



**Economic and Social  
Council**

Distr.  
GENERAL

EB.AIR/WG.5/2002/3  
10 July 2002

ORIGINAL : ENGLISH

ECONOMIC COMMISSION FOR EUROPE

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

Working Group on Strategies and Review  
(Thirty-fourth session, Geneva, 18-20 September 2002)  
Item 6 of the provisional agenda

**AMMONIA ABATEMENT**

Prepared by the Chairman of the Expert Group on Ammonia Abatement  
in collaboration with the secretariat

**Introduction**

1. In accordance with the work-plan for the implementation of the Convention (ECE/EB.AIR/75, annex VI, item 1.8) and at the invitation of the Government of Italy, the Expert Group on Ammonia Abatement met from 26 to 28 November 2001, in Bologna, Italy. The meeting was attended by experts from the following Parties: Austria, Denmark, Finland, Germany, Hungary, Ireland, Italy, Finland, Germany, Netherlands, Norway, Slovenia, Switzerland, United Kingdom. A representative from the International Institute for Applied Systems Analysis (IIASA) was also present, as was a member of the UNECE secretariat.
2. Mr. Ian Davidson (United Kingdom) chaired the meeting.

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3. The meeting was opened by Mr. V. MAZZOTTA (Italy), who welcomed participants on behalf of the Ente per le Nuove tecnologie, l'Energia e l'Ambiente (ENEA) and the Government of Italy. He stressed the need to improve emissions inventories on ammonia, from both agricultural and non-agricultural sources, and underlined the importance of the Expert Group's work on revising the Draft Guidance Documents on Control Techniques and Economic Instruments to the Gothenburg Protocol (EB.AIR/1999/2).

## I. ABATEMENT POLICIES AND STRATEGIES

4. During the round-table discussion, the Expert Group noted various developments in countries towards using best practices in abating ammonia emissions, both from agricultural and from non-agricultural sources, and implementing the European Commission's integrated pollution prevention and control (IPPC) guidelines. A range of pilot projects were under way to test abatement techniques on commercial farms, and experiment with fertilizers to reduce nitrate leaching. It was found that a delay between cutting grass and fertilizing may reduce ammonia emissions. Specific measures taken by Parties are elaborated below.

5. In Austria there was a need to implement IPPC guidelines, although there were few large pig and poultry farms in Austria. An advisory code for smaller farms with a focus on new buildings was being developed. A paper covering reduced emissions from all livestock had, moreover, been prepared for internal discussion. There was an increasing need for actual data from farms, rather than relying on expert opinion. A detailed questionnaire on ammonia abatement practices to be sent to regional experts was being prepared.

6. In Denmark, the Government had implemented an ammonia abatement action plan targeting emissions from the storage and spreading of manure. Legislation requiring covers on storage facilities and the use of low-ammonia spreading techniques was put in place.

7. In Finland, the European Community Nitrate Directive and ammonia targets were cross-referenced. A Finnish agri-environment support programme introduced economic incentives to farmers for undertaking abatement measures. This programme, which presented farmers with a choice of measures for manure storage (e.g. cover slurry stores) or for solid manure (e.g. cover with a roof, peat, or plastic sheeting), covered 91 per cent of farms, and 96 per cent of the field area. However, these support mechanisms could only support up to 40 per cent of the costs (of pollution control measures). Subsidies were calculated per hectare: the more fields, the more subsidies.

8. In Germany, a new ammonia inventory had been developed which would be discussed with a Government representative in December 2001. In addition, there was a project under way to improve the efficiency of nitrogen fertilizers, especially urea, and consequently reduce ammonia emissions.
9. Hungary, too, had adopted the European Community nitrate directive. Good farming practice notes had been written for nitrate and these needed to be revised to take ammonia into account. There appeared to be no problem in meeting targets due to the continuing reduction in livestock numbers. It was planned, moreover, to subsidize new livestock buildings that incorporated ammonia control.
10. In Italy, there was no specific agricultural IPPC, although there were new regulations in place based on best available techniques for new installations. For example, new houses cannot be fully slatted (for pigs).
11. In the Netherlands, there were strategies in place for ammonia, and the ability to comply with the EC nitrate directive. In addition, there were housing standards for pigs and poultry that would apply to all farms in 2008, and new or renovated houses from January 2002. By 2003, all farms must demonstrate they have enough land for manure disposal at prescribed rates and, if not, farmers must find other farms with an appropriate amount of arable land. In the Netherlands, 40-50 per cent of farm-related ammonia emissions were from pig and poultry, while the remainder were from cattle.
12. In Slovenia, an agriculture and environment programme which set nitrogen application limits to qualify for "conservation payments" was established on small farms (80 per cent of farms). Farmers could qualify for subsidies only if nitrogen (non-organic  $\text{NH}_3$ ) emissions were less than 170 kg per year.
13. In Switzerland, further work was under way to develop new dynamic inventories that focused on a regional/farm approach to abatement, depending on the natural environment. While the methodology for emissions inventories was previously based on expert opinion, for reporting under the Gothenburg Protocol it was preferable to develop a model based increasingly on actual farm data. Switzerland would develop a first-phase network with Denmark and the United Kingdom, to be broadened later to include other Parties with the aim of reducing ammonia emissions. Various measures were recommended for farms under different conditions. The project would look at 15 to 20 farms and determine measures taken by farms and their outcome. The results would then be scaled to the national level. They were, moreover, looking at emissions of  $\text{NH}_3$  and  $\text{PM}_{10}$  (particulate matter < 10  $\mu\text{m}$ ), with

particular regard to effects. Further work on modelling links between emissions and monitoring was needed. A recent workshop found that the winter application of fertilizer had a lower risk of leaching.

14. In the United Kingdom, IPPC guidance notes had been prepared, including mandatory measures for spreading manure. An ammonia consultation document was being written and a GIS-based ammonia policy model that would look at abatement in a spatial context for different sectors and regions of the country was being developed. A number of pilot schemes had been set up to test abatement techniques on commercial farms, and a farm practice survey was used to look at current manure practices countrywide. Regarding fertilizer practices, the United Kingdom too discouraged application of slurry until October to prevent nitrate leaching.

## **II. REVIEW OF GUIDANCE DOCUMENT ON AMMONIA ABATEMENT TECHNIQUES**

15. The Expert Group discussed its review of and possible revisions to the Guidance Document on Control Techniques for Preventing and Abating Emissions of Ammonia (EB.AIR/1999/2, chap. V). It noted that many parts of the document were out of date and could be revised. It discussed in outline some of the possible revisions to the document and assigned to individuals specific tasks for re-drafting and updating of texts in the following areas: pressurized slurry injection; storing slurry in bags; application of slurry in irrigation by low-pressure techniques; cattle housing including costs; feeding strategies; design of straw-based systems for NH<sub>3</sub> control; fertilizer management and abatement of non-agriculture emissions. Preliminary work on many of these areas had already been done in advance of the meeting.

16. The Expert Group invited participants to send any detailed suggestions for possible revisions to the Chairman by 15 January 2002. The proposed modifications would be discussed at the next meeting of the Expert Group. The review and proposed revision would reflect, if necessary, new data or techniques that had arisen since the original document was produced in 1999. In the review process, the Expert Group would take into account the contents of the Framework Advisory Code of Good Agricultural Practice for Reducing Ammonia Emissions and the relevant section of the EU IPPC BAT reference document for pigs and poultry.

### III. EMISSIONS PROJECTIONS AND INVENTORIES

#### A. Agricultural sources

17. Mr. U. DAEMMGEN (Germany) reported on the activities of the agriculture and nature panel of the Task Force on Emissions Inventories and Projections, concluding that the second edition of the EMEP/CORINAIR Guidebook should be updated with particular emphasis on ammonia and particulate matter. He described a detailed methodology tracing nitrogen from manures (or total ammoniacal nitrogen) using the nitrogen flow pattern elaborated in his paper, taking into account the suggestions made by the Expert Group. A copy of the report is available through the secretariat. A list of available partial emission factors was presented. Excel spread sheets assisting the calculation procedures were available from the Task Force on Emissions Inventories and Projections. Further information is available from [ulrich.daemmgen@fal.de](mailto:ulrich.daemmgen@fal.de).

#### B. Hardstandings

18. Mr. J. WEBB (United Kingdom) presented a paper on “hardstandings”, large unroofed concrete areas used by livestock in the United Kingdom that were associated with emissions. A questionnaire circulated in advance of the meeting suggested these structures were present in other countries as well. Italy had already estimated an emission factor from outdoor yards and included it in their inventory. Germany also suggested that it had adjusted housing emission factors to account for hardstandings but needed to ensure that there were neither double counting nor missing emissions. The Expert Group decided to explore this issue further at its next meeting. A paper summarizing the replies to the questionnaire on hardstandings would be circulated to members of the Expert Group for comment. Experts were requested to assess the significance of this for their own inventories. Countries with relevant emissions factors for “hardstandings” should send them to Ms. Sharon Ellis (United Kingdom) ([sharon.ellis@defra.gsi.gov.uk](mailto:sharon.ellis@defra.gsi.gov.uk)).

#### C. Non-agricultural sources

19. Mr. M. HOLLAND (United Kingdom) reported on ammonia emissions from non-agricultural sources. He suggested that non-agricultural ammonia emissions in the United Kingdom in 2010 would total 51 kt (range 50-77 kt per year). Abatement options were described; the preferred options were wet scrubbers. A cost curve was produced showing a maximum feasible reduction of 4 kt in 2010 (8% of the non-agricultural total) costing between £100-£400 per ton abated. The full report, “Controlling Ammonia from Non-agricultural

Sources" is available at <http://www.airquality.co.uk>.

#### **IV. FUTURE MONITORING OF COMPLIANCE WITH INTERNATIONAL AGREEMENTS**

20. Mr. M. SUTTON (United Kingdom) gave a brief presentation on "The need for low-cost speciated monitoring of  $\text{NH}_x$  within EMEP," which suggested a number of approaches to monitoring. It concluded that long-term trends in  $\text{NH}_3$  and  $\text{NH}_4^+$  could be seen using a monthly sampling strategy. It highlighted the urgency for establishing an effective monitoring network given the decision taken by the Expert Group to have a target of eight years' monitoring data by 2010.

21. Mr. H. VAN JAARSVELD (Netherlands) suggested, in a related presentation, that there were particular problems in measuring dry deposition and that more information on the influence of weather and its variation between years was needed when looking at trends in the data.

#### **V. CONCLUSIONS AND RECOMMENDATIONS**

22. The Expert Group agreed that:

(a) Non-agricultural ammonia emissions may be much higher than previously thought, although significant uncertainties remained. Limited opportunities for abatement were identified, and emission factors from horses and wood burning needed more work;

(b) It should consider ways to ensure that non-agricultural ammonia emissions received proper attention in future. It proposed to refer this issue to the Task Force on Emission Inventories and Projections, through its panel on agriculture and nature, and possibly to the Task Force on Integrated Assessment Modelling. Further confirmation on the definition of anthropogenic emissions would first be necessary;

(c) Monitoring to separate ammonia and ammonium was needed, and this should, in particular, focus on low-cost, monthly sampling. In addition, it was important to reinforce monitoring recommendations to EMEP, the Task Force on Measurements and Modelling, as well as to the Implementation Committee and national agencies. Transparent communication with farmers of agreed abatement measures and of reports of the component breakdowns of national ammonia emissions was also important;

(d) It would elaborate, at its next meeting, a work programme for 2003-2004. Moreover, it stressed the need to improve links with emissions monitoring and projections; links with measurements and modelling; as well as links with other groups under the Convention;

(e) Its next meeting would be held as a joint meeting with the agriculture panel of the Task Force on Emission Inventories and Projections. It would take place in Vienna from 28 to 30 October 2002.