HELCOM Recommendation 42-43/5

Supersedes HELCOM Recommendation 24/3

Adopted 20 May 2024,
having regard to Article 20, Paragraph 1b)
of the Helsinki Convention

MITIGATION OF AMMONIA EMISSIONS FROM AGRICULTURE

THE COMMISSION,

RECALLING Article 6 of the Convention on the Protection of the Marine Environment of the Baltic Sea Area, 1992 (Helsinki Convention), in which the Contracting Parties undertake to prevent and eliminate pollution of the Baltic Sea Area from land-based sources,

HAVING REGARD also to Article 3 of the Helsinki Convention, in which the Contracting Parties shall individually or jointly take all appropriate legislative, administrative or other relevant measures to prevent and abate pollution in order to promote the ecological restoration of the Baltic Sea Area,

RECOGNIZING the specific requirements for the Prevention of Pollution from Agriculture as laid down in Annex III, part II of the Helsinki Convention,

RECALLING ALSO the updated Baltic Sea Action Plan (BSAP) adopted at the HELCOM Ministerial Meeting 2021 and the agreement to revise by 2023 the HELCOM Recommendation 24/3 on "Measures aimed at the reduction of emissions and discharges from agriculture" ensuring reduction of agricultural ammonia emissions and considering relevant Best Available Technology (BAT) and Best Environmental Practice (BEP),

RECALLING FURTHER the agreement in the BSAP to "Develop by 2025 recommendations for Best Available Technology (BAT)/Best Environmental Practice (BEP) to reduce ammonia and greenhouse gas emissions from livestock housing, manure storage and spreading" that will further specify the provisions of this Recommendation,

RECOGNIZING ALSO that a substantial part of the eutrophication problems observed in the Baltic Sea Area are caused by nutrient inputs from diffuse sources and that airborne transport plays a significant role for the input of nitrogen;

RECOGNIZING FURTHER in this respect that, while the NOx deposition on the Baltic Sea is steadily decreasing, the deposition of ammonia is not declining and is mainly coming from agriculture and there is an urgent need to mitigate ammonia emissions from agriculture;

ACKNOWLEDGING existing national and international legislation and competences and, for those Contracting Parties being EU Member States, also other relevant EU legislation, aiming at preventing further degradation of the marine and freshwater environments and at achieving a healthy sea in good environmental/ ecological/chemical status;

RECOMMENDS to the Governments of the Contacting Parties to the Helsinki Convention:

A) that the following principles of nitrogen management in general are taken into account when considering measures to abate ammonia emissions from agriculture:

Principle a: It is important that there are different measures available to mitigate and reduce N emissions, but specific measures are needed to target ammonia emissions. Most of agricultural ammonia emissions are formed in livestock production and especially manure management, to which measures to reduce ammonia emissions should thus be targeted.

Principle b: The purpose of integrated sustainable nitrogen (N) management in agriculture is to decrease nitrogen losses to the environment, while ensuring high nitrogen use efficiency through appropriately balanced nitrogen inputs.

Principle c: Though potential trade-offs need to be addressed when abating/mitigating emissions, it is simultaneously necessary to enable the choice of a measure or a group of measures which have as efficient impact as possible on ammonia emissions, while having the least trade-offs.

Principle d: Nitrogen input control measures influence all N loss pathways. These are attractive measures because reductions in N input (e.g., by avoidance of excess fertilizer, of excess protein in animal diets, and of human foods with high nitrogen footprint), lead to less nitrogen flow throughout the soil-feed-food system.

Principle e: It is both economically and environmentally sustainable to reduce N evaporation from livestock manure, as more N is then directed to fertilization in manure and subsequently to harvested yield, resulting in less supplementing fertilization needed.

Principle f: The nitrogen input-output balance encapsulates the principle that what goes in must come out, and that N input control and maximization of N circulation in agricultural system (in manure, soil and plants) are main mechanisms to reduce N losses.

Principle g: In order to minimize pollution associated with N losses from fields, all factors that define, limit and reduce crop growth have to be addressed simultaneously and in balance to optimize crop yield and N use efficiency.

B) that the following most relevant or similarly effective measures to reduce ammonia emissions from agriculture are recommended for use on all farms when technologically possible and/or economically feasible. Additional measures to reduce ammonia emissions are included in annex 1.

1. Integrated sustainable nitrogen management

- Use nitrogen input-output budgeting tools to integrate N sources and N species for well-defined areas at various scales;

2. Livestock feeding strategies

- Adapt protein intake in diet of all livestock;
- Increase lifetime productivity (dairy and beef cattle);
- Increase longevity (dairy cattle);

3. Animal housing techniques

- Apply more frequent removal of manure to storage and cleaning of housing surfaces;
- Use ammonia-absorbing litter/bedding materials;
- Treat exhaust air by acid scrubbers or biofilters;

4. Manure storage

- Cover the manure storages, preferably with a tight lid, roof or tent or with plastic sheeting;
- Apply adequate storage capacity for the manure produced;
- Reduce the surface area of manure storages by e.g. encouraging replacement of existing lagoons by tanks/silos;
- Cover temporary (time limited) manure heaps;
- Encourage acidification of liquid livestock manure/slurry, if technologically feasible;

5. Field application of organic and inorganic fertilizers

- Compile/establish a fertilization plan;
- Apply nutrients at the appropriate rate and weather conditions;
- Use low-emission manure spreading techniques, such as trailing hose, trailing shoe, injection or acidification, rapid incorporation into soil;

6. Emission-reducing manure processing and nutrient recovery on farms, such as

- Mechanical solid-liquid separation of liquid livestock manure/slurry;
- Anaerobic digestion of manure;
- Pelletizing, granulation of manure;

The impact of manure processing on ammonia emissions depends on the technology chosen and also the measures taken prior to the processing step and with the storage and application of the end-products.

7. Other measures related to agricultural nitrogen

- Encourage sustainable and balanced grazing.

C) to monitor the ammonia emissions from agriculture and verify the impacts of the measures, e.g. with modelling.

D) to support research:

- that produces data and models required to optimize the management and use of N-fertilizers, including livestock manure;
- that quantifies the effectiveness of measures to reduce ammonia emissions with particular consideration of techniques and machinery used in practical farming (avoid experimental proxy systems);
- that analyses and develops the technical, economic and environmental aspects of fertilizer and manure management, application, processing technologies and other aspects that support the reduction of ammonia emissions.

RECOMMENDS FURTHER that the actions taken by the Contracting Parties should be reported to the Commission in 2027 utilizing the reporting format in Annex 2 and thereafter every four years.

Annex 1. Additional information on measures to reduce ammonia emissions from agriculture

This document provides background for measures to reduce ammonia emissions from agriculture. In addition to the measures recommended as most relevant in the Recommendation, annex 1 outlines also other examples of concrete measures to mitigate ammonia emissions from agriculture. The list is not exhaustive and other suitable measures may also be available.

1. Integrated sustainable nitrogen management

Measures:

- Nitrogen input-output budgeting tools to integrate N sources and N species for well-defined areas at various scales (from farms to continents) and that are easy-to-understand by farmers, advisors, fertilizer and feed producers, authorities and policy makers

Calculation is mainly an informational tool about the possible losses but not the tool to reduce ammonia emissions directly.

Additional measures:

- Stakeholder dialogue and communication are essential for exchanging views between actors in N management issues, which can help make the concepts transparent and facilitate the adoption of targets and the implementation of measures in practice

2. Livestock feeding strategies

The most crucial step is to adapt the N content in the livestock diet as closely as possible to the requirements of the animals. This ensures the health and productivity of the animal, while avoiding unnecessary excretion of nitrogen into faeces and urine.

Measures:

- Adapt protein intake in diet of all livestock

Feeding measures include e.g. phase feeding, formulating diets based on digestible/available nutrients, using low-protein, amino acid supplemented diets, and feed additives/supplements. The crude protein content of the animal ration can be reduced if the amino acid supply is optimized through the addition of synthetic amino acids. For dairy and beef cattle increasing the energy/protein ratio in the diet is a well-proven strategy to reduce levels of crude protein.

- Increase lifetime productivity (dairy and beef cattle)
- Increase longevity (dairy cattle)

Increasing the nutrient use efficiency (NUE) by improving animal performance (milk yield, growth rate, feed conversion efficiency, etc.), so that a diminishing proportion of the total protein requirement is used for maintenance. Increase productivity while not decreasing longevity.

3. Animal housing techniques

Ammonia volatilization depends on temperature and pH; the higher they are, the higher the risk for volatilization. Limited manure surface area to ambient air reduces the risk.

Priorities for ammonia reduction: (i) reduction of indoor temperature, e.g. by optimized ventilation; (ii) reduction of emitting surfaces and soiled areas; (iii) reduction of air-flow over soiled surfaces; (iv) use of additives (e.g., acidification), and (v) regular removal of manure to an outside storage.

Measures:

- More frequent removal of manure to storage and cleaning of housing surfaces
- Use of ammonia-absorbing litter/bedding materials
- Treatment of exhaust air by acid scrubbers or biotrickling filters; use of acid air scrubbers (cattle, pigs, poultry), use of biological air scrubbers (pigs, poultry)

Additional measures:

- Immediate segregation of urine and faeces
- Reducing manure surfaces, such as soiled floors
- Using manure aisles with deeply grooved floors (cattle housing)
- Partly slatted floors in pig housing (slurry systems)
- Increase bedding material (cattle, pigs with solid manure)
- The collection of manure on belts and drying it in housing of laying hens; Rapid drying of poultry litter
- Keeping the litter dry in broiler housing and in storage
- Lowering the indoor temperature and ventilation as animal welfare and/or production allow
- Slurry acidification during housing (pig and cattle housing)
- Cooling the manure

4. Manure storage (slurry, solid manure, processed manure)

Ammonia volatilization from storage of manure and organic fertilizers is dependent on their pH and temperature, the type of storage and volume to surface ratio of storage. Covering and reducing the surface area of the storages reduce volatilization. Concomitantly it is good to consider measures to reduce methane emissions.

Measures:

- Covering the manure storage with tight lid, roof or tent or with plastic sheeting
- Adequate storage capacity for the manure produced
- Reducing the surface area of manure storages e.g. by replacement of lagoons by tanks/silos
- Covering of temporary (time limited) manure heaps
- Slurry acidification (manure storage)

5. Field application of organic and inorganic fertilizers

Ammonia is easily volatilized during and after the application of organic (incl. manure) and inorganic fertilizers. Application technology and the conditions (temperature, wind) during and after the application affect the emission risk significantly. Also, additives can be used to reduce the volatility of ammonia.

Measures:

- Compiling/establishing a fertilization plan
- Apply nutrients at the appropriate rate and weather conditions
- Low-emission manure spreading technique (trailing hose, trailing shoe or injection, rapid incorporation into soil)

Additional measures:

- Using well-studied urease inhibitors with urea or urea ammonia nitrate solution fertilizers
- Slurry acidification (during field application)
- Replacing urea-based fertilizers by ammonium nitrate based fertilizers
- Controlled release fertilizers

- Precision fertilization
- Fertigation: In areas subject to drought or limited soil water availability, the efficiency of water and N use should be managed in tandem
- Limit and avoid the spreading of fertilizers and manure during high-risk weather conditions

6. Manure processing and nutrient recovery

Manure can be processed to concentrate nutrients into smaller volumes and/or to separate phosphorus and nitrogen into different fractions. The rationale behind manure processing can be nutrient recovery and enhancement of their use efficiency and/or reallocation of manure nutrients from regions of dense livestock production to regions with crop production. Some of the technologies are more feasible only on a larger scale, while others can also be used on a farm scale.

The impact of manure processing on ammonia emissions depends on the technology chosen and also the measures taken prior to the processing step and with the storage and application of the end-products.

Measures:

- Mechanical solid-liquid separation of slurry
- Anaerobic digestion of manure
- Pelletizing, granulation;

Additional measures:

- Solid-state fermentation
- Thermal processes, such as combustion, gasification, pyrolysis, drying, hydrothermal carbonization
- Struvite precipitation
- Ammonia stripping and recovery
- Membrane filtration
- Evaporation

7. Other measures related to agricultural nitrogen

Ammonia gas, a localised pollutant containing nitrogen and hydrogen, is produced when urea, in urine, and the enzyme urease, in faeces, mix. When animals are out in the field, they rarely urinate and dung in the same place. Therefore, when grazing animals urinate and urine is not mixed with faeces, there are reduced opportunities for the urease enzyme to breakdown the urea producing ammonia. Whilst urease is naturally present in the soil, it is at a much lower level than faeces and therefore the associated ammonia emissions are reduced.

Measures:

- Grazing

A reduction of ammonia emissions from ruminants can also be achieved by increasing the proportion of time that the animals spend grazing. This is because much of the urine infiltrates into the soil before urea is degraded and lost as ammonia. Nevertheless, the total N efficiency of grazing systems tends to be lower than that of cut grassland due to the uneven distribution of the excreta. The extent of grazing is typically limited by climatic and soil conditions as well as farm structure. A minimum period of grazing per year may be required in some countries for animal welfare reasons.

Annex 2. Reporting format

a. How have ammonia emissions from agriculture developed in your country during the reporting period? (prefilled from the pollution load compilation) Have you been able to meet the ammonia emission reduction targets set by the EU National Emission Ceilings (NEC) Directive or other international commitments including the Gothenburg Protocol?

b. How have the measures in the following categories been implemented on farms?

1. Integrated sustainable nitrogen management
2. Livestock feeding strategies
3. Animal housing techniques
4. Manure storage
5. Field application of organic and inorganic fertilizers
6. Emission-reducing manure processing and nutrient recovery on farms, such as
7. Other measures related to agricultural nitrogen

c. If ammonia emissions from agriculture have not decreased in the reporting period, what actions are planned to be taken nationally?

d. If ammonia emissions from agriculture have decreased, what has been the most efficient measure to reduce them or the factor that contributed to the decrease in emissions the most?