

## **DRAFT REVISED TECHNICAL ANNEX IX**

### **Informal document from the Task Force on Reactive Nitrogen**

In addition to the formal version of Annex IX submitted to WGSR-47 which uses 'bracketed text' (marking changes from the existing Annex IX, ECE/EB.AIR/WG.5/2010/14), the Task Force here provides two informal versions which:

- a) Show a clean version of the possible new Annex IX removing the bracketed text markings. This format is designed for quick reading of the proposed options.
  
- b) Show the bracketed text, also highlighting the location of the proposal amendments of TFRN-4. This format highlights the amendments made by TFRN-4 in bold, with new deletions marked by crossed-through text).

In order to allow better comparison, the numbering of the paragraphs here follows that used in the last version discussed at WGSR-46 (ECE/EB.AIR/WG.5/2010/5). For this reason the numbering of deleted paragraphs is retained, with new paragraphs numbered as 13a, 15a etc.

## **MEASURES FOR THE CONTROL OF EMISSIONS OF AMMONIA FROM AGRICULTURAL SOURCES**

1. The Parties that are subject to obligations in article 3, paragraph 8 (a), shall take the measures set out in this annex.
2. Each Party shall take due account of the need to reduce losses from the whole nitrogen cycle. Each Party shall ensure that efforts are made to develop strategies for increasing nitrogen-use efficiency in crop and animal production. A high nitrogen-use efficiency is indicative for low nitrogen losses, low risk of pollution swapping and a high economic return on farm expenditure on nitrogen.

### **A. Advisory code of good agricultural practice**

3. Each Party shall establish, publish and disseminate an advisory code of good agricultural practice to control ammonia emissions, based on the framework code for good agricultural practices for reducing emissions of ammonia, adopted by the Executive Body at its thirty-third session (EB.AIR/WG.5/2001/7) and any amendment thereto. The advisory code shall take into account the specific conditions within the territory of the Party and shall include provisions on the following items:
  - (a) Nitrogen management, taking into account the full nitrogen cycle;
  - (b) Livestock feeding strategies;
  - (c) Low-emission manure spreading approaches;
  - (d) Low-emission manure storage systems;
  - (e) Low-emission manure processing and composting systems;
  - (f) Low-emission animal housing systems;
  - (g) Possibilities for limiting ammonia emissions from the use of mineral fertilizers.

The advisory code shall be reviewed and updated at least every five years and whenever the framework code is revised; it shall take into account the most recent insights and developments related to ammonia emissions abatement. Parties should give a title to the code and are encouraged to link the advisory code to other codes of good agricultural practices describing good management of the overall nitrogen cycle.

### **B. Nitrogen management, taking into account the full nitrogen cycle**

4. Each party shall ensure that all available on-farm nitrogen sources and external nitrogen inputs are used effectively. For that purpose, each party shall ensure that nitrogen input-output (i.e. farm-gate) balances are used on demonstration farms<sup>1</sup> representative of various farming systems and typical

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<sup>1</sup> The Task Force notes that it is a matter for further discussion with the Working Group on Strategies and Review to agree the manner in which such "demonstration farms", "pilot farms" or "demonstration on farm" would be established.

farming conditions within one year of entry into force of the revised protocol. Farm-type-specific baseline values of these farm-level input-output balances shall be established as an average of the first five year period after entry into force of the revised protocol. During the second and subsequent five year periods Parties shall ensure a relative improvement of {30 per cent (option A); 20 per cent (option B); 10 per cent (option C)} of the nitrogen-use efficiency and a reduction of the nitrogen surplus of {30 per cent (option A); 20 per cent (option B); 10 per cent (option C)} relative to the previous five-year average for these demonstration farms. The improvement shall continue under a continuous programme until levels of high efficiency and low nitrogen surplus are achieved, as specified in Guidance Document V adopted by the Executive Body at its seventeenth session (decision 1999/1) and any amendments thereto (hereafter referred to as the Guidance Document).

4.a Based on the experience gained with the methods applied on demonstration farms, Parties shall ensure that nitrogen input-output balances are implemented on all farms {(Option A) with more than 5 livestock units; (Option B) with more than 50 livestock units for cattle farms, 200 livestock units for pigs or 40000 places for poultry; (Option C) with more than 50 livestock units for cattle farms, 2000 fattener pigs, 750 sows or 40000 poultry 3/} within ten years of entry into force of the revised protocol. These input-output balances shall be used to ensure a relative improvement of {30 per cent (option A); 20 per cent (option B); 10 per cent (option C)} of the nitrogen-use efficiency and a reduction of the nitrogen surplus of {30 per cent (option A); 20 per cent (option B); 10 per cent (option C)} over a five-year period relative to the previous five-year average on these farms. For the first five-year period, the farm-type-specific baseline values collected on demonstration farms may be used as reference. The improvement shall continue under a continuous programme until a level of high efficiency is achieved, as specified in the Guidance Document.

### **C. Livestock feeding strategies**

5. Each party shall ensure that low-protein animal feeding strategies are used, within one year of entry into force of the revised protocol on all farms {(Options A) with more than 5 livestock units; (Option B) with more than 50 livestock units for cattle farms, 200 livestock units for pigs or 40000 places for poultry; (Option C) with more than 50 livestock units for cattle farms, 2000 fattener pigs, 750 sows or 40000 poultry} 3/. Baseline animal feeding strategies at farm level for each Party shall be established as an average of the first five year period after entry into force of the present protocol as described in Guidance Document V. During the second and subsequent five year periods, the parties shall ensure that these feeding strategies result in a relative reduction of both the ammonia volatilization potential and the nitrogen excretion of {15 per cent (option A); 10 per cent (option B); 5 per cent (option C)} relative to the previous five-year period. The use of low-protein animal feeding strategies shall continue under a continuous programme until a low level of ammonia volatilization potential and nitrogen excretion has been achieved in a continuous improvement programme, as specified in the Guidance Document.

### **D. Animal housing**

6. A Party shall use, for existing animal housing on large pig and poultry farms of 2,000 fattening pigs or 750 sows or 40,000 poultry, housing systems which have been shown to reduce emissions by

20 per cent or more compared to the reference (as listed in the Guidance Document ). The timescale for the application of this measure shall be 31 December 2007. 2/

7. Within one year of the date of entry into force of the present Protocol for it, a Party shall use, for all new or largely rebuilt animal housing for cattle, housing systems that can reduce ammonia emissions by at least 25 per cent {single option} compared with the reference, as listed in Guidance Document, where the Party considers this technically and economically feasible and acceptable for animal welfare reasons.

8. Within one year of the date of entry into force of the present Protocol for it, a Party shall use, for all new or largely rebuilt animal housing for pigs, housing systems that have been shown to reduce ammonia emissions compared with the reference, as listed in Guidance Document, by at least {(Option A) 35 per cent for locations where the average air temperature of the warmest month exceeds 20°C (based on a five-year mean) and 60 per cent for other locations; (Option B) 25 per cent for locations where the average temperature of the warmest month exceeds 20°C (based on a five-year mean) and 35 per cent for other locations; (Option C) 25 per cent}.

10. Within one year of the date of entry into force of the present Protocol for it, a Party shall use, for all new and largely rebuilt animal housing for broilers (including chicken, turkeys, geese and other table birds), housing systems that can reduce ammonia emissions compared with the reference, as listed in the Guidance Document, by at least 20 per cent {single option proposed at this stage}.

11. Within one year of the date of entry into force of the present Protocol for it, a Party shall use, for all new and largely rebuilt housing for laying hens, housing systems that can reduce ammonia emissions compared with the reference, as listed in the Guidance Document, by at least {60 per cent for layer hens in cages and non-caged layer hens (option A); 50 per cent for layer hens in cages and 60 per cent for non-caged layer hens (option B); 30 per cent for layer hens in cages and 60 per cent for non-caged layer hens (option C)}.

13. For existing and new animal housing for other livestock categories than those listed in paragraphs 6 to 11, a Party shall use low-emission housing systems, as far as it considers them technically and economically feasible.

13a. For each of the measures outlined in paragraphs 7 to 11 concerning new or largely rebuilt livestock housing, farms of 5 livestock units or fewer shall be exempt from the requirements (options A, B, C). 3/

#### **E. Manure storage outside of animal houses**

14. Within one year of the date of entry into force of the present Protocol for it, a Party shall ensure that for new slurry stores outside of animal houses for cattle, pigs and poultry, low-emission storage systems or techniques are used that have been shown to reduce ammonia emissions by {80 per cent (option A); 60 per cent (option B); 40 per cent (option C)} or more compared to the reference, as listed in the Guidance Document, or other systems or techniques with a demonstrably equivalent efficiency. 2/

15. For existing slurry stores outside of animal houses for cattle, pigs and poultry, a Party shall ensure that ammonia emission reductions of at least 40 per cent are achieved compared with the reference described in the Guidance Document. For existing very large lagoons, a Party shall ensure that ammonia emission reductions of 40 per cent are achieved compared with the reference, as described in the Guidance Document, provided the Party considers it technically and economically feasible. The timescales for the application of these measures shall be as follows: {on ratification (option A); 31 December 2019 (options B, C) for Parties with economies in transition and {on ratification (option A); 31 December 2017 (options B, C)} for all other Parties. 1/

15a. For existing and new stores for solid manure, a Party shall use low-emission storage systems as described in the Guidance Document, so far as it considers them technically and economically feasible.

### **E1. Manure processing and composting**

15b. Each Party shall ensure that low-emission manure processing and composting systems (as listed in the Guidance Document) are used as far as the Party considers this feasible.

### **F. Manure application**

16. Each Party shall ensure that low-emission slurry and solid manure application approaches, as listed in the Guidance Document, are used that reduce ammonia emissions as specified in the table below, as compared with the reference specified in the Guidance Document. This provision applies to the land application of slurry and solid manure from all livestock types to both arable and grassland. The timescales for the application of these measures shall be: 31 December 2019 for Parties with economies in transition and 31 December 2017 for other Parties, in order to allow gradual accommodation by the sector. 1/

**TABLE: {Ammonia emission reduction requirements for slurry and solid manure application to arable and grassland (option A)}**

| <b>Category</b>   | <b>Requirement <sup>a</sup></b>  | <b>Description/Rationale</b>  |
|---|--|---|
| Standard requirement for slurry application to arable and grass land and for solid manure application to bare soils   | To use methods that reduce emissions by at least 60% compared with the reference method.                                       | Default mandatory requirement   |
| For slurry application to solid-seeded winter cereal crops after seedling emergence.  | To use methods that reduce emissions by at least 50% compared with the reference method.                                       | Relaxation: Slurry injection methods are not suitable for application in winter cereal crops after seedling emergence.  |
| For solid manure application only to grassland or arable crops after sowing (i.e not including solid manure application to bare arable land)  | To use methods that reduce emissions by at least 30% compared with the reference, as far as the Party considers this feasible. | Relaxation: Incorporation of solid manure is not possible for grasslands and arable crops after sowing.   |
| For mainly livestock farm holdings with less than the following thresholds (but not including mainly arable farms):<br>a) 50 livestock units for cattle<br>b) 200 livestock units for pigs<br>c) 40000 livestock places for poultry | To use methods that reduce emissions by at least 30% compared with the reference.  | Relaxation: Economies of scale make it more costly to apply low emission techniques on small farms unless contractors are used.<br>A threshold of 100 livestock units for cattle might be requested by EECCA countries.   |
| For slurry applications to fields where the slope is more than 15% from horizontal.   | To use methods that reduce emissions by at least 30% compared with the reference.  | Relaxation: Nutrient loss by run-off can be increased by the presence of injection channels on steep slopes. A higher level of abatement is not technically possible in this situation.<br><br>Slurry application to fields where the slope is above 15% increases the risk for water pollution, especially when close to water courses on vulnerable soils, therefore application on these fields should be avoided. |
| For slurry application to stony fields or high clay soils (>35% clay particle content) in very dry conditions or peat soils (>25% organic matter content)   | To use methods that reduce emissions by at least 30% compared with the reference.  | Relaxation: Injection techniques are not suitable under these conditions.   |

a/ The reference specified is that listed in the Guidance Document.

**Ammonia emission reduction requirements for slurry and solid manure application to arable and grassland (option B)**

| <b>Category</b>   | <b>Requirement a/</b>  | <b>Description/Rationale</b>   |
|---|--|--|
| Standard requirement for slurry application to arable and grass land and for solid manure application to bare soils   | To use methods that reduce emissions by at least 30% compared with the reference method.                                       | Default mandatory requirement  |
| For solid manure application only to grassland or arable crops after sowing (i.e not including solid manure application to bare arable land)  | To use methods that reduce emissions by at least 30% compared with the reference, as far as the Party considers this feasible. | Relaxation: Incorporation of solid manure is not possible for grasslands and arable crops after sowing.  |
| For slurry and solid manure application to land when using existing mobile slurry tankers and solid manure spreaders having less than 3 m <sup>3</sup> capacity (but not applying to newly built tankers) | To use methods that reduce emissions by at least 30% compared with the reference, as far as the Party considers this feasible. | Relaxation: Tanker size is an indicator of farm size, avoiding the need for information on animal numbers. The exemption applies in practice to small farms. |
| For livestock farms with less than 5 livestock units (but not applying to mainly arable farms)  | To use methods that reduce emissions by at least 30% compared with the reference, as far as the Party considers this feasible. | Relaxation: Exclusion for the smallest farms, including hobby farms  |

a/ The reference specified is that listed in the Guidance Document.

**Ammonia emission reduction requirements for slurry and solid manure application to arable and grassland (option C)**

| <b>Category</b>  | <b>Requirement a/</b>  | <b>Description/Rationale</b>   |
|--|--|--|
| Standard requirement for slurry application to arable and grass land and for solid manure application to bare soils  | To use methods that reduce emissions by at least 30% compared with the reference method.                                       | Default mandatory requirement  |
| For mainly livestock farm holdings with less than the following thresholds (but not including mainly arable farms):<br><br>a) 50 livestock units for cattle<br>b) 2000 livestock places for fattener pigs<br>c) 750 livestock places for sows<br>d) 40000 livestock places for poultry | To use methods that reduce emissions by at least 30% compared with the reference, as far as the Party considers this feasible. | Relaxation: Economies of scale make it more costly to apply low emission techniques on small farms unless contractors are used. A threshold of 100 livestock units for cattle might be requested by EECCA countries. |
| For slurry and solid manure application to land when using any mobile slurry tankers and solid manure spreaders having less than 5 m <sup>3</sup> capacity   | To use methods that reduce emissions by at least 30% compared with the reference, as far as the Party considers this feasible. | Relaxation: Tanker size is an indicator of farm size, avoiding the need for information on animal numbers. The exemption applies in practice to small farms.   |
| For solid manure application to grassland or arable crops after sowing (but not applying to solid manure application to bare arable land)  | To use methods that reduce emissions by at least 30% compared with the reference, as far as the Party considers this feasible. | Relaxation: Incorporation of solid manure is not possible for grasslands and arable crops after sowing.  |

a/ The reference specified is that listed in the Guidance Document.

### **G. Urea-and ammonium-based fertilizers**

17. Within one year of the date of entry into force of the present Protocol for it, a Party shall ensure that low-emission application approaches for fertilizers based on urea, as listed in the Guidance Document, are used that have been shown to reduce ammonia emissions by at least {80 per cent (option A); 50 per cent (option B); 30 per cent (option C)} compared with the reference specified in that guidance document.

18. Within one year of the date of entry into force of the present Protocol for it, a Party shall prohibit the use of ammonium carbonate fertilizers.

19. Within one year of the date of entry into force of the amended Protocol for it, a Party shall ensure that, where fertilizers based predominantly on ammonium sulphate or ammonium phosphate are applied to calcareous soils, the Party shall ensure that low-emission application techniques, as listed in the Guidance Document, are used that have been shown to reduce mean ammonia emissions by at least {80 per cent (option A); 50 per cent (option B); 30 per cent (option C)} as compared with the reference specified in that guidance document.<sup>2</sup>

### **H. Reporting requirements**

20. Parties shall report on a periodic basis, in accordance with article 7, paragraph (1) (a), quantitative data on the selection, implementation, effectiveness and efficiency of measures as outlined in this Annex, to facilitate the sharing of information and experience of ammonia mitigation in the context of the wider nitrogen cycle.

21. Where measures are used, other than those listed as Category 1 in Guidance Document V adopted by the Executive Body at its seventeenth session (decision 1999/1) and any amendments thereto, Parties shall report and provide justification of the verification procedures used to estimate the abatement efficiencies specified, according to the principles set out in that guidance document.

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<sup>2</sup>This paragraph was proposed based on current understanding, pending full documentation of further evaluations and fertilizer trials.

## Notes

1/ For the purpose of the present annex, a country with an economy in transition refers to a Party that, by means of its instrument of ratification, acceptance, approval or accession, has made a declaration stating that it wishes to be treated as a country with an economy in transition for the purposes of paragraphs 14 and/or 16 of this annex.

2/ Where a Party judges the reduction of emissions from manure storage required under paragraph 14 not to be technically or economically feasible, documentation to this effect shall be reported in accordance with article 7, paragraph 1 (a).

3/ Data on animals are converted into livestock units (LU) using the following coefficients: Cattle: Under one year old: 0.4; One year or over but under two years: 0.7; Two years old and over: Male animals: 1.0; Dairy cows: 1.0; Other cows and heifers: 0.8. Sheep and 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, (see ECE/EB.AIR/WG.5/2010/5).

## **Informal version B: Version highlighting changes made at TFRN-4 (Prague, May 2010).**

For ready reference, TFRN-4 amendments are highlighted in bold, and cross out for deletions compared with the previous version. Bracketed text refers to changes compared with the original Annex IX.

### **MEASURES FOR THE CONTROL OF EMISSIONS OF AMMONIA FROM AGRICULTURAL SOURCES**

1. The Parties that are subject to obligations in article 3, paragraph 8 (a), shall take the measures set out in this annex.
2. Each Party shall take due account of the need to reduce losses from the whole nitrogen cycle. [insert: Each Party shall ensure that efforts are made to develop strategies for increasing nitrogen-use efficiency in crop and animal production. A high nitrogen-use efficiency is indicative for low nitrogen losses, low risk of pollution swapping and a high economic return on farm expenditure **on nitrogen.**]

#### **A. Advisory code of good agricultural practice**

3. [delete: Within one year from the date of entry into force of the present Protocol for it, a] [insert: Each] Party shall establish, publish and disseminate an advisory code of good agricultural practice to control ammonia emissions [delete:.] [insert: , based on the framework code for good agricultural practices for reducing emissions of ammonia, adopted by the Executive Body at its thirty-third session (EB.AIR/WG.5/2001/7) and any amendment thereto.] The [insert: advisory] code shall take into account the specific conditions within the territory of the Party and shall include provisions on the following items:

- (a) Nitrogen management, taking into account the full nitrogen cycle;
- (b) Livestock feeding strategies;
- (c) Low-emission manure spreading [delete: techniques] [insert: approaches];
- (d) Low-emission manure storage systems;
- (e) **[insert: Low-emission manure processing and composting systems;]**
- (f) Low-emission animal housing systems;
- (g) Possibilities for limiting ammonia emissions from the use of mineral fertilizers.

[insert: The advisory code shall be reviewed and updated at least every five years and whenever the framework code is revised; it shall take into account the most recent insights and developments related to ammonia emissions abatement.] Parties should give a title to the code **[delete: with a view to avoiding confusion with other codes of guidance. Parties]** [insert: and are encouraged to link the advisory code to other codes of good agricultural practices describing good management of the overall nitrogen cycle.

#### **B. Nitrogen management, taking into account the full nitrogen cycle**

4. Each party shall ensure that all available on-farm nitrogen sources **(for example, manure, crop residues, biological fixed nitrogen and atmospheric deposition)** and external nitrogen inputs **(for example, mineral fertilizers, composts, manures)** are used effectively. For that purpose, each party shall ensure that nitrogen input-output (i.e. farm-gate) balances are used on **representative or**

demonstration farms<sup>3</sup> **representative of various farming systems and typical farming conditions** within one year of entry into force of the revised protocol. **Farm-type-specific baseline values of these farm-level input-output balances shall be established as an average of the first five year period after entry into force of the revised protocol. During the second and subsequent five year periods Parties shall** ~~These input-output balances shall be used to verify~~ ensure a relative improvement of {30 per cent (option A); 20 per cent (option B); 10 per cent (option C)} of the nitrogen-use efficiency **and a reduction of the nitrogen surplus of {30 per cent (option A); 20 per cent (option B); 10 per cent (option C)} relative to the previous five-year average for these demonstration farms. on these farms over a five-year period.** The improvement shall continue under a continuous programme until ~~a~~ levels of high efficiency and **low nitrogen surplus are** achieved, as specified in Guidance Document V adopted by the Executive Body at its seventeenth session (decision 1999/1) and any amendments thereto (hereafter referred to as the Guidance Document).

4.a Based on the experience gained with the methods applied on demonstration farms, Parties shall ensure that nitrogen input-output balances are implemented on all **large farms** ~~(see annexes I and II of document ECE/EB.AIR/WG.5/2010/4 for definition of sizes)~~ **{(Option A) with more than 5 livestock units; (Option B) with more than 50 livestock units for cattle farms, 200 livestock units for pigs or 40000 places for poultry; (Option C) with more than 50 livestock units for cattle farms, 2000 fattener pigs, 750 sows or 40000 poultry 3/}** within ~~five~~ **ten** years of entry into force of the revised protocol. These input-output balances shall be used to ~~verify~~ **ensure** a relative improvement of {30 per cent (option A); 20 per cent (option B); 10 per cent (option C)} of the nitrogen-use efficiency **and a reduction of the nitrogen surplus of {30 per cent (option A); 20 per cent (option B); 10 per cent (option C)} over a five-year period relative to the previous five-year average on these farms over a five-year period. For the first five-year period, the farm-type-specific baseline values collected on demonstration farms may be used as reference.** The improvement shall continue under a continuous programme until a level of high efficiency is achieved, as specified in the Guidance Document ~~V adopted by the Executive Body at its seventeenth session (decision 1999/1) and any amendments thereto.~~

### C. Livestock feeding strategies

5. Each party shall ensure that low-protein animal feeding strategies are used, ~~at least on all large farms (see annexes I and II of document ECE/EB.AIR/WG.5/2010/4 for definition of sizes),~~ within one year of entry into force of the revised protocol **on all farms {(Options A) with more than 5 livestock units ; (Option B) with more than 50 livestock units for cattle farms, 200 livestock units for pigs or 40000 places for poultry; (Option C) with more than 50 livestock units for cattle farms, 2000 fattener pigs, 750 sows or 40000 poultry} 3/**. Baseline animal feeding strategies at farm level for each Party shall be established as an average of the first five year period after

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<sup>3</sup> The Task Force notes that it is a matter for further discussion with the Working Group on Strategies and Review to agree the manner in which such "demonstration farms", "pilot farms" or "demonstration on farm" would be established.

**entry into force of the present protocol as described in Guidance Document V. During the second and subsequent five year periods, the parties shall ensure that these feeding strategies result in a relative reduction of both the ammonia volatilization potential and the nitrogen excretion of { 15 per cent (option A); 10 per cent (option B); 5 per cent (option C) } relative to the previous over a five-year period. The use of low-protein animal feeding strategies shall continue under a continuous programme until a low level of ammonia volatilization potential and nitrogen excretion has been achieved in a continuous improvement programme, as specified in the Guidance Document ~~V adopted by the Executive Body at its seventeenth session (decision 1999/1) and any amendments thereto.~~**

#### **D. Animal housing**

6. ~~[delete: Within one year from the date of entry into force of the present Protocol for it, a]~~ **[Insert: A] Party shall use, for [delete: new][insert: existing] animal housing on large pig and poultry farms of 2,000 fattening pigs or 750 sows or 40,000 poultry, housing systems which have been shown to reduce emissions by 20 per cent or more compared to the reference (as listed in the Guidance Document ) [delete: V adopted by the Executive Body at its seventeenth session (decision 1999/1) and any amendments thereto), or other systems or techniques with a demonstrably equivalent efficiency. 2/ Applicability may be limited for animal welfare reasons, for instance in straw-based systems for pigs and aviary and free-range systems for poultry.] [Insert: . The timescale for the application of this measure shall be 31 December 2007. 2/]**

7. ~~[insert: Within one year of the date of entry into force of the present Protocol for it, a Party shall use, for all new or largely rebuilt animal housing for cattle, housing systems that can reduce ammonia emissions by at least 25 per cent {single option} compared with the reference, as listed in Guidance Document V adopted by the Executive Body at its seventeenth session (decision 1999/1) and any amendments thereto,~~ where the Party considers this technically and economically feasible and acceptable for animal welfare reasons.

8. Within one year of the date of entry into force of the present Protocol for it, a Party shall use, for **all** new or largely rebuilt animal housing for pigs ~~other than lactating sows,~~ housing systems that have been shown to reduce ammonia emissions compared with the reference, as listed in Guidance Document ~~V adopted by the Executive Body at its seventeenth session (decision 1999/1) and any amendments thereto,~~ by at least {(Option A) 35 per cent for locations where the average air temperature of the warmest month exceeds 20°C (based on a five-year mean) and 60 per cent for other locations; (Option B) 25 per cent for locations where the average temperature of the warmest month exceeds 20°C (based on a five-year mean) and 35 per cent for other locations; (Option C) 25 per cent}.

9. ~~Within one year of the date of entry into force of the present Protocol for it, a Party shall use, for all new or largely rebuilt animal housing for lactating sows, housing systems that have been shown to reduce ammonia emissions compared with the reference, as listed in Guidance Document V adopted by the Executive Body at its seventeenth session (decision 1999/1) and any amendments thereto, by at least {(Option A) 35 per cent for locations where the average air temperature of the warmest month exceeds 20°C (based on a five-year mean) and 65 per cent for other locations; (Option B) 35 per cent; (Option C) 25 per cent }.~~

10. Within one year of the date of entry into force of the present Protocol for it, a Party shall use, for **all** new and largely rebuilt animal housing for broilers (**including chicken, turkeys, geese and other table birds**), housing systems that can reduce ammonia emissions compared with the reference, as listed in **the** Guidance Document ~~V adopted by the Executive Body at its seventeenth session (decision 1999/1) and any amendments thereto~~, by at least 20 per cent {single option proposed at this stage}.

11. Within one year of the date of entry into force of the present Protocol for it, a Party shall use, for **all** new and largely rebuilt housing for laying hens, housing systems that can reduce ammonia emissions compared with the reference, as listed in **the** Guidance Document ~~V adopted by the Executive Body at its seventeenth session (decision 1999/1) and any amendments thereto~~, by at least {60 per cent for layer hens in cages and non-caged layer hens (option A); 50 per cent for layer hens in cages and 60 per cent for non-caged layer hens (option B); 30 per cent for layer hens in cages and 60 per cent for non-caged layer hens (option C)}.

~~12. Within one year of the date of entry into force of the present Protocol for it, a Party shall use, for new or largely rebuilt mechanically ventilated livestock housing for other livestock categories, housing systems which have been shown to reduce emissions compared with the reference, as listed in Guidance Document V adopted by the Executive Body at its seventeenth session (decision 1999/1) and any amendments thereto, by at least {50 per cent (option A); 30 per cent (option B); 20 per cent (option C)}.~~

13. For existing **and new** animal housing ~~and for new or largely rebuilt naturally ventilated housing~~ for other livestock categories **than those listed in paragraphs 6 to 11**, a Party shall use such low-emission housing systems, provided it considers them technically and economically feasible.

**13a. For each of the measures outlined in paragraphs 7 to 11 concerning new or largely rebuilt livestock housing, farms of 5 livestock units or fewer shall be exempt from the requirements (options A, B, C). 3/]**

#### **E. Manure storage [insert: outside of animal houses]**

14. Within one year of the date of entry into force of the present Protocol for it, a Party shall [delete: use; insert: ensure that **the following approaches are used**] for new slurry stores [insert: : **outside of animal houses for cattle, pigs and poultry**] [delete: on large pig and poultry farms of 2,000 fattening pigs or 750 sows or 40,000 poultry], low-emission storage systems or techniques [insert: **are used**] that have been shown to reduce ammonia emissions by {80 per cent (option A); 60 per cent (option B); 40 per cent (option C)} or more compared to the reference, as listed in **the** Guidance Document [delete: **V adopted by the Executive Body at its seventeenth session (decision 1999/1) and any amendments thereto**, or other systems or techniques with a demonstrably equivalent efficiency. 2/]

15. For existing slurry stores [insert: **outside of animal houses for cattle, pigs and poultry**] [delete: on large pig and poultry farms of 2,000 fattening pigs or 750 sows or 40,000 poultry], a Party shall [delete: achieve] [insert: ensure that] ammonia emission reductions of [insert: at least] 40 per cent [insert: are achieved compared with the reference described in **the** Guidance Document ~~V adopted by the Executive Body at its seventeenth session (decision 1999/1) and any amendments thereto~~. For

existing very large lagoons, a Party shall ensure that ammonia emission reductions of 40 per cent are achieved compared with the reference, as described in **the Guidance Document ~~V adopted by the Executive Body at its seventeenth session (decision 1999/1) and any amendments thereto~~**, as far as the Party considers it technically and economically feasible.] ~~[delete: insofar as the Party considers the necessary techniques to be technically and economically feasible. 2/]~~ The timescales for the application of these measures shall be as follows: ~~[delete: 31 December 2009]~~ ~~[insert: {on ratification (option A); 31 December 2019 (options B, C)}]~~ for Parties with economies in transition and ~~[delete: 31 December 2007]~~ ~~[insert: {on ratification (option A); 31 December 2017 (options B,C)}]~~ for all other Parties. 1/

15a. **~~[insert: For existing and new stores for solid manure, a Party shall use low-emission storage systems as described in the Guidance Document, so far as it considers them technically and economically feasible.]~~**

#### **E1. Manure processing and composting**

**15b. Each Party shall ensure that low-emission manure processing and composting systems (as listed in the Guidance Document) are used as far as the Party considers this feasible].**

#### **F. Manure application**

16. Each Party shall ensure that low-emission slurry ~~[insert: and solid manure]~~ application ~~[delete: techniques]~~ ~~[insert: approaches]~~, as listed in **the Guidance Document ~~[delete: V adopted by the Executive Body at its seventeenth session (decision 1999/1) and any amendments thereto, that have been shown to reduce emissions by at least 30 per cent compared with the reference specified in that guidance document]~~** are used ~~[delete: as far as the Party in question considers them applicable]~~, ~~[insert: selecting approaches]~~ **that take into account local soil and geomorphological conditions, slurry ~~[delete: type]~~ ~~[insert: characteristics]~~ and farm structure ~~[insert: that reduce ammonia emissions as specified in the table below, as compared with the reference specified in the guidance document . This provision applies to the land application of slurry and solid manure from all livestock types to both arable and grassland.]~~** The timescales for the application of these measures shall be: 31 December ~~[delete: 2009]~~ ~~[insert: 2019]~~ for Parties with economies in transition and ~~[delete: 31 December 2007]~~ ~~[insert: 31 December 2017]~~ for other Parties, in order to allow gradual accommodation by the sector. 1/

~~[delete: Within one year from the date of entry into force of the present Protocol for it, a Party shall ensure that solid manure applied to land to be ploughed shall be incorporated within at least 24 hours of spreading as far as it considers this measure applicable, taking account of local soil and geomorphological conditions and farm structure.]~~

[INSERT TABLE: {Ammonia emission reduction requirements for slurry and solid manure application to arable and grassland (option A)}

| Category  | Requirement <sup>a</sup>   | Description/Rationale   |
|---|--|---|
| Standard requirement for <b>slurry application to arable and grass land and for solid manure application to bare soils</b>  | To use methods that reduce emissions by at least 60% compared with the reference method.                                       | Default <b>mandatory</b> requirement  |
| For slurry application to solid-seeded winter cereal crops after seedling emergence.  | To use methods that reduce emissions by at least 50% compared with the reference method.                                       | <b>Relaxation:</b> Slurry injection methods are not suitable for application in winter cereal crops after seedling emergence.   |
| For solid manure application <b>only</b> to grassland or arable crops after sowing (i.e not including solid manure application to bare arable land)   | To use methods that reduce emissions by at least 30% compared with the reference, as far as the Party considers this feasible. | <b>Relaxation:</b> Incorporation of solid manure is not possible for grasslands and arable crops after sowing.  |
| For mainly livestock farm holdings with less than the following thresholds (but not including mainly arable farms):<br>d) <b>50</b> livestock units for cattle<br>e) <b>200 livestock units for pigs</b><br>f) 40000 livestock places for poultry | To use methods that reduce emissions by at least 30% compared with the reference.  | <b>Relaxation:</b> Economies of scale make it more costly to apply low emission techniques on small farms unless contractors are used.<br><b>A threshold of 100 livestock units for cattle might be requested by EECCA countries.</b>   |
| For slurry applications to fields where the slope is more than 15% from horizontal.   | To use methods that reduce emissions by at least 30% compared with the reference.  | <b>Relaxation:</b> Nutrient loss by run-off can be increased by the presence of injection channels on steep slopes. <b>A higher level of abatement is not technically possible in this situation.</b><br><br>Slurry application to fields where the slope is above 15% increases the risk for water pollution, especially when close to water courses on vulnerable soils, therefore application on these fields should be avoided. |
| For slurry application to stony fields or high clay soils (>35% clay particle content) in very dry conditions or peat soils (>25% organic matter content)   | To use methods that reduce emissions by at least 30% compared with the reference.  | <b>Relaxation:</b> Injection techniques are not suitable under these conditions.  |

a/ The reference specified is that listed in the **Guidance Document V adopted by the Executive Body at its seventeenth session (decision 1999/1)** and any amendments thereto.

**Ammonia emission reduction requirements for slurry and solid manure application to arable and grassland (option B)**

| <b>Category</b>   | <b>Requirement a/</b>   | <b>Description/Rationale</b>  |
|---|---|---|
| <b>Standard requirement for slurry application to arable and grass land and for solid manure application to bare soils</b>  | To use methods that reduce emissions by at least 30% compared with the reference method.  | Default <b>mandatory</b> requirement  |
| For solid manure application <b>only</b> to grassland or arable crops after sowing (i.e not including solid manure application to bare arable land)   | To use methods that reduce emissions by at least 30% compared with the reference, as far as the Party considers this feasible.        | Incorporation of solid manure is not possible for grasslands and arable crops after sowing.   |
| <b>For slurry and solid manure application to land when using existing mobile slurry tankers and solid manure spreaders having less than 3 m<sup>3</sup> capacity (but not applying to newly built tankers)</b> | <b>To use methods that reduce emissions by at least 30% compared with the reference, as far as the Party considers this feasible.</b> | <b>Tanker size is an indicator of farm size, avoiding the need for information on animal numbers. The exemption applies in practice to small farms.</b> |
| <b>For livestock farms with less than 5 livestock units (but not applying to mainly arable farms)</b>   | <b>To use methods that reduce emissions by at least 30% compared with the reference, as far as the Party considers this feasible.</b> | <b>Exclusion for the smallest farms, including hobby farms</b>  |

a/ The reference specified is that listed in the **Guidance Document V adopted by the Executive Body at its seventeenth session (decision 1999/1)] and any amendments thereto.**

**Ammonia emission reduction requirements for slurry and solid manure application to arable and grassland (option C)**

| Category  | Requirement a/  | Description/Rationale   |
|---|---|---|
| Standard requirement <b>for slurry application to arable and grass land and for solid manure application to bare soils</b>  | To use methods that reduce emissions by at least 30% compared with the reference method.  | <b>Default</b> mandatory requirement  |
| For mainly livestock farm holdings with less than the following thresholds (but not including mainly arable farms):<br><br>e) <b>50</b> livestock units for cattle<br>f) 2000 livestock places for fattener pigs<br>g) 750 livestock places for sows<br>h) 40000 livestock places for poultry | To use methods that reduce emissions by at least 30% compared with the reference, as far as the Party considers this feasible.        | Economies of scale make it more costly to apply low emission techniques on small farms unless contractors are used. <b>A threshold of 100 livestock units for cattle might be requested by EECCA countries.</b> |
| <b>For slurry and solid manure application to land when using any mobile slurry tankers and solid manure spreaders having less than 5 m<sup>3</sup> capacity</b>  | <b>To use methods that reduce emissions by at least 30% compared with the reference, as far as the Party considers this feasible.</b> | <b>Tanker size is an indicator of farm size, avoiding the need for information on animal numbers. The exemption applies in practice to small farms.</b>   |
| For solid manure application <del>only</del> to grassland or arable crops after sowing <b>(but not applying to solid manure application to bare arable land)</b>  | To use methods that reduce emissions by at least 30% compared with the reference, as far as the Party considers this feasible.        | Incorporation of solid manure is not possible for grasslands and arable crops after sowing.   |

a/ The reference specified is that listed in the **Guidance Document V adopted by the Executive Body at its seventeenth session (decision 1999/1) and any amendments thereto.** ]

### **G. Urea-and ammonium [~~delete: carbonate~~] [~~insert: -based~~] fertilizers**

17. Within one year of the date of entry into force of the present Protocol for it, a Party shall [~~delete:~~ take such steps as are feasible to limit ammonia emissions from the use of solid fertilizers based on urea.] [~~insert: ensure that low-emission application approaches for fertilizers based on urea, as listed in~~ **the** Guidance Document V ~~adopted by the Executive Body at its seventeenth session (decision 1999/1) and any amendments thereto, are used,~~ that have been shown to reduce ammonia emissions by at least {80 per cent (option A); 50 per cent (option B); 30 per cent (option C)} compared with the reference specified in that guidance document,~~are used.~~]

18. Within one year of the date of entry into force of the present Protocol for it, a Party shall prohibit the use of ammonium carbonate fertilizers.

19. [~~insert: Within one year of the date of entry into force of the amended Protocol for it, a Party shall ensure that, where fertilizers based predominantly on ammonium sulphate or ammonium phosphate are applied to calcareous soils, the Party shall ensure that low-emission application techniques, as listed in~~ **the** Guidance Document V ~~adopted by the Executive Body at its seventeenth session (decision 1999/1) and any amendments thereto, are used,~~ that have been shown to reduce mean ammonia emissions by at least {80 per cent (option A); 50 per cent (option B); 30 per cent (option C)}as compared with the reference specified in that guidance document,~~are used.~~]<sup>4</sup>

### **H. Reporting requirements**

20. [~~insert: Parties shall report on a periodic basis, in accordance with article 7, paragraph (1) (a), quantitative data on the selection, implementation, effectiveness and efficiency of measures as outlined in this Annex, to facilitate the sharing of information and experience of ammonia mitigation in the context of the wider nitrogen cycle.~~

21. Where measures are used, other than those listed as Category 1 in Guidance Document V adopted by the Executive Body at its seventeenth session (decision 1999/1) and any amendments thereto, Parties shall report and provide justification of the verification procedures used to estimate the abatement efficiencies specified, according to the principles set out in that guidance document.]

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<sup>4</sup>This paragraph was proposed based on current understanding, pending full documentation of further evaluations and fertilizer trials.

## Notes

1/ For the purpose of the present annex, a country with an economy in transition refers to a Party that, by means of its instrument of ratification, acceptance, approval or accession, has made a declaration stating that it wishes to be treated as a country with an economy in transition for the purposes of paragraphs [~~6 and/or 9~~][insert: 14 and/or 16] of this annex.

2/ Where [~~a Party judges that other systems or techniques with a demonstrably equivalent efficiency can be used for manure storage and animal housing in order to comply with paragraphs 8 and 10, or~~] a Party judges the reduction of emissions from manure storage required under paragraph [~~9~~][insert: 14] not to be technically or economically feasible, documentation to this effect shall be reported in accordance with article 7, paragraph 1 (a).

**[insert: 3/ Data on animals are converted into livestock units (LU) using the following coefficients: Cattle: Under one year old: 0.4; One year or over but under two years: 0.7; Two years old and over: Male animals: 1.0; Dairy cows: 1.0; Other cows and heifers: 0.8. Sheep and 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, (see ECE/EB.AIR/WG.5/2010/5)]**