Task Force on Reactive Nitrogen (TFRN)

Update and Proposals for revision of Annex IX of the Gothenburg Protocol

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WGSR-46, 14 April 2010
The Nitrogen Cascade

Fertilizer manufacture

Atmospheric N₂ fixed to reactive nitrogen (Nₐ)

Crops for food & animal feed

Nitrous Oxide (N₂O)

Nitrogen oxides (NOₓ)

Ammonia (NH₃)

Ammonium nitrate in rain (NH₄NO₃)

Further emission of NOₓ & N₂O carrying on the cascade

Livestock farming

Natural ecosystems

Leached Nitrate (NO₃⁻)

Nitrate in Streamwaters

TFRN is developing the integrated perspective needed to manage the interactions
TFRN Elements


• **Nitrogen & Climate** – Special Report for WGSR-47 and EB during 2010 – highlighting the co-benefits of an integrated approach.
Current Annex IX of Gothenburg Protocol

| A. Advisory code of good agricultural practice |
| B. Urea and ammonium carbonate fertilizers: ban on ammonium carbonate fertilizers; no quantitative targets for urea fertilizers |
| C. Manure application: soft target >30% reduction from reference method in the Guidance Doc. |
| D. Manure storage: large pig & poultry farms: firm target >40% reduction for new stores |
| E. Animal housing: large pig & poultry farms: firm target > 20% reduction for new housing |
What are the main sources of NH₃ emission?

NH₃ emission from animal manure systems in EU-27 in 2000, Gg N

- Grazing
- Storage
- Application
- Housing

Dairy cattle
- Other cattle
- Pigs
- Poultry
- Other Livestock

Plus 10% from fertilizers + 10% from other sources

Oenema et al., 2008
It is clear that more can be done…

• Only a few countries have so far implemented existing technical capability

• A long-term perspective encouraging gradual change may be needed
TFRN documents to WGSR-46

Provided for this meeting:

• **Annex IX options** (ECE/EB.AIR/WG.5/2010/5)

  • **Appendix I**: Simple method for farm size thresholds
  • **Appendix II**: Alternative detailed approach for thresholds based on manure nitrogen

• **Informal Note 11**: Factors affecting net costs and benefits of ammonia abatement
Proposals for Updated and New measures in Annex IX

- Nitrogen management, considering the whole N cycle
- Livestock feeding strategies
- Animal housing, including cattle housing
- Manure storage, including those for cattle manure
- Manure spreading, including those for cattle manure
- Mineral fertilizer use, including urea, ammonium phosphate and ammonium sulphate
- Possibility for a “Pick and Mix” approach
Livestock population \rightarrow Livestock feeding \rightarrow Manure in housings \rightarrow Manure storages \rightarrow Manure application

Humans’ quest for animal protein

Manure storages

NH₃

Manure application

Fertilizer application

Grazing animals

NH₃

Measures of proposed/revised Annex IX
1. Nitrogen management: affect all sources
2. Livestock feeding strategies; affect all manure sources
3. Animal housing systems: affect one source
4. Manure storage systems; affect one source
5. Manure application affect one source, but cumulative
6. Fertilizer application: affect one source
Ammonia Guidance Document and Category 1, 2, 3 techniques

- The Guidance Document for ammonia lists 3 categories of techniques:
  - Category 1: well proven methods
  - Category 2: sound, but some uncertainties
  - Category 3: problems and not recommended

- Category 2 and 3 methods may be used to meet Annex IX commitments, but suitable verification should be provided by the Party.

- Guidance document being updated. Drafts on TFRN Website: Revised versions after TFRN-4 (11-13 May 2010, Prague)
A. Technically feasible options that reflect a high level of ambition in reducing NH$_3$ emissions, while remaining cost effective

B. Technically feasible options that reflect a moderate level of ambition, as well as being cost effective;

C. Technically feasible options that reflect a modest level of ambition, as well as being cost effective;
Use of thresholds to vary ambition levels of Options A-C

Farm Size Thresholds
- Medium and large farms (future economic development)
- Small farms (few animals per farm and different economics)

Options for scaling farm size (TFRN-3 Appendices I & 2):
- Number of livestock units on the farm
- Amount of N excreted by housed animals on the farm

Other Threshold Option(s)
(e.g., equipment standards for manure spreading)
## Decisions needed from WGSR on thresholds approaches

<table>
<thead>
<tr>
<th>Threshold Indicator</th>
<th>Number of Livestock units on each farm</th>
<th>Total N excretion of housed livestock on each farm</th>
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<tbody>
<tr>
<td>Described</td>
<td>TFRN-3: App I</td>
<td>TFRN-3: App II</td>
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<tr>
<td>Benefits</td>
<td>• Simple to calculate</td>
<td>• More accurate and equitable indicator</td>
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<tr>
<td></td>
<td>• Available statistics</td>
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<tr>
<td></td>
<td>• Costings easier</td>
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<tr>
<td>Disadvantages</td>
<td>• N excretion technically superior</td>
<td>• Harder to apply detailed method</td>
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<tr>
<td></td>
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<td>• Additional resources needed to develop and estimate costings</td>
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### Specific Proposals
- To use the simpler approach (Appendix I), unless WGSR expresses a preference otherwise
- To investigate supporting thresholds based on equipment standards for manure spreading (e.g. simple exemption for small slurry tankers)
Selecting thresholds

Threshold for cattle farming (~50% agric NH₃)
- 50 livestock units: 13% of farms in EU; 72% of cattle
- 100 livestock units: 6% of farms in EU; 50% of cattle

Threshold for pig farming (~20% agric NH₃)
following EU-IPPC regulations:
- Sows 750
- Fattener Pigs: 2000  
  Covering ~20% of pigs in EU

Threshold for poultry farming (~15% NH₃)
following EU-IPPC regulations:
- 40,000 broilers /laying hens ~70% of EU poultry in EU

Specific Proposals
- For cattle farms: use threshold of 50 livestock units, unless certain parties request to use 100 livestock units (e.g. for EECCA countries).
- TFRN consider a second pig threshold for simple basic measures

25% decrease → 3% NH₃ reduction
Good Nitrogen Management

- Nitrogen Use Efficiency (NUE) and Nitrogen Input-Output Balances (NIOB) proposed as indicators for integrated N management at farm level
- A-C Options proposed initially for demonstration farms

Livestock Feeding Strategies

- Protein content of animal feed and emission potential of the excreta as indicators for housed animals
- A-C Options proposed for medium and large farms

Farm-specific targets listed in the Ammonia Guidance Document on the basis of a transparent calculation program. (see TFRN website)
Animal housing & Manure Storage

Animal housing
- Applies to new housing only
- A-C Options have specific achievable targets for cattle, pig, poultry, other.
- For pigs: a specific relaxation to Option A, B, applies to areas with defined warm climate

Manure Storage
- Options A-C given for new slurry stores
- Well-established methods listed in the Guidance Doc.
- Only option C applies for existing stores
- Solid manure: no mandatory options agreed
Slurry spreading: a wide range of low-emission techniques are available

Splash Plate Spreader - 1950s technology

Trailing Shoe

Trailing Hose

Slot Injector

The car and the exhaust pipe...
Low-emission spreading methods, such as band spreading and slurry injection have been shown to be cost-effective.

Proposed to phase out the unabated, surface application of slurry: according to three levels of ambition (A-C).

**Targets and Options**

- Alternative technologies can be included subject to verification by adopting Parties, e.g. “Application Timing Management Systems” (ATMS) and slurry dilution.
- Other exemptions apply for specific soil types, solid manure applied to cropped land, etc.
- Possibility for additional simple exemption for small slurry tankers.
No prohibition on urea use is proposed because of market interactions and the availability of low-emission methods.

Quantitative urea targets are proposed for Options A-C that match to available techniques for fertilizer application.

New targets for ammonium sulphate and ammonium phosphate based fertilizers applied to calcareous soils (subject to confirmation by results of new field tests).
TFRN Option B compared with Current Plans

- Current Reduction Plans are mainly modest ambition
- TFRN Option B gives significant additional reduction
- BE, NL, DK show that much more can be done if there is willingness

Zig Klimont, IIASA
Option A has the potential to reduce NH$_3$ emissions by 30-50%: already by NL and DK.

Invitation to TFRN-4
11-13 May 2010, Prague
Thanks to Czech Ministry of Agriculture

Ongoing work
- Completing of revised Guidance Document.
- More detailed calculations, for all options, still have to be made by IIASA.
- Overview of cost interactions: Informal Doc. 11
Questions to WGSR

1. Does WGSR disagree with the proposed approach for setting farm size thresholds? (e.g. animal numbers rather than N excretion)
2. Are the options A-C suitably ambitious? (e.g. **all** options, even A, are less than MFR)
3. Are different target dates, thresholds or ambition levels requested by EECCA countries?