more nitrogen was saved in the farming system, and that the financial value of that savings needed to be integrated into the cost calculations. As that savings represented a reduction of nitrogen loss, and the relevant measures also proposed the more effective use of on-farm nitrogen sources, the Task Force agreed that that savings be counted at the equivalent cost of mineral nitrogen fertilizer.

15. The Task Force estimated costs of improving nitrogen use efficiency through "nitrogen management" and "improved feeding strategies". It found that the costs of increasing nitrogen use efficiency through improving management were in the range of -1.0 to 1.0 euros per kg NH₃-N saved, while costs for improving livestock feeding strategies ranged from -0.5 to 0.5 euros per kg NH₃-N saved, depending on the ambition level.

16. The Task Force agreed that the highest costs of measures for animal housing would be largely avoided by focusing on measures for new or largely rebuilt buildings. That was because including low-emission technologies at the time of erecting new farm buildings was much cheaper than the cost of retrofitting options for existing buildings. The largest

³ Available on the Working Group's web page at <http://www.unece.org/env/lrtap/WorkingGroups/wgs/docs46th%20session.htm>.

costs were estimated for the highest ambition options, e.g., air scrubbing technologies at 2 to 10 euros per kg NH₃-N saved, while lower costs applied to methods such as partially slatted floors, at 0 to 6 euros per kg NH₃-N saved. The cheapest methods for poultry systems focused on keeping manure dry, ventilation and avoidance of water spillage at 0 to 3 euros per kg NH₃-N saved.

17. The Task Force found that many measures for covering manure storage were somewhat cheaper than for animal housing. For covering new slurry stores on large farms, costs ranged from 0.5 to 4 euros per kg NH₃-N saved, depending on the technique used and ambition level. For existing outside slurry and solid manure stores on large farms, costs were estimated at 0.5 to 2 euros per kg NH₃-N saved.

18. In the case of manure application to fields, the Task Force refined a spreadsheet model to estimate costs and to encourage further testing across the United Nations Economic Commission for Europe (UNECE) area. Costs were in the range 0.1 to 5 euros per kg NH₃-N saved, with the smallest costs for immediate incorporation of slurries and solid manure, where feasible (i.e., on bare arable land). The estimates were most sensitive to assumed farm size, with substantially improved economies of scale on larger farms, where low-emission equipment was shared between several farms, or where specialist contractors were used. Based on a cost-optimized approach, the GAINS model would assume that, on smaller farms, equipment would be shared or contractors used. On that basis, the costs for low-emission slurry application would be typically less than 1 euro per kg NH₃-N saved.

19. The Task Force concluded that costs for low-emission application of urea-based fertilizers were relatively small, at around 0–1.5 euros per kg NH₃-N saved, with a range of techniques available, including drilling into soil, coated fertilizers, urease inhibitors and the choice to use ammonium nitrate-based fertilizers.

20. The Task Force noted that many of the cost estimates summarized above were in the range of 0.5 to 2 euros per kg NH₃-N saved, especially on the larger farms and/or in case of the use of contractors for manure spreading. Integration of those costs with the financial benefit of the nitrogen saved (at around 1 euro per kg N, depending on current fertilizer prices), showed that many of the measures had the potential to provide net financial benefit to farmers. Considering that low-emission measures provided other co-benefits to the farmer that were harder to quantify in monetary terms (e.g., value of improved agronomic flexibility, reduced odour and more consistent use of the manure fertilizer resource), the financial benefits estimated could be considered as being conservative (see also informal document No. 11, “Overview of interacting factors affecting net costs and benefits of ammonia abatement”, prepared by the Task Force for the Working Group’s forty-sixth session in April 2010).⁴

21. The Task Force agreed that there were also substantial co-benefits of ammonia mitigation for climate management. Overall, a more streamlined management of the reactive nitrogen resource reduced inputs to the system (e.g., reducing the carbon dioxide (CO₂) emission associated with fertilizer manufacture). More important, however, was the potential for better nitrogen (N) management to reduce overall agricultural emissions of nitrous oxide. Although it had sometimes been noted that low ammonia emission manure spreading methods could increase nitrous oxide emissions, that potential trade-off was considered not to be significant in the broader picture where overall N losses were minimized and retained in the farming system. That was because of: (a) the potential to

⁴ Available on the Working Group’s web page at <http://www.unece.org/env/lrtap/WorkingGroups/wgs/docs46th%20session.htm>.

reduce fertilizer N inputs by more efficient management; and (b) the potential to reduce secondary emissions of nitrous oxide, that otherwise arose from N losses by ammonia emissions and nitrate leaching. The use of urease inhibitors was highlighted as a specific method able to reduce (by 50 per cent or more) both ammonia emissions and nitrous oxide emissions.

22. Following the Task Force's meeting, in cooperation with CIAM, the updated costs information would be incorporated into the GAINS model as a basis for cost-optimization analysis to be presented to the Working Group in April 2011.

C. Options for revising annex IX to the Gothenburg Protocol

23. The Task Force discussed the suggestion by members of the Working Group to link some of the options laid out in annex IX to farm size, i.e., that within one ambition level, large farms should have stronger obligations than small farms and vice versa, but no consensus was reached. It was proposed that the effects of farm-size dependent obligations would be further explored with the GAINS model if possible.

24. The Task Force noted the point made by the Working Group in September 2010 that the adoption of legislation and its enforcement would take time, even as regarded measures that were already available. For that reason, the Task Force acknowledged that it was technically appropriate to allow for a period of at least five or six years until possible new commitments would take effect under a revised annex IX.

Amended options agreed by the Task Force

25. The Task Force agreed on the following additional minor amendments to the options for revising annex IX to the Gothenburg Protocol (as they were presented in document ECE/EB.AIR/WG.5/2010/14):

(a) Paragraph 2: A proposal was included to ensure that national nitrogen budgets were made in order to follow the course of overall reduction in nitrogen losses;

(b) Paragraph 4: The obligations to increase the nitrogen use efficiency and decrease the nitrogen surplus were changed to be more farm-specific;

(c) Paragraphs 14 and 15 dealing with manure storage:⁵ The Task Force clarified that those provisions did *not* currently address the obligation of having sufficient storage capacity. As such an obligation was of key importance for managing and using nitrogen on farms effectively, the Task Force agreed that it should be included into the draft revised annex IX for consideration by the Working Group;

(d) Paragraphs 4–8, 10, 11, 14, 17 and 19: It was proposed to change the timescale of the options from the date of ratification to five years after the entry into force of the obligations, to allow time for implementation of those measures by Parties to the Convention.

26. Based on the above amendments agreed by the Task Force, the draft options for revising annex IX (in ECE/EB.AIR/WG.5/2010/14 and in informal document No. 2 to the Working Group in September 2010), would be updated and submitted for consideration by the Working Group at its forty-eighth session in April 2011 (ECE/EB.AIR/WG.5/2011/3).

⁵ Paragraph 14 of document ECE/EB.AIR/WG.5/2010/14 relates to the covering of new slurry stores, and paragraph 15 to the covering of existing slurry stores, as well as new and existing dung storages (subparagraph (a)).

Further work on the options

27. The Task Force agreed to explore further combinations of options A, B and C of the draft annex IX (as presented in ECE/EB.AIR/WG.5/2010/14 and informal document 2 of September 2010) and to assess the costs involved (as calculated by the GAINS model).

28. The Task Force agreed on the following four stages of work to be completed before the Working Group's session in April 2011:

(a) Finalizing the inventory on cost calculations of the various ammonia emissions abatement measures;

(b) Providing the economic costs of the various measures for the GAINS model in a transparent way and defining scenarios to be assessed by the GAINS model in liaison with experts of the Task Force;

(c) Liaising with CIAM to run the GAINS model for the scenarios chosen; and

(d) Preparing of an informal document for the Working Group at its forty-eighth session in April 2011, with notes on the costs and the total ammonia reduction values for the scenarios chosen.

29. The Task Force noted that the assessment of the options and scenarios described above was a very demanding task and agreed to do it as far as was feasible. The Task Force's priority was to develop information and consensus on specific techniques and, from that, the costs of options A, B and C. Hence, the assessment of a mixture of options A, B and C might have to wait until summer 2011, which would allow the inclusion of feedback from the Working Group.

Supplementary formulation of the options

30. As a first step to support the Working Group in its deliberations on further combinations of options A, B and C, the Task Force co-Chairs and experts worked further on options for revising annex IX. The options, as they would be presented to the Working Group in April 2010 (in document ECE/EB/WG.5/2011/3) aimed to stimulate further feedback from the Working Group to the Task Force.

31. The purpose of the further consideration of the options for annex IX was to emphasize to the Working Group that:

(a) A simpler formulation of the same level of ambition could be expressed in the options if the structure of the current annex IX was different;

(b) There were several ways in which the ambition level might be varied, including percentage abatement targets, implementation date, farm size and equipment size thresholds;

(c) It was up to the Working Group to combine different elements of options A, B, and C;

(d) In most European countries, the majority of animals (and hence emissions) occurred on a small fraction of the farms (as indicated by the tabulated values for cattle in annex I to ECE/EB.AIR/WG.5/2010/4), leading to the question of whether annex IX should cover all farms or just medium and large farms. The formulation of the options by the Task Force included measures for all but the very smallest farms (less than 5 livestock units), with a higher level ambition for larger farms and with options for different size thresholds;

(e) The ambition level for pigs should be discussed by the Working Group. The size thresholds for each of the three categories of livestock — cattle, pigs and poultry (options A, C) — were set to ensure that higher level provisions applied to 70 per cent of

animals (based on data for the European Union (EU)). In the case of poultry, the target of 70 per cent of animals lead to the same threshold as for the current annex IX (40,000 bird places, also in the European Directive on Integrated Pollution Prevention and Control (IPPC) (now Industrial Emissions Directive)). By contrast, only 23 per cent of pigs (in the EU) were above the existing Gothenburg Protocol and the IPPC Directive threshold of 2,000 fatteners/750 sows, whereas a threshold of 200 livestock units would include 70 per cent of pigs.

32. The co-Chairs invited the Working Group to express its preferences in the further combination of options A, B, and C, to allow the Task Force to focus its future efforts. Furthermore, the Working Group was invited to address the following questions:

(a) Whether the Working Group envisaged setting a common date for the various technical provisions within annex IX, and whether it proposed to consider relaxation of implementation dates for countries with economies in transition;

(b) Whether the Working Group agreed on the use of single farm-size thresholds for all Parties to ensure a common standard and avoid the movement of farm businesses to areas within the UNECE with lower environmental standards;

(c) Whether the Working Group agreed with the approach to set farm-size thresholds for the most stringent measures, based on a common target that included 70 per cent of the animals (and emissions) for each category of livestock — cattle, pigs and poultry — as a means to maximize cost effectiveness and inter-sectoral equitability;

(d) Whether the Working Group agreed that further use of thresholds based on the size of spreaders for slurry and solid manure application to land provided a useful way to reduce regulatory complexity;

(e) Whether the simpler formulation of the different options A, B and C for annex IX (ECE/EB/WG.5/2011/3) was a useful approach to stimulate the discussion on combining options by the Working Group.

III. Other matters and future work

33. The Task Force members were updated on the progress with the report on nitrogen and climate interactions. As requested by the Executive Body at its twenty-seventh session in 2009 (ECE/EB.AIR/99, para. 86 (c)), information had been submitted to the twenty-eighth session of the Executive Body in December 2010 (informal document No. 9: “Nitrogen management interactions with climate change”).⁶

34. The Task Force planned the ongoing work of its Expert Panel on Nitrogen Budgets (EPNB) and its Expert Panel on Nitrogen and Food (EPNF). The EPNB would hold a meeting immediately after the Task Force’s meeting in Paris, in cooperation with the Organization for Economic Cooperation and Development (OECD), to consider the relationships between different nitrogen budgeting approaches. The EPNF agreed to meet in Brussels in January 2011.

35. The Task Force Coordinator, Dr. C. Howard, reported on the status of the European Nitrogen Assessment (ENA), which was being finalized with Cambridge University Press. The ENA would be launched on 11 April 2011 and would be followed by a Workshop on Current and Future Nitrogen policies, jointly organized by the Task Force. Those events

⁶ Available on the Executive Body’s web page at <http://www.unece.org/env/lrtap/ExecutiveBody/welcome.28.html>.

would contribute to the “Nitrogen and Global Change” Conference to be held in Edinburgh, Scotland, from 11 to 15 April 2011.⁷

36. The Task Force agreed that its sixth meeting, to be held in Italy from 10 to 12 May 2011, would cover all the items in the workplan of the Task Force, and be arranged to coincide with meetings of its expert panels on mitigation of agricultural nitrogen, nitrogen and food, and nitrogen budgets.

⁷ Further information on this event can be found at: <http://www.nitrogen2011.org/>.