Advance copy

UNITED
NATIONS

E

Economic and Social Council

Distr.
GENERAL

ECE/EB.AIR/WG.5/2010/4
1 February 2010

Original: ENGLISH

ECONOMIC COMMISSION FOR EUROPE

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

Working Group on Strategies and Review

Forty-sixth session
Geneva, 12–15 April 2010
Item 3 of the provisional agenda

OPTIONS FOR REVISING THE GOTHENBURG PROTOCOL

REACTIVE NITROGEN

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

I. INTRODUCTION

1. This report describes the results of the third meeting of the Task Force on Reactive Nitrogen, held on 24–25 November 2009 in Amsterdam, the Netherlands, in accordance with item 1.9 of the 2009 work plan for the implementation of the Convention (ECE/EB.AIR/96/Add.2) adopted by the Executive Body at its twenty-sixth session in December 2008. It also includes detailed description of the rationale to amend annex IX of the 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone. The presentations made during the meeting and the reports presented can be accessed at: www.clrtap-tfrn.org.

A. Attendance

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

3. Also present were representatives from the Task Force on Emission Inventories and Projections, Centre for Integrated Assessment Modelling (CIAM) at the International Institute for Applied Systems Analysis (IIASA) of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP), the Directorate-General for the Environment of the European Commission and Fertilizers Europe, previously the European Fertilizer Manufacturers Association (EFMA). A member of the secretariat of the United Nations Economic Commission for Europe (UNECE) also attended.

B. Organizational matters

4. Mr. O. Oenema (Netherlands) and Mr. M. Sutton (United Kingdom), the Co-Chairs of the Task Force on Reactive Nitrogen, chaired the meeting. It was hosted by the Ministry of Agriculture, Nature and Food Quality of the Netherlands.

II. REVISION OF ANNEX IX

5. The Task Force agreed to prepare the draft revised technical annex IX as a separate document (ECE/EB.AIR/WG.5/2010/5) and to explain the rationale underlying the different proposed abatement options in this report. The following definitions for three ambition levels were used:

(a) High ambition (A): Technically feasible options that reflect a high level of ambition in reducing ammonia (NH_3) emissions, while remaining cost-effective. These options are reflective of the urgent need for action to reduce ammonia emissions, in the light of widespread effects on the environment and human health;

(b) Medium ambition (B): Technically feasible options that reflect a moderate level of ambition, as well as being cost-effective. These options include decisive action with unambiguous mandatory action to ensure that significant progress is made in reducing ammonia emissions, given its effects on the environment and human health;

(c) Low ambition (C): Technically feasible options that reflect a modest level of ambition. These options emphasize discretionary mandatory requirements, recognizing that social and political constraints may limit the possibility for the Parties to agree more ambitious commitments.

6. The Task Force agreed that the high ambition options described were in several cases less than the maximum feasible reductions, either because of cost considerations or because of current limited applicability of the measures across the whole UNECE region. The Task Force noted that it was a matter for Working Group on Strategies and Review to consider whether the options in these cases were suitably ambitious.

7. The options proposed represented the basic steps of good agricultural management needed by the Parties to make significant progress towards the national emissions ceilings. It expected that the Parties would complement these basic actions with additional measures and structural changes in order to meet the national emissions ceilings.

8. Ammonia had many effects on the environment, both through effects on ecosystems through eutrophication and acidification, and on human health through particulate matter production. The Task Force noted results that had been presented at recent expert workshops showing that, per kilogram of nitrogen deposited to sensitive habitats, ammonia was more damaging than nitrogen oxides and wet deposited nitrate. That finding emphasized the need to make progress reducing ammonia emissions in addition to the progress in reducing emissions of nitrogen oxides.

9. There were many co-benefits in reducing ammonia emissions. In particular, measures to reduce ammonia emissions focused on retaining valuable fertilizer nitrogen within the farming system. That included the nitrogen in animal feeds and in the resulting manures. Reducing ammonia emission had the potential to make better use of on-farm nitrogen sources, for example, manure, and of imported fertilizer nitrogen, and to reduce farmer exposure to fertilizer price fluctuation. At the same time, increasing nitrogen-use efficiency could have significant greenhouse gas benefits, also because nitrogen fertilizer production was energy intensive. When accounting for both CO2 and N2O produced during fertilizer production, estimates suggested that about 5 (2.5 to 10) kilogram CO2 equivalent could be saved for every kilogram of decreased nitrogen consumption. Increasing nitrogen use efficiency would also decrease water pollution by nitrates from agriculture. Nevertheless, the Task Force recognized that more work was needed on this topic to form firm conclusions of the net effect of reducing nitrogen emissions, owing to the existence of many trade-offs regarding the fate of nitrogen in the environment, such as interactions with forest growth, secondary emissions of nitrous oxide, ozone and particulate matter formation).

10. The Task Force agreed to revise the Guidance Document on Control Techniques for Preventing and Abating Emissions of Ammonia (ECE/EB.AIR/WG.5/2007/13, hereinafter Guidance Document). It was recalled that the Guidance Document classified different abatement techniques according to three categories:

(a) Category 1 techniques were well researched, considered to be practical, with quantitative data on their abatement efficiency, at least on the experimental scale;

(b) Category 2 techniques were promising, but research on them was at present inadequate, or it would always be difficult to quantify their abatement efficiency. That did not mean that they could not be used as part of an NH_3 abatement strategy, depending on local circumstances;

(c) Category 3 techniques had been shown to be ineffective or were likely to be excluded on practical grounds.

11. Category 1 techniques provided the basis for meeting the options in revising annex IX. The options were phrased so as to allow the use of other techniques by Parties where justified.

12. The Task Force agreed that farm-size thresholds, below which firm mandatory measures were not required, were a useful approach to vary the options for different levels of ambition. For example, at a high level of ambition (level A), the techniques needed could be justified for large farm sizes as a result of the economies of scale. Therefore, ambition level A might include more ambitious mandatory requirements for large farms. By contrast, at a low level of ambition

(level C), it might be appropriate to exclude small farms from firm mandatory requirements for some farming activities. The Task Force also agreed that the use of farm-size thresholds could increase administrative complexity. As a result, where it was considered feasible, options were also provided without any farm-size threshold.

13. There were two possible indicators to defining farm-size thresholds. In a simpler approach, thresholds could be defined based on the number of animal places, as currently used in annex IX for large pig and poultry farms, or on the number of livestock units for cattle. A more detailed alternative indicator for farm size would be to use the amount of manure nitrogen (N) produced during periods of animal housing. That indicator was more closely linked to ammonia and other N emissions, but would need additional data. The two approaches are described in annex I and annex II of this document.

14. The Task Force agreed that the choice of farm-size thresholds and the indicator used would need to be decided by the Working Group on Strategies and Review. Properly chosen thresholds might encourage ratifications by countries in Eastern Europe, Caucasus and Central Asia (EECCA).

15. There were no provisions in the current annex IX for farms with cattle and animal types other than pigs and poultry, except for manure application to land, while cattle housing and cattle manure storage systems were significant sources of ammonia. The Task Force therefore gave attention to specify options for cattle housing and manure storage that would complement the options for manure application and overall management of the nitrogen cycle.

16. Tentative cattle farm-size thresholds of 50 or 100 livestock units would cover a large part of total ammonia emissions from cattle, and addressed a limited number of farms where future economic investment would be most likely. About 13 per cent of cattle farms were larger than 50 livestock units, with those farms comprising 72 per cent of the cattle herd in the European Union in 2007. About 6 per cent of cattle farms were larger than 100 livestock units, with those farms comprising 50 per cent of the cattle herd. (Further national data for EU-27 are summarized in annex I.) The Task Force did not have access to available data for Eastern Europe, the Caucasus and Central Asia (EECCA), but the values were expected to be similar to those specified for some of the new member States of the European Union.

17. The Task Force proposed to keep the existing farm sizes for pigs and poultry, also applied in the Integrated Pollution Prevention and Control (IPPC) Directive[1] in force within the European Union. These size thresholds covered 70 per cent of poultry, although they only covered 20 per cent of pigs in the European Union. However, as the mean farm size increased rapidly in practice, the percentage of livestock covered by those size thresholds would also increase rapidly.

18. The existing annex IX included a differentiation of target dates for some measures, with a longer delay specified for countries with economies in transition. Where a lead-in time to

---

[1] Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control.

measures was considered by the Task Force as being justified, such as to develop economies of scale and allow gradual accommodation by the sector, the same differentiation had been retained. Any alteration of this differentiation was a matter to be taken up by the Working Group.

19. In the following, the section numbering refers to respective sections in annex IX.

A. Advisory code of good agricultural practice

20. The Task Force agreed to revise the UNECE Framework Code for Good Agricultural Practice for Reducing Ammonia (EB.AIR/WG.5/2001/7), hereinafter the Framework Code, which was used as guidance for the national advisory codes. The revision of the Framework Code would be based on the revised version of the Guidance Document. The proposed modification of the text allowed for regular updating of the national advisory codes.

B. Nitrogen management and the full nitrogen cycle

21. Annex IX provided no means for taking into account the whole N cycle. The Task Force agreed to propose a specific provision on integrated N management as key to improve nitrogen-use efficiency (NUE) to decrease the difference between the N input and output in useful products at farm level and to prevent pollution swapping. NUE was an indicator for the overall nitrogen resource use efficiency, and was defined as the ratio between the total N output in useful products and the total nitrogen input at farm level. The N input–output balance (NIOB) related to the difference between total N input and output in useful products at farm level. It was a pressure indicator for the total N losses to the environment. The Task Forces agreed that NUE and NIOB were two complementary indicators to be jointly used.

22. There was scope for improving NUE at farm level to help reduce ammonia emissions. NUE indicated how well the imported N on the farm was used to produce crops and animal products (milk, meat and eggs). Improving NUE should be done by increasing the output of N in useful products (improved management, breeding, technology), decreasing N losses (improved management) and/or decreasing N inputs, while maintaining productivity.

23. There was a relative wealth of experience with using NUE and NIOB as indicators for the performance of nitrogen management in practice. However, there was relatively less experience with using NUE and NIOB as regulatory instruments. Also, different countries often used different methodologies; therefore, values of NUE and NIOB were difficult to compare between different countries. The Task Force agreed to propose to the Working Group the setting up of continuous learning and improvement programmes aimed at the further development and testing of NUE and NIOB at farm level in practice. The implementation of those continuous learning and improvement programmes should start at representative (demonstration) farms so as to gain experience and to harmonize procedures for the estimation of NIOB at farm level. Based on the experiences gained during the first five years following its implementation, NIOBs should be established across the farming sector, at least on all farms larger than a size threshold to be agreed by the Working Group.

24. The Task Force agreed on the proposal of implementing NIOBs at farm level together with targets for increasing NUE and decreasing the values of NIOB. It was agreed that a relative

increase in NUE and a relative decrease in NIOB of 30 per cent (ambition level A), 20 per cent (ambition level B) or 10% (ambition level C) could be achieved over a five-year period in demonstration farms. Improvement should be continued for subsequent five-year periods under a continuous improvement programme until a level of high efficiency and low nitrogen input–output balances have been achieved, as specified in the Guidance Document. A five- year period accounted for both the required learning time and annual variations in meteorological conditions. Those targets were valid for all farms as defined above by the Working Group.

25. The high efficiency levels for NUE were farm-type specific and therefore should be derived for various categories of livestock farms, as indicated in the Guidance Document. High efficiency levels also depended on the level of technology and genetic resources, and as these could improve over time, it was expected that the high efficiency levels set out in the Guidance Document would be updated, revised and approved by the Parties every 5 to 10 years.

26. Achieving the improvement targets for NUE was relatively easy for farms reflecting a large gap between the current NUE and its defined high efficiency level. The same was true of the NIOB. When the current NUE approached the high efficiency level of NUE, and the current NIOB approached the target NIOB, further improvements would become increasingly difficult, in line with the law of diminishing returns.

C. Livestock feeding strategies

27. Current annex IX did not contain specific provisions for livestock feeding strategies, apart from a mention in the Framework Code for Good Agricultural Practice. The Task Force agreed to propose a specific provision on livestock feeding strategies, as livestock feeding was one of the most cost-effective and strategic ways of reducing nitrogen excretion and reducing associated ammonia emissions. For each percentage (absolute value) decrease in protein content of the animal feed, NH_3 emissions from animal housing, manure storage and the application of animal manure to land were reduced by 5 to 15 per cent, depending on the pH of the urine and dung. Low-protein animal feeding also decreased N_2O emissions and NO_3 leaching losses and increased the efficiency of nitrogen use in animal production. Some of the strategies also led to a fall in CH_4 emissions. As long as the animal requirements for all amino acids were met, as specified in the Guidance Document, there were no animal health and animal welfare implications.

28. The Task Force agreed that livestock feeding strategies for mitigation of NH_3 emissions were most applicable to housed livestock and less applicable to grassland-based systems with grazing livestock. The NH_3 volatilization potential of nitrogen in dung and urine from grazing livestock was relatively low because of the rapid infiltration of urine in soil and the subsequent adsorption of ammonium to the soil.

29. The Task Force agreed that options for livestock feeding strategies should be implemented for housed livestock and that those feeding strategies would result in a relative decrease of the nitrogen excretion and ammonia emission potential of the dung and urine of 15 per cent (ambition level A), 10 per cent (ambition level B) or 5 per cent (ambition level C) over a five- year period. As discussed with respect to NUE, that improvement should continue for subsequent five-year periods under a continuous improvement programme until the targeted low

levels of nitrogen excretion and ammonia emission potentials were achieved, as stated in the Guidance Document. The five-year period accounted for both the required learning time and annual variations in meteorological conditions.

30. The target levels of nitrogen excretion and ammonia emission potentials were livestock-type specific and therefore must be derived for various categories of livestock, as indicated in the Guidance Document. Low-protein or amino acid-supplemented diets were key to achieving low levels of nitrogen excretion and ammonia emission potentials, and feed additives or supplements such as benzoic acid could help lower the ammonia emission potential without lowering the N excretion. Setting targets for both nitrogen excretion and ammonia emission potentials minimized the risks of pollution swapping and possible conflict with animal welfare issues.

31. The economic costs of low-protein or amino acid-supplemented diets and feed additives or supplements depended on the world market prices for soy beans and the level of technology for producing synthetic amino acids. Implementation of targets for livestock feeding could lead to market adjustments, hence price changes. The technology for producing and supplementing synthetic amino acids in livestock feed was expected to improve with a steady increase in demand for feeds. That, in turn, could lead to a drop in the price per unit of synthetic amino acid, due to developing economies of scale.

32. Nitrogen excretion and ammonia emission potentials also declined when animal production efficiency rose. Nitrogen excretion and ammonia emission potentials also depended on the genetic potential of the herd and as they could improve over time, the targeted low nitrogen excretion and ammonia emission potentials set out in the Guidance Document should therefore be reviewed every 5 to 10 years.

D. Animal housing

33. Ammonia emissions from animal housing could be most easily reduced for new or largely rebuilt housing systems. Requirements for new or largely rebuilt housing could be made one year from the date of entry into force of the Protocol. Because of the larger associated costs, none of the options listed here had requirements for existing livestock houses. The term “largely rebuilt” referred to drastic renovation and modernization of existing housing systems; the result could be similar to new housing, though in essence, it was not new, but rather rebuilt to a large extent.

34. The implementation of existing and new animal welfare legislation in some parts of UNECE would, in many cases, require livestock farms to be rebuilt or substantially modified. In general, the changes to meet the new animal welfare standards tended to increase ammonia emissions, for example, by expanding the area of dirty surfaces. Animal welfare legislation was, therefore, somewhat in conflict with the need to reduce ammonia emissions. Nevertheless, the changes for animal welfare could also be considered to be an opportunity to reduce ammonia emissions because introducing ammonia emission reduction measures along with the necessary changes to meet animal welfare requirements substantially reduced the cost of ammonia mitigation. It was important that such requirements should be matched by parallel mandatory action to reduce ammonia emissions from new or largely rebuilt farm buildings.

35. The Task Force noted that in case of new animal housing, there is no reason for considering for farm-size thresholds, since the cost of the proposed low-emission techniques are not much higher (or in some cases lower) than that of the reference system, irrespective of the farm size. Moreover, most new housing systems are (much) larger than current housing systems. The Task Forces noted that the costs of monitoring compliance was largely unrelated to farm size.

36. Biological and chemical air scrubbing systems were a suitable approach for achieving maximum reductions in ammonia emissions from mechanically ventilated buildings. Such scrubbing systems also provided co-benefits in reducing particulate matter emissions and in-house air quality, thereby leading to increased animal productivity. Those systems were especially justified to reduce emissions from large farm units located near sensitive ecosystems. Because of the significant associated costs – investments and operational costs – a requirement to use these methods for all new mechanically ventilated buildings, mainly for pigs, broilers and laying hens, would represent a high level of ambition. At present, the Task Force had not reached agreement on their possible inclusion in the options for a revised annex IX, although it expected to continue the discussion in 2010. There was a need for Parties to share best practices regarding such systems, since developing economies of scale could be expected to reduce costs in the future.

1. Housing systems for cattle

37. There was a need to include measures on cattle housing because of cattle's large share in the total budget of ammonia emissions. Nevertheless, only one Category 1 technique was described in the Guidance Document and experience regarding the technique was limited to a few countries. Some new techniques were under development in the Netherlands and it was expected that additional information would be available in the coming years. A new paragraph on cattle housing was therefore added, with wording to make the percentage of reduction flexible mandatory, that is, where technically possible and economically feasible. It was intended that exercise yards and hard standings for cattle should be included in the housing systems.

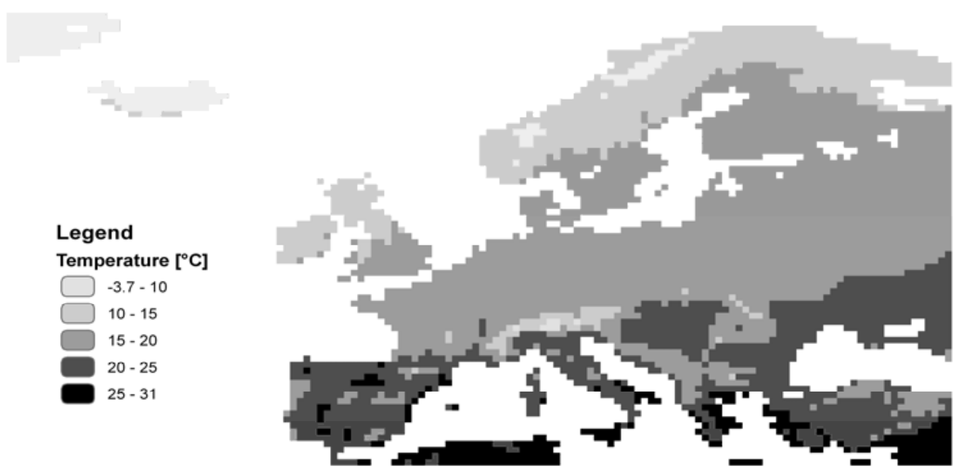
38. The current Guidance Document contained two reference systems for cattle housing: cubicle housing (reference 1) and tied housing (reference 2). Tied housing systems, which were fairly common in many countries, emitted less ammonia than cubicle housing systems in which the animals were free to move about. Since tied housing systems had been prohibited in some countries for animal welfare reasons, the Task Force agreed that the cubicle house should be the reference for new buildings in the revised Guidance Document. As the new housing reference system (reference 1) produced higher emissions than the reference system for existing housing (reference 2), mandatory percentage reductions in relation to the reference would be easier to achieve.

2. Housing systems for pigs

39. The Guidance Document offered a number of options with varying reduction efficiencies considered as Category 1 techniques for pig houses. Hence, there was scope to differentiate three levels of ambition. The lower level (ambition level C) was the minimum reduction level that in the Guidance Document was still considered as BAT by the reference documents on Best

Available Techniques (BREFs) of the European Union. The 50 per cent reduction was achievable in new houses with partly slatted floors and reduced manure pits. However, use of the partly slatted floor in regions that experienced hot summers could cause the pigs to lie on the slatted part of the floor to enjoy the cool air produced by ventilation, thus hindering the access of the other pigs to the manuring area. In this way, the ammonia emissions increased to a higher level than with a fully slatted floor. The Task Force agreed that the requirement should be more lenient for locations where the long-term average temperature of the warmest month exceeded 20 °C. See temperature map below.

40. In practice, there were different housing systems for (a) mating and gestating sows, (b) farrowing/lactating sows with piglets, (c) weaners, and (d) growers/finishers. The differentiation also related to the potential for emission reduction, which in housing systems with mating and gestating sows was more or less similar to that of weaners and growers or finishers. Housing systems for farrowing or lactating sows had less potential for emission reduction, especially in regions with warm summer months. The Task Force agreed to make a differentiation between housing systems for farrowing or lactating sows and those for all other pigs. The contribution of housing systems with farrowing or lactating sows with piglets to the total ammonia emissions from all pig houses was relatively small. Housing systems for mating and gestating sows, farrowing or lactating sows and weaners were commonly found on the same farm. Therefore, the Task Force expected to consider proposals in 2010 allowing a combination of the housing options for different pig categories.



Mean temperatures of the warmest month (long-term climatological average), above and below 20 °C.

3. Housing systems for broilers

41. The Reference System in the Guidance Document for broiler housing systems was the mechanically ventilated, fully littered floor. The only two Category 1 techniques listed in the document were houses with fully littered floors and non-leaking drinking water systems with (a) natural ventilation and (b) mechanical ventilation and well insulation. A proposal was made to list a measure with a minimum reduction level (20 per cent).

42. Broiler production was the most rapidly growing animal production system in the world, and mechanically ventilated buildings with biological or chemical air scrubbing systems were highly effective in reducing ammonia emissions. However, the Task Force was not able to agree on more than one ambition level, that is, a low level of ambition. Currently, air scrubbing techniques for broiler systems and for laying hens with forced ventilation were listed as Category 2 techniques, mainly because of cost considerations and a relative lack of experience in some parts of UNECE, owing in part to lack of regulations.

4. Housing systems for layer hens

43. Conventional cage systems would be prohibited within the European Union by January 2012 at the latest according to a European Council Directive laying down minimum standards for the protection of laying hens. Therefore, it was appropriate to consider only alternative systems (enriched cages or non-cage systems) for that part of UNECE. Not much experience had been acquired in the realm of emissions from enriched cages on non-aerated open manure storage under cages, which was the reference system for conventional cages. Furthermore there was a limited number of studies on the other systems listed in the Ammonia Guidance Document, if applied to enriched cages. In contrast, a great deal of experience had been gained with respect to conventional cages. The reduction level achievable in the case of the techniques for conventional cages could be transferred to enriched cages. Experimental data on new housing was available for the Netherlands, and new data from Spain would be forthcoming in 2010.

44. The Task Force agreed to set aerated open manure storage under the cages as the new reference system when considering the animal welfare legislation for the new housing systems for laying hens with enriched cages. It was necessary to update the Guidance Document both with regard to the reference system and the different abatement options. The previous reference values for non-caged hens and aviaries remained valid.

5. Housing systems for other livestock categories

45. Housing systems for housed animal categories other than poultry, pigs and cattle could be significant regional sources of ammonia emissions. The other animal categories could include turkeys, geese, ducks and fur animals. The Task Force agreed to include an additional heading for other livestock categories in the options for revising annex IX. The reduction of ammonia emissions from large housing systems with the other livestock categories using mechanically ventilated systems should have priority. Livestock housed in naturally ventilated systems would not be included in that provision.

E. Manure storage

46. In principle, it was agreed that all livestock farms should be included in provisions dealing with reducing ammonia emissions from manure storage systems, that is, including cattle farms and other livestock categories, irrespective of farm size. Differentiation was needed for existing and new storage systems. Storage facilities generally had a working life of about 20 years and it was not easy to make structural changes to the storage facilities. The Task Force agreed on one ambition level for existing manure stores, noting that differentiation in ambition

levels for existing manure stores could be achieved by differentiating the timescale for implementation and differentiating farm size. (See annexes I and II for size thresholds.)

47. Achieving a minimum of 40 per cent emission reduction on existing stores was feasible via the formation of a natural crust in the case of cattle slurry or the addition of chopped straw in the case of pig slurry, in cost-effective ways. Alternatively, a simple, floating plastic sheet, or surface layer of bark, peat, or Leca achieved a similar abatement. Those techniques were cost-effective, as they saved nitrogen from emissions to air, thereby decreasing the need for purchasing additional fertilizer nitrogen. Depending on the ambition level, an exemption would be needed for large open lagoons where strong winds could blow the above-mentioned covers to one side of the lagoon. The alternatives were an eventual phasing out of such lagoons (options A and B) or an exemption applied to farm holdings based on economic considerations (option C).

48. The Task Force proposed options for minimum ammonia emissions reduction targets of more than 80 per cent (option A), 60 per cent (option B) and 40 per cent (option C) for new stores. It recommended that new large open lagoons, where the low-cost covers of option C were less feasible, should be prohibited. For each option – A, B and C – uncovered open storage (the reference system) would no longer be acceptable for new manure stores after the date specified. Clearly, a high ambition level was easier to achieve on large farms.

F. Slurry spreading measures and land application of manure

49. Most of the options for reducing ammonia emissions from livestock farming focused on retaining ammoniacal nitrogen in solid manures and slurries. Each stage of manure management needed to be considered, so that reductions in ammonia emissions obtained during animal housing and manure storage did not translate into larger emissions when the manure was applied to land. Therefore, the reduction of ammonia emissions following the land application of slurries and solid manure was an essential foundation of any ammonia emission control policy. Often such measures were also more cost-effective than many other technical ammonia reduction measures.

50. Although low-emission slurry spreading methods had been mandatory in a few European countries such as the Netherlands and Denmark since the 1990s, only over the last decade had those techniques become more widely available. The need for precautions when spreading sewage wastes to land, together with the increased use of farm contractors, had led to widespread use of those methods. At the same time, farmers had increasingly realized the benefits of low-emission application methods in reducing water pollution and the nuisance of odour, improving agronomic flexibility and maximizing the nitrogen fertilizer value of manures. The latter had been increasingly recognized as mineral fertilizer prices had fluctuated, especially as low-emission techniques could reduce both emissions and the variation in nitrogen losses, allowing nitrogen savings to be credited more reliably.

51. A possible trade-off with nitrous oxide emissions was now considered to be less important than previously thought. Although reducing ammonia tended to retain more nitrogen in the field and therefore increase nitrous oxide emissions, that must be considered against a parallel reduction in indirect nitrous oxide emissions from atmospheric ammonia deposition to other ecosystems. The associated reduction in odour emissions provided by many low-emission

spreading approaches also implied a reduced emissions of volatile organic compounds (VOCs). The quantitative proportionality between reduction of ammonia and VOC emissions offered by these low-emission spreading techniques should be further explored.

52. According to available data, the costs of using low-emission slurry spreading methods, such as trailing hose, trailing shoe and open-slot injection, had decreased over time. Depending on which national data was used, those methods had the potential to be cost-neutral or to save farmers money by lessening the requirement for additional mineral fertilizers. Information on the actual costs charged by contractors from the United Kingdom provided the smallest costs, highlighting that the main cost was in travelling time and labour, which did not differ significantly between the reference method and the low-emission techniques. Those methods were expected to become cheaper in the future, based on developing economies of scale.

53. The Task Force proposed various timescales for implementation of the options with 8 to 10 years lead-in time to reduce overall costs by allowing gradual accommodation within the sector. It was concluded that the option of altering the allowance of an extended lead-in time for countries with economies in transition should be discussed by the Working Group.

54. The intention of proposed annex IX was that unabated, broadcast application slurries and solid manures (the reference method) should be avoided. The phrasing of the options allowed for flexibility between the use of (a) low-emission spreading methods, such as band spreading and manure injection and (b) improved timing of manure application to reduce emissions, according to the principles of the Application Timing Management Systems (ATMS) approach described in proposed revisions to the Guidance Document.

55. An advantage of the ATMS approach was that it could reduce the requirement for Parties to invest in new technologies. It offered potential, building on the use of already existing modelling approaches. By contrast, it was essential to verify that farm holdings implementing such methods achieved the target emission reduction levels set under annex IX. Therefore, the Task Force agreed that the ATMS approach should remain a Category 2 method. The need for verification was incorporated into a new overall requirement for verification of the measures used by Parties to implement annex IX (see reporting and verification requirements). A disadvantage of the ATMS approach compared with technical measures was that it did not provide the co-benefit of odour reduction.

56. The debate on the relative merits of the ATMS approach had focused on its potential to reduce emissions with low costs, versus the challenge for Parties to implement suitable verification procedures as outlined in the Guidance Document.

57. There was current debate on the quantitative effectiveness of slurry dilution for irrigation as a means of reducing ammonia emissions. Slurry dilution was currently listed in the Guidance Document as a Category 2 method. During 2010, the Task Force would consider a proposal for consideration of the dilution of slurry for irrigation (for example, managed dilution from at least 5 per cent dry matter content to less than 2 per cent dry matter content) as a Category 1 method.

58. The options for solid manure in the proposed revision of the Gothenburg Protocol paralleled those specified for slurry, allowing the text requirements for solid manure to be

incorporated into a revised version of annex IX, paragraph 16. (see ECE/EB.AIR/WG.5/2010/5). The text description of paragraph 16 was the same for each of the ambition levels, A, B, and C (see second table).

59. Option A for slurry and manure application required the most detailed version of table 2 because the overall high level of ambition needed to be matched by a correspondingly longer list of exemptions to the default requirement. While 60 per cent could be considered less than the maximum feasible reduction, it was identified as suitable for option A as an abatement percentage that was widely achievable for different soils. The relaxation of the 60 per cent reduction requirement for smaller farms was included in ambition level A because it increased the flexibility of measures to encourage eventual possible ratification.

60. Option B only required a simple version of table 2 because it applied to all farms, avoiding the need to specify a farm-size threshold. A wide range of low-emission techniques and approaches were available to achieve the 30 per cent reduction target. The only relaxation required related to the application of solid manure to grassland or arable crops after sowing where it was not possible to incorporate the manure. No technical exemption was required for steep slopes, where low-emission approaches could be used. In order to prevent the pollution of water courses, the application of manures to steeply sloping ground should be avoided wherever possible. Similarly, no technical exemption was necessary for stony soils.

61. Option C included a threshold in table 2 (below) for which the default mandatory requirement would not apply, that is, Parties would implement the measures as far as they considered it feasible. The farm size exemption was worded as applying to holdings which were mainly livestock farms. By doing so, it was intended that large arable farms receiving animal manures from other farms would not be included in the exemption. The exemption for small livestock farms was justified because economies of scale would imply additional costs unless contractors were used. The rationale for other possible exemptions was the same as for option B.

62. Under options A and C, the relaxations and exemptions for smaller farms applied to farms of less than 50 or 100 livestock units for cattle, 40,000 places for poultry, 2,000 places for fattener pigs and 750 places for sows. The choice of those thresholds was affected by economic and structural considerations, including the needs of EECCA countries, and was a matter to be considered by the Working Group.

G. Mineral fertilizers

63. Mandatory requirements for the application of mineral fertilizers were technically appropriate and feasible.

64. The Task Force proposed the inclusion of abatement measures when using ammonium phosphate and ammonium sulphate on calcareous soils (see proposal). However, it required further evaluation to be fully documented as a basis for possible inclusion in options to revise the Gothenburg Protocol. Fertilizer trials of ammonium sulphate had recently been commissioned within the industry, the results of which would be available in 2011.

65. An indication of the relative contribution of urea, ammonium phosphate (monoammonium phosphate plus diammonium phosphate (MAP + DAP)) and ammonium

sulphate (AS) in Europe was provided by the following sales figures within the EU-27 for agricultural use (averaged for 2006/07, 2007/08, 2008/09 as volume of pure nitrogen): 1,990 kt straight urea (19 per cent of total nitrogen use in EU-27); 1,200 kt for urea as part of urea ammonium nitrate solution (11 per cent of total nitrogen use); 270 kt for MAP + DAP (3 per cent of total nitrogen use), 310 kt for AS (3 per cent of total nitrogen use). Total nitrogen sales in EU-27 were 10,500 kt. The sum of AS + MAP + DAP was equivalent to approximately 20 per cent of the total urea sales.

66. It remained a matter of discussion whether, at ambition level C, the paragraph on ammonium phosphate and ammonium sulphate application to calcareous soils would be included. Calcareous soils were defined as those with (>0.5 per cent) free calcium carbonate.

67. The Task Force discussed the need for an exemption to the requirement for urea under ambition level C for unirrigated grassland. If accepted, the requirement for that situation would be to take steps to achieve the specified reduction as far as the Party considered it reasonable.

68. A delayed implementation date for each fertilizer type could reduce costs of implementation of those options. For example, it was suggested that the high ambition option (option A) should be linked to an implementation date of 2019 rather than upon immediate ratification. A delayed implementation date could also be considered for option B by the Working Group, particularly if the requirement to include emission reductions for ammonium phosphate and ammonium sulphate were included.

69. The exact wording of the options for mineral fertilizers remained a matter of discussion. In principle, the intention was that unabated, free broadcast of urea (the reference method) was to be avoided. The debate between alternative wording could depend on the extent to which ATMS approaches were considered applicable to reduce ammonia emissions following urea application.

70. The wording of the options for mineral fertilizers required an updating of the section in the Guidance Document, where further measures to reduce ammonia emissions following urea application might also be included.

71. The existing Protocol text included a complete prohibition of ammonium carbonate use as a fertilizer. In principle, a prohibition of urea use could also be considered as there were alternative nitrate-N fertilizers with minimal NH_3 losses. A ban on urea fertilizers was discussed when originally negotiating the Gothenburg Protocol prior to 1999. The Task Force did not propose a prohibition of urea fertilizer for technical and market reasons. Firstly, major reductions in ammonia emissions from urea could be achieved by technical measures. Secondly, market mechanisms resulted in urea acting as a buffer in the European market price and volume of other nitrogen fertilizers. Thirdly, urea had a very large share (about 56 per cent) in the global market of N fertilizer (about 30 per cent in Europe). Recognizing that a prohibition of urea use could provide an artificial barrier to international trade, it was concluded that the focus on mitigating ammonia emissions from urea use should be on technical measures.

72. The Task Force agreed on technical grounds that the three ambition levels would apply to all farm sizes, since that would ease implementation and other available fertilizers could be used as an alternative to urea.

H. Reporting and verification requirements

73. The Task Force agreed to propose reporting requirements for annex IX to be carried out during the bi-annual questionnaires, focusing on specification of the emission abatement methods used and description of the methods used to implement the emission reductions. Reporting was especially important, given the known challenges in reducing ammonia emissions and the need to share best practice information.

74. With regard to Category 1 methods, verification was considered to be established by the present Guidance Document. For other methods, parties should explain the procedures used to verify the abatement efficiencies, following the principles recommended in the Guidance Document. The verification requirement was particularly important where ATMS methods were used by Parties to meet their mandatory commitments. More generally, this requirement was added to make it clear that allowance was provided for Parties to use other Category 2 or Category 3 methods, or methods not described in the Guidance Document, as long as the effectiveness of these other methods was verified.

III. OUTCOME OF OTHER ACTIVITIES

A. Total abatement costs and uncertainties

75. A representative of CIAM (Mr. Z. Klimont) presented the calculation of control options and costs for ammonia in the GAINS model. The options were currently categorized in line with the structure of annex IX. The Task Force took note of the need to clearly identify current penetration of controls and the theoretical applicability further controls. It also agreed to circulate the table listing the possibilities to reduce ammonia emissions, the priority in deriving technical details on the options, their impacts on emission reduction potential and related costs, and whether the cost calculation was already included in the GAINS model or elsewhere.

76. The Task Force decided to initiate a review on the costs of all proposed reduction measures to provide quantitative data for input to the GAINS model. It set up a drafting group and invited the coordinator to report AT its next meeting in May 2010.

B. Guidance document

77. The Task Force decided to revise the guidance document with the new material before its next meeting in May 2010 with the aim to approving them. It agreed to provide the draft revised guidelines as an informal document to support the proposals for annex IX submitted to the forty-sixth session of the Working Group on Strategies and Review in April 2010.

C. Nitrogen budgets

78. The Task Force took note of the progress in developing nitrogen budgets, inter alia the interactive spreadsheet template made available for all interested Parties to help devising national sinks, sources and flows. It invited the relevant experts to develop a new guidance document for the calculation of regional nitrogen budgets and to present the progress at its next meeting in May 2010, for eventual reporting to the Working Group.

D. Nitrogen and human diet

79. The Task Force welcomed the progress in work on nitrogen and human food and invited the relevant experts to report in detail at its next meeting in May 2010.

80. The Task Force took note of a round-table initiative on European food, sustainable consumption and production aimed at establishing scientifically reliable and uniform environmental life-cycle assessment methodologies for food and drinks, including nitrogen. The EU-wide approach was open to all interested stakeholders and would be operational from 2009 to 2011. The Task Force expressed a wish to establish links with the initiative.

E. Links to other international processes

81. The Task Force took note of the future possibilities to prepare a special report on nitrogen jointly with the Inter-governmental Panel on Climate Change. The planning and resource requirements for an assessment of that scale would mean that such an assessment could not be expected before 2014.

82. The Task Force took note of the tentative results from a workshop on air pollution and climate interactions held in Gothenburg, Sweden, in October 2009. While welcoming the invitation to examine the links between nitrogen and climate, the Task Force noted that the resources for carrying out such extra work were limited and agreed to emphasize the need for adequate additional resources to carry out such work.

83. The Task Force took note of the progress of the *European Nitrogen Assessment,* which would be published in 2011. The Task Force also took note of a proposal to initiate a global nitrogen assessment linked to the programme of the International Nitrogen Initiative.

84. The Task Force took note of the outcome of the meeting held in Edinburgh, United Kingdom, in November 2009 between experts of the Convention on Long-range Transboundary Air Pollution and the Convention on Biological Diversity. It also took note of the need to be involved in technical collaboration.

[ENGLISH ONLY]

Annex I

Information on possible farm-size thresholds in relation to mandatory measures for land application of manures

Background

1. Under both the low and high ambition options for land application of manures, exemptions/relaxations are specified that apply only to farm holdings under a certain size. For the high ambition option (Option A), a relaxation is given to allow approaches that achieve a 30 per cent rather than 60 per cent abatement for farm holdings smaller than the threshold. For the low ambition option (Option C), an exemption is given, specifying no firm mandatory requirements for farms smaller than the threshold (i.e., as far as the Party considers it feasible).

2. In the case of pig and poultry farms, thresholds have already been established in the original annex IX, consistent with the European Directive on Integrated Pollution, Prevention and Control (IPPC): 40000 bird places for poultry, 750 places for sows and 2000 places for fattening pigs. Overall, around 70 per cent of the poultry flock and around 20 per cent of the pig herd across the EU are held in farm holdings larger than these thresholds. In the case of poultry farming, most of the European flock is therefore covered by the threshold. By contrast, only a small fraction of the European pig herd is covered by these thresholds.

3. In the case of cattle farming, under options A and C, a new farm-size threshold would need to be agreed. There are various indicators which could be used to establish this threshold, from simple approaches, such as total cattle numbers, to more detailed approaches, for example based on total nitrogen excretion and the proportion of the year that cattle spend housed or grazing on each farm (see Appendix B). The approach used in this appendix applies total livestock units (LU)[2] as the farm size indicator, which provides a simple yet relatively equitable approach, for which European statistics are widely available. Nevertheless, it is noted that even these simple statistics may not currently be available for all cattle farm sizes across the whole of the UNECE area.

---

[2] The Livestock unit (LU) is a unit used to compare or aggregate numbers of animals of different species or categories. Equivalences based on the food requirements of the animals are defined. By definition, a cow weighing 600 kg and producing 3000 litres of milk per year = 1 LU, a calf for slaughter = 0.45 LU, a nursing ewe = 0.18 LU, a sow = 0.5 LU and a duck = 0.014 LU.

Data on animals are converted into livestock units using the following coefficients: Equidae: 0.8. Bovine animals: Under one year old: 0.4; One year or over but under two years: Male animals: 0.7; Female animals: 0.7; Two years old and over: Male animals: 1.0; Heifers: 0.8; Dairy cows: 1.0; Other cows: 0.8. Sheep (all ages): 0.1. Goats (all ages): 0.1. Pigs: Piglets having a live weight of under 20 kg per 100 head: 2.7; Breeding sows weighing 50 kilograms and over: 0.5; Other pigs 0.3 FAO (2003) Compendium of Agricultural - Environmental Indicators (annex 2, p 34). http://www.fao.org/es/ess/os/envi_indi/default.asp
http://www.fao.org/es/ess/os/envi_indi/default.asp)

4. For simplicity with the approach taken in this annex, the thresholds are taken to apply both to housed and to grazing cattle. Where cattle are grazed all year round, by definition there is no requirement for the land application of manures.

5. Although the initial focus of this appendix applies to the farm-size thresholds for land application, in principle this approach could be used to develop standard thresholds for all mandatory measures to reduce ammonia emission related to cattle farming (i.e., where thresholds are defined for integrated N management, animal feeding, livestock housing and manure storage). The possibilities for application across the sector will be discussed at TFRN-3 (24-25 November 2009).

Criteria for setting cattle thresholds

6. Under recent negotiations for a revision of the IPPC directive, possible farm-size thresholds were considered for inclusion of cattle farms. As the IPPC directive represents a comprehensive regulatory regime, relatively large farm-size thresholds were considered (e.g., >350 to >450 cattle). This had the disadvantage that only a small fraction of the European cattle herd (around 10 per cent to 12 per cent) would have been included, giving rise to questions over the merit of the approach.

7. By contrast to the complex regulatory regime of IPPC, the Options A, B, and C focus on the application of simple basic requirements to reduce ammonia emissions, aiming to minimize the regulatory overhead. In this context, a possible farm-size threshold may be considered as affected by the following criteria:

(a) the aim to include farms where future investment in environmental technology would be most likely, while excluding the smallest farms (including ‘hobby farms’) where future investment would be less likely;

(b) the applicability of low-emission spreading techniques that can be implemented by specialist contractors, recognizing that this is typically the approach taken for small farms where the capital costs of owning low-emission spreading technology make purchasing this equipment economically less attractive;

(c) the aim to include a sufficiently large fraction of the European cattle herd to make significant progress in reducing ammonia emissions, while focusing on a smaller fraction of cattle farm holdings, thereby minimizing requirements across the sector;

(d) the aim to select a threshold that is acceptable to Parties based on the structure of their agricultural industry and the availability of relevant agricultural statistics.

Scenarios investigated

8. In the following tables, the following cattle farm-size thresholds for Options A and C are investigated:

Scenario 1: Exemptions for cattle farms with less than 20 livestock units (LU)
Scenario 2: Exemptions for cattle farms with less than 50 livestock units (LU)
Scenario 3: Exemptions for cattle farms with less than 100 livestock units (LU)
Scenario 4: Exemptions for cattle farms with less than 500 livestock units (LU).

These scenarios are selected to provide a wide range of variation in addressing the criteria listed, while being based on farm size information that is easily available from Eurostat.

9. Table 1 shows the percentage of the European cattle herd as animal numbers in 2007 that would be included in (i.e., not be excluded from) mandatory requirements under the four scenarios listed. To illustrate the trends with time, in comparison with table 1, table 2 shows the percentage values for cattle numbers in 2000. Table 3 shows the percentage numbers of farm holdings in 2007 that would be included in (i.e., not be excluded from) mandatory requirements under the four scenarios.

Table 1: Percentages of cattle herd as animal numbers that occur on farms exceeding the size thresholds for Scenarios 1 to 4 for the EU-27 (source Eurostat, heading J02_08). Data are for 2007. Note that the statistics are considered most reliable for larger countries with many cattle farms.

Country	% no. cattle on farms > threshold (Scenario 1: 20 LU)	% no. of cattle on farms > threshold (Scenario 2: 50 LU)	% no. of cattle on farms > threshold (Scenario 3: 100 LU)	% no. of cattle on farms > threshold (Scenario 4: 500 LU)
Austria	71%	22%	4%	0%
Belgium	97%	88%	62%	3%
Bulgaria	41%	25%	14%	3%
Cyprus	99%	98%	90%	0%
Czech Republic	95%	90%	85%	63%
Denmark	95%	86%	74%	8%
Estonia	87%	78%	71%	42%
Finland	90%	48%	17%	1%
France	97%	87%	55%	2%
Germany	95%	79%	54%	11%
Greece	87%	64%	30%	1%
Hungary	86%	76%	69%	54%
Ireland	93%	70%	38%	1%
Italy	87%	70%	50%	13%
Latvia	53%	35%	25%	9%
Lithuania	42%	28%	20%	10%
Luxembourg	99%	93%	70%	2%
Malta	97%	90%	65%	0%
Netherlands	98%	91%	67%	6%
Poland	53%	20%	10%	4%

Country	% no. cattle on farms > threshold (Scenario 1: 20 LU)	% no. of cattle on farms > threshold (Scenario 2: 50 LU)	% no. of cattle on farms > threshold (Scenario 3: 100 LU)	% no. of cattle on farms > threshold (Scenario 4: 500 LU)
Portugal	82%	65%	47%	10%
Romania	14%	8%	5%	1%
Slovakia	94%	93%	90%	59%
Slovenia	41%	12%	4%	0%
Spain	89%	70%	49%	10%
Sweden	92%	73%	45%	4%
UNITED KINGDOM	97%	90%	76%	11%
Average EU-27	**87%**	**72%**	**50%**	**8%**
Inter-country coeff of variation	**29%**	**44%**	**58%**	**154%**

Table 2: Percentages of cattle herd as animal numbers that occur on farms exceeding the size thresholds for Scenarios 1 to 4 for the EU-17+1 (source Eurostat). Data are for the year 2000. Note that the statistics are considered most reliable for larger countries with many cattle farms.

Country	% cattle LU> threshold (Scenario 1: 20 LU)	% cattle LU> threshold (Scenario 2: 50 LU)	% cattle LU> threshold (Scenario 3: 100 LU)	% cattle LS> threshold (Scenario 4: 500 LU)
Austria	65%	14%	2%	0%
Belgium	96%	84%	54%	2%
Denmark	95%	84%	59%	3%
Finland	80%	23%	4%	0%
France	96%	81%	45%	1%
Germany	93%	74%	44%	11%
Greece	78%	51%	24%	2%
Ireland	92%	69%	37%	1%
Italy	85%	65%	45%	10%
Latvia	30%	21%	17%	8%
Luxembourg	98%	91%	60%	0%
Netherlands	97%	89%	58%	4%
Norway	83%	26%	5%	0%
Portugal	71%	51%	34%	6%
Slovenia	32%	10%	5%	3%
Spain	84%	59%	39%	9%
Sweden	89%	62%	28%	1%
United Kingdom	97%	89%	72%	7%
Average EU-17+1	**91%**	**73%**	**45%**	**5%**

Table 3: Percentage numbers of farm holdings that exceed the thresholds for Scenarios 1 to 4 for EU member states and for the EU-27 (source Eurostat, heading J02_08). Data are for the year 2007. Note that the statistics are considered most reliable for larger countries with many cattle farms.

Country	% no. of cattle farm holdings > threshold (Scenario 1: 20 LU)	% no. of cattle farm holdings > threshold (Scenario 2: 50 LU)	% no. of cattle farm holdings > threshold (Scenario 3: 100 LU)	% no. of cattle farm holdings > threshold (Scenario 4: 500 LU)
Austria	38%	7%	1%	0%
Belgium	75%	56%	31%	1%
Bulgaria	3%	1%	0%	0%
Cyprus	86%	79%	62%	0%
Czech Republic	33%	19%	13%	6%
Denmark	61%	42%	30%	3%
Estonia	15%	8%	5%	1%
Finland	68%	20%	4%	0%
France	76%	55%	25%	1%
Germany	67%	39%	18%	1%
Greece	43%	20%	5%	0%
Hungary	19%	7%	4%	2%
Ireland	69%	35%	12%	0%
Italy	38%	18%	7%	1%
Latvia	6%	2%	1%	0%
Lithuania	3%	1%	0%	0%
Luxembourg	89%	72%	42%	1%
Malta	65%	52%	26%	0%
Netherlands	81%	64%	35%	1%
Poland	13%	2%	0%	0%
Portugal	21%	10%	5%	0%
Romania	1%	0%	0%	0%
Slovakia	8%	6%	5%	2%
Slovenia	11%	2%	0%	0%
Spain	44%	22%	10%	1%
Sweden	59%	32%	13%	0%
United Kingdom	73%	53%	35%	2%
Average EU-27	**24%**	**13%**	**6%**	**0.3%**
Inter-country coeff of variation	**69%**	**91%**	**111%**	**155%**

Consideration of the possible thresholds for cattle.

10. The following points should be noted:

(a) The size above which cattle farms are likely to include possible future investment in environmental technology will vary across the UNECE region. However, it is likely that this would be in the region of 50 (20 to 100) LU;

(b) According to the Eurostat data for 2007, less than 1% of cattle farms have more than 500 LU (table 3), while these farms account for only around 8% of the European cattle herd (table 1). The selection of such a large threshold (Scenario 4) would therefore not meet the criteria to include a significant fraction of the European cattle herd, and would make little contribution to regional ammonia emissions reductions;

(c) Selection of the smallest thresholds of 20 LU (Scenario 1) would include nearly all of the European cattle herd (87% in 2007, table 1). This can therefore be considered as being similar to ambition level B, which applies to farm holdings of all sizes. Nevertheless, under Scenario 1, only around a quarter farm holdings (24%) would be included;

(d) Selection of the threshold of 50 LU (Scenario 2) represents significantly lower ambition than Scenario 1. This threshold is nevertheless effective in applying to most of the European cattle herd (72% in 2007, table 1), while only applying to a small fraction of cattle farm holdings (13% in 2007, table 3). This scenario appears to meet the criteria a, b, and c. listed under paragraph 5;

(e) In terms of the European cattle herd, selection of the threshold of 100 LSU (Scenario 3) represents around half of the ambition of Scenario 1 (50% of the cattle herd included for 2007, compared with 45% for 2000, tables 1 and 2). By contrast, under Scenario 3, only around 6% of cattle farm holdings would be included (table 3). This scenario also appears to meet the criteria a, b, and c. listed under paragraph 5;

(f) It is anticipated that both Scenarios 2 and 3 would meet the structural and statistical requirements of Parties across the UNECE region (criterion d.). This needs to be confirmed by the different Parties;

(g) In principle, variation in profitability per animal is expected to differ between dairy versus beef cattle sectors. WGSR might therefore wish to consider the option to distinguish thresholds between these sectors. This could lead to a more financially equitable approach, at the expense of additional complexity in the thresholds. The present Scenarios are considered sufficient to illustrate the broad differences across Europe in relation to cattle and cattle farm holdings of different sizes. It may be noted that the percentage numbers of dairy cows included for the four scenarios are similar to the numbers shown in table 1 for total cattle. The equivalent values in 2007 for dairy cows are: 83%, 68%, 47% and 8%, for Scenarios 1 to 4, respectively.

11. Based on these statistics, Scenarios 2 and 3 (cattle farms with more than 50 or 100 LU, respectively) appear to be the most appropriate in meeting the criteria for the cattle farm thresholds. In the case of ambition level C, these thresholds allow for a clear distinction from the goals of ambition level B. In the case of ambition level A, they provide a clear distinction that focuses the highest ambition measures on farms where future investment is most likely.

12. It is noted that cattle-farm size-distributions are expected to change substantially over the next decade at least for member states of the European Union. Following the abolition of the milk quota system in the EU, farms will have to be competitive with dairy farmers in US, New Zealand, South America, which is expected to lead to a rapid up-scaling of farm sizes.

Consideration of regional differences in cattle farm sizes

13. The tables show significant variation between Parties in regards of the percentage numbers of animals and numbers of farms above the thresholds. In 2000, Belgium, Denmark, the Netherlands and the United Kingdom were among the Parties with the largest percentage cattle herd above the thresholds (Scenario 2: 84%-89% of cattle, Scenario 3: 54%-72% of cattle). In 2007, the largest percentages of cattle included were for, the Netherlands and the Czech Republic (Scenario 2: 91%; Scenario 3: 67%-85%).

14. Relatively large fractions of the cattle herd in Czech Republic, Estonia, Hungary, and Slovakia are present on the largest farms (>500 LU), reflecting a farm structure that is also typical for EECCE countries across the UNECE area. For these four countries, 42% to 62% of cattle are on farms with more than 500 LU. By contrast, a large number of very small farms in these countries results in them having, overall, a smaller percentage of cattle farms above the thresholds for Scenarios 2 and 3 (up to 5% to 13%), than is the case for most other countries.

15. The four scenarios can be considered as varying in their equitability between Parties. The coefficient of variation (standard deviation/mean) between Parties provides a suitable indicator, with a lower coefficient implying greater equitability. in For the percentage cattle herd included in the scenarios, the values are: 29%, 44%, 58% and 154% for Scenarios 1 to 4, respectively. Similarly, the coefficients of variation in the percentage number of holdings included are: 69%, 91%, 111% and 155% for Scenarios 1 to 4, respectively. Overall, Scenario 2 can therefore be considered as being more equitable than Scenario 3, while Scenario 4 can be considered the least equitable. Scenario 1 is the most equitable of the scenarios shown, although by definition, ambition level B, which applies to farms of all sizes, represents the most equitable distribution of mandatory action between the Parties.

16. Comparison of tables 1 and 2 shows that cattle farm sizes have increased since 2000, giving larger percentages of the cattle herd included the scenarios for 2007. The largest increases in farm sizes for Scenarios 2 and 3 occurred for Finland, Sweden, Spain and Portugal (increases of 8% to 25%). By contrast, the values for Ireland, the United Kingdom and Slovenia were rather stable (-1% to 4% change).

A possible farm-size threshold for the application of pig manures

17. Based on Scenario 2, the fraction of the European cattle herd above the threshold would be roughly consistent with the percentage of animals above the existing threshold for poultry farms (70%). By comparison, at ~20%, only a small fraction of the European pig herd is above the existing threshold in annex IX and IPPC. Even in the case of Scenario 3 for cattle (45% of the European herd included), when in applied ambition level C, the fraction of pigs for which mandatory measures would apply remains low compared with cattle and poultry.

18. Based on these comparisons, it would be relevant to review the options for a smaller farm-size threshold for the application of pig slurries and solid manures than is currently adopted by annex IX and the IPPC directive. In addition to the objective to ensure comparability between

sectors, this would have additional benefits given the particular concern of odours from pig manures, since low ammonia emission spreading techniques also reduce odour emissions. Such thresholds could be further reviewed by TFRN, subject to feedback from WGSR on the existing options presented. As an indication, based on Eurostat data (2000), 93% of pigs in the EU-17+1 are on holdings with more than 50 LU, 85% of pigs are on holdings with more than 100 LU, while approximately 70% of pigs are on holdings with more than 200 LU.

[ENGLISH ONLY]

Annex II

An alternative approach to calculate threshold farm sizes based on amounts of nitrogen under manure management.

Background

1. The overall purpose of the annex IX is to reduce the ammonia emission from agriculture. In the current annex IX, pigs (sows >750 and fattening pigs >2.000) and poultry (>40.000) are included but not cattle and other animal types. The emission of ammonia is related to the amount of manure nitrogen produced. The amount of manure nitrogen produced per livestock unit (LU) varies between livestock type and between countries (see table 1). The amount of manure nitrogen produced on a farm can be used as an alternative to numbers of LU as an indicator of farm size, providing a closer link to the level the ammonia emission.

2. The amount of manure nitrogen produced can be estimated as the number of animals multiplied by the amount of nitrogen typically excreted by animals for that particular country and animal type, as reported by the Party in its annual GHG inventory submission to UN under the Climate Convention (UNFCCC). These nitrogen excretion rates are reviewed annually for accuracy and consistency by UNFCCCs Expert Review Team (ERT). According to this approach, the farm level thresholds for mandatory measures (under ambition level options A and C) would differ between countries and over time, according to the actual nitrogen excretion level in that particular country. For example, increased productivity per animal in the future, would tend to reduce the threshold with time, when expressed on a per animal basis.

3. For cattle, a proportion of the manure nitrogen produced will usually be deposited during grazing. The emission of ammonia from manure deposited during grazing is low in comparison with the emission from manure deposited in livestock housing or on stock yards. In addition, there are no practical measures available to reduce ammonia emission from manure deposited during grazing. It is therefore appropriate that animal manure deposited during grazing should be excluded from the calculation of farm-size thresholds for mandatory options. Information on average grazing period at a country level is reported for all relevant animal categories to the UN in the Party's annual GHG inventory submission.

Calculation methodology

4. The nitrogen calculation approach for setting the farm-size thresholds could be:
$N_{manure} > \sum Nex_i * No_i * (1\text{-}Frac_{PRP,i})$

where:
N_{manure} is the amount of nitrogen handled by the manure management system on the farm, kg N yr^{-1}

Nex_i is nitrogen excretion rate for animal type *I*, kg N animal^{-1} yr^{-1}
No_i is number of animals or animal places
$Frac_{PRR,i}$ is the fraction of manure deposited during grazing for animal type *i*

5. Table 2 shows the consequences of setting N_{manure} to 20000, 10000 or 1000 kg N yr^{-1} for typical Danish and Portuguese situations (actual data has to be verified). The Danish and Portuguese situations were chosen to represent relatively intensive and relatively extensive management systems respectively.

Consideration of the approach and question to WGSR

6. The examples illustrated in table 2, show that a farm threshold of 10000 kg N in manure would correspond to 73 dairy cows under typical Danish management and 115 dairy cows under typical Portuguese management. The same threshold for sows (including piglets) would amount to 357 sows in Denmark and 400 sows in Portugal. The table also illustrates differences in nitrogen excretion rates between categories already included in annex IX and the IPPC directive. For example, 10000 kg N in manure would equate to around 14000 layers or 4000 turkeys.

7. The approach outlined here has the advantage of being more equitable between countries to take account of national differences in characteristic excretion rates and fraction of the time in which animals are not at grazing. It provides the facility to build on data already collected under the UNFCCC. Similarly, by considering the total amounts of manure handled, this approach would provide the facility to include both producer of manures (livestock farmer) and the user of manure in land application (which may be a different farmer including arable farms). By contrast, a natural consequence of this approach is that in terms of animal numbers, thresholds defined will change with time, for example as animal productivity changes. Further work would be needed to calculate statistics for each Party on the fraction of national livestock herd and fraction of farms above thresholds.

8. In principle the approach of this Appendix is scientifically fairer than the simpler approach outlined in Appendix A, although more work would be required to manage the approach described here. TFRN invites WGSR to consider the comparison between different methods for considering farm-size thresholds (Appendices I and II).

Table 1: Nitrogen excretion (Nex) per animal and LU for Denmark and Portugal. Actual figures have to be verified (as of 2007).

Denmark	**Nex**	**Nex per LU***
	kg N yr^{-1}	kg N yr^{-1} LU^{-1}
Dairy cows	137	137
Beef cattle	65	81
Sows incl. piglets	28	56
Fatteners	12	40
Layers	0.7	70
Turkeys	2.5	83
Portugal		
Dairy cows	87	87
Beef cattle	70	88
Sows incl. piglets	25	50
Fatteners	7.9	26
Layers	0.7	70
Turkeys	2.5	83

* Animal numbers converted to LU using the method described in Appendix A (for poultry, FAO)

Table 2: Threshold numbers for Denmark and Portugal at different threshold N_{manure}. Actual figures have to be verified (as of 2007).

		Thresholds: Animal number				
		Target, N_{manure}, kg N yr^{-1}				
Denmark	**Frac,PRP***	**20000**	**10000**	**1000**		**Current threshold**
Dairy cows	0.05	146	73	7		none
Beef cattle	0.62	311	155	16		none
Sows incl. piglets	0	714	357	36		750
Fatteners	0	1667	833	83		2000
Layers	0	28571	14286	1429		40000
Turkeys	0	8000	4000	400		40000
Portugal						
Dairy cows	0.25	231	115	12		none
Beef cattle	0.9	289	145	14		none
Sows incl. piglets	0	800	400	40		750
Fatteners	0	2532	1266	127		2000
Layers	0	28571	14286	1429		40000
Turkeys	0	8000	4000	400		40000

* Frac,PRP = proportion of nitrogen excreted whilst the livestock are grazing