

## **Further details of responses to Reviewer Comments on the draft Guidance Document on Integrated Sustainable Nitrogen Management, made as part of the WGSR review**

Note prepared by the co-chairs of the Task Force on Reactive Nitrogen

5 November 2020

On behalf of the Task Force on Reactive Nitrogen (TFRN), the co-chairs thank those parties who provided comments as part of the WGSR review of the draft Guidance Document on Integrated Sustainable Nitrogen Management. The inputs have helped improve the guidance document significantly. Most of the requests have simply been adopted and directly incorporated into the revised text, including correcting typographical errors and suggestions to improve sentence formulation. In a few instances, suggested changes have not been adopted, for which we give the rationale below. (Comments of WGSR members are shown in blue with dashed underscore. Revisions are shown in green with solid underscore).

This document is presented in two parts:

- **Part A:** Responses to comments provided by WGSR members during the review of May 2020. These comments have been used as the basis for the Draft UNECE Guidance Document (official document, including French and Russian translations). The comments in Part A refer to the word document version of May 2020.
- **Part B:** Responses to comments provided by WGSR members in advance of and during the e-pre meeting held on 3 November 2020. These comments have been used as the basis for a Track Changes Document submitted as an Inf. Doc. to WGSR-58, including minor formatting edits. The comments in Part B refer to the draft UNECE document of September 2020 (ECE/EB.AIR/2020/6-ECE/EB.AIR/WG.5/2020/5), which is now available in English, French and Russian.

Part A of these comments was provided in advance to delegates attending the e-pre meeting of 3 November 2020.

## Part A: Comments from WSGR members during May 2020.

### Comments Provided by Track Changes

1. **Title of the document.** One of the parties has suggested to change the title of the document from its present title: [Guidance Document on Integrated Sustainable Nitrogen Management. Agriculture, Food and Environment](#). An alternative title is suggested as: [Guidance Document on Integrated Sustainable Nitrogen Management in Agriculture and Food Production](#). We have not adopted the proposed revision since we consider this not justified on technical grounds (no reason for the proposed change was given). While we consider that the original title is more accurate, we see this as a point for reflection by WSGR. We note:
  - i. That a proposal to remove ‘environment’ from the sub-title would downplay the environmental focus of this guidance document, including the land-use and landscape scale aspects.
  - ii. That a proposal to restrict the discussion of ‘food’ (which includes both production and consumption elements) to only ‘food production’ would not be consistent with the content which highlights the need to consider both food consumption and production.
  - iii. That that to write both ‘agriculture and food production’ is a double emphasis of essentially overlapping terms, whereas the use of ‘agriculture, food and environment’ emphasizes the holistic perspective that is being encouraged by the guidance document.
2. **Executive Summary, Main Points.** We note a proposal to add the word [agricultural](#) into the eighth bullet. We consider this would be overdoing it, since the word ‘agricultural’ is already included as the seventh word of this sentence.
3. **Executive Summary (para. 22).** It has been proposed to add the word ‘unintended’ to the following sentence: “This means that abatement of [\[unintended\]](#) N<sub>2</sub> emissions is important because it can help improve overall system efficiency.” We have not accepted this proposal, since this could be taken to imply that intended N<sub>2</sub> emissions are acceptable. As may be seen, the philosophy of the guidance document is that both intended and unintended N<sub>2</sub> emissions represent a waste of reactive nitrogen resources.
4. **Executive Summary (Figure ES.3) and Chapter 1, key points (para. 163).** It has been suggested to add [“the natural N cycle”](#) to Key Point 1. We note that the phenomena of the N cycle has been addressed in Key Points 5 and 6. To mention the nitrogen cycle also in Key Point 1 would therefore be redundant.
5. Concerning Figure ES.3 we think it important to keep the figure as simple as possible. Therefore, it has to be recognized that it is not possible to make every point in this figure, but rather allude to key points as a simple illustration. As such, we have not inserted the suggested addition into the figure: [“Humans introduce huge amounts of artificial nitrogen into the nitrogen cycle and influence global nitrogen pathways in](#)

[such a way, that the natural nitrogen cycle is out of balance](#)". However, we agree that the sentiment is relevant and have reflected this in the Figure caption: "[Humans introduce huge amounts of additional reactive nitrogen into the nitrogen cycle so that the system is now out of balance](#)".

6. **Executive Summary (Figure ES.3) and Chapter 1 (para. 162, Principle 8).** We have not included a proposal to mention mycorrhizae of forest trees in Figure ES.3, since we consider that this would be too much detail for this particular figure. However, we agree that this is a relevant point to mention mycorrhizae in the main text. As such, we have included a sentence on this in Chapter 1 (Principle 8, para. 162): "[In unfertilized agroecosystems, forests and natural habitats, mycorrhizae \(soil fungi living in association with plants\) can play an important role in bringing nutrients to plant roots. High levels of external nitrogen input can affect the performance of such mycorrhizal symbioses](#)".
  
7. **Executive Summary (para. 28).** It is commented: "[Harmful impacts of excess nitrogen inputs on forests are underpinned by many studies of ICP Forest, Modelling & Mapping and Integrated Monitoring; therefore in our view it is unacceptable to use woodlands as buffers against nitrogen loads from agriculture.](#)" We agree with the scientific interpretation that nitrogen deposition affects biodiversity of woodlands. However, we disagree with the conclusion that it is "unacceptable to use woodlands as buffers". We consider that this reflects a need for the guidance document to be more specific about when it is acceptable and when it is not acceptable to use woodlands as buffers. For instance:
  - a. *We would not consider it acceptable* to use a woodland that is prioritized for nature conservation of oligotrophic plant species as a buffer for nitrogen pollution (e.g., a site designated under the EU Habitats Directive).<sup>1</sup>
  - b. *We would consider it acceptable* to plant a woodland on former agricultural land with the specific purpose of increasing buffering capacity and landscape resilience. Such a planted to structure to fulfil this purpose can be designed to help protect priority designated natural habitats.

To address this in the executive summary, we have added to the end of the sentence about buffer vegetation: "[so long as this does not contravene any specific habitat](#)

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<sup>1</sup> We leave it open as a matter of legal interpretation whether it is acceptable to include buffer zones within the territory of specific nature conservation sites, according to their designation context. For example, some would consider areas of degraded habitat within a EU Special Area of Conservation (SAC) to represent 'site fabric' that does not need to be protected, and therefore can be used as buffer areas (where adverse effects are acceptable). Conversely, others would consider that there is a duty to restore degraded habitat within a SAC, so that such areas must not be used as buffer areas (where adverse effects would not be acceptable). This represents a relevant debate in the context of retaining historical woodland encroachment near to roads *within* designated SACs, and of woodland encroachment around the *inside* of SACs in agricultural landscapes (helping to protect the central parts of SACs). However, these are very different issues from the use of new woodland plantings, where the purpose is specifically to increase landscape resilience outside of designated conservation areas.

conservation objectives for the identified buffer ecosystems themselves”, as well as reflected this message in Chapter 4 (para. 460).

8. **Technical Summary (Box TS1)**. It has been proposed to lengthen the text box with further information about the natural nitrogen cycle. In order to keep the text box short, and within one page, we have not done this. However, we have incorporated the suggestion from this comment into the full description given in Chapter 1, Principle 1 (para. 163).
9. **Technical Summary (Principle 11) and Chapter 1 (para. 164)**. Suggestions have been made to reformulate or delete this principle. We find this surprising as this principle is derived from nature. Fertility gradients and natural attenuation gradients are found everywhere on the world, and contribute also to biodiversity. This principle also underpins existing policies, for example the obligations to have buffer strips and riparian zones. We therefore consider that there are robust scientific grounds for retaining Principle 11.
10. To our understanding, the concern is not so much with the principle itself (which, by definition, is a simple reality), but to do with preferences between different policy options that derive from the principle. To address this concern, we have reformulated the principle to make it more clear, and to distinguish the implications of the principle. The revised text in the Technical Summary (also reflected in Chapter 1), reads:

**“Principle 11: The structure of landscape elements affects the capacity to store and buffer nitrogen flows. This means that ecosystems with high N storage capacity (e.g. woodlands and unfertilized agricultural land) tend to buffer the effects of N compounds emitted to the atmosphere, so that less N is transferred to other locations. In this way, woodlands, extensive agricultural land and other landscape features help absorb and utilize N inputs from atmospheric N deposition or N that would otherwise be lost through lateral water flow. This principle is the basis of planning to increase overall landscape resilience, where, for example, planting of new woodland (with the designated function of capturing N) may be used as part of a package of measures to help protect other habitats (including other woodland and ecosystems, where nature conservation objectives are an agreed priority).”**
11. It is therefore open for Parties to express their various preferences in relation to the policy options (e.g., desirability and limitations of different measures), while the text is now more clear that this paragraph is focused on the unalterable principles of nitrogen flows in landscapes, from which the possible measures may be derived.
12. The reformulation of Principle 11 has also been used to address these same concerns where they are expressed at Table TS.1 (para. 136).
13. **Technical Summary (para. 82, Manure acidification)**. It is suggested to add that acidified manure cannot be used for biogas production. Our understanding (as reflected in the existing text; para 65, Housing Measure 8) acidified slurry can be

used, but only as a smaller proportion of the overall feedstock. We have reflected this, while noting that acidification of digestate following anaerobic digestion can also reduce emissions: [“While feedstock for biogas production can only contain limited amounts of acidified slurry, acidification after anaerobic digestion can help to reduce subsequent NH<sub>3</sub> emissions”](#).

14. **Technical Summary (para. 52, Anaerobic digestion).** It is suggested that we add again that slurry acidification prevents its use of anaerobic digestion. We have not added this here since it is already covered in Housing Measure 8 and Manure Measure 8) and because para. 52 is already rather long. We prefer not to lengthen it further, since the intent is to keep the summary as short as possible.
15. **Technical Summary (para. 91, Concentration of nitrogen salts).** As the measure is assigned UNECE Category 3 for all N forms, we consider that it is not helpful to make this summary longer by describing present energy requirements. However, we have now emphasized this point in the main text (para. 281), noting that the future must be to make such nutrient recovery processes more energy efficient: [“At present, such approaches have significant energy requirements, so the challenge for the future must include to improve energy efficiency, with lower energy requirements per kg recovered nitrogen and other nutrients.”](#)
16. **Technical Summary (para 109, Nitrification inhibitors).** We note the proposal of the reviewer to add that [“Possible long-term effects of nitrification inhibitors, inter alia on non-target aquatic and terrestrial organisms, should be considered.”](#) Recognizing the need for brevity in this summary paragraph, we have included this in summarized form as: [“Potential long-term effects of nitrification inhibitors on non-target organisms should be considered”](#). The text is also added to footnote 8, in response to the same request. Further details are provided in the full description given in Chapter 3. That chapter also reflects on the concerns expressed during TFRN technical discussions about urease inhibitors, for which recent review has also failed to show any evidence of adverse effects.
17. **Chapter 1 (para 130, Principle 11).** The comment is given: [“This contradicts WGE views please delete. At least please consult WGE”](#). Please see our explanation at paragraphs 7 and 11 above. The distinction to be made is between the *principles* themselves *versus* the *measures* that parties may or may not prefer to adopt according to their national priorities. We fully understand that, some parties may wish to benefit from measures to increase landscape resilience, while other parties may prefer measures that focus on control of emissions at source. However, we note that this is a different thing from recognizing the fundamental principles. We hope that the adjusted text and this explanation satisfies the concern.
18. **Chapter 2 (para. 184).** An expert contributor has pointed out the need to give further mention of the reference system, when describing the ‘Magnitude of Effect’ of the

measures. The following text has therefore been included: “Where clarification is necessary, Magnitude of Effect of a measure is described in comparison to a specified reference system. For example, in the case of livestock housing this includes *ad libitum* feeding, as well as storage of slurry without cover and without an impermeable base. In some parts of the UNECE, use of certain reference systems may be prohibited, e.g., because of the associated pollution levels.”

19. In accordance with this point, a brief reference is similarly added to other chapters:
- a. **Technical Summary (para. 20):** “Where clarification is necessary, Magnitude of Effect of a measure is described in comparison to a specified reference system.”
  - b. **Chapter 3 (para. 314):** “Where clarification is necessary, Magnitude of Effect of a measure is described in comparison to a specified reference system. For example, in the case of slurry application to land, the reference system is surface application without any specific restriction or additive. In some parts of the UNECE, use of certain reference systems may be prohibited, e.g., because of the associated pollution levels.”
  - c. **Chapter 4 (para. 436):** “Where clarification is necessary, Magnitude of Effect of a measure is described in comparison to a specified reference system. For example, in the case of constructed wetlands, two reference systems are specified: a) taking no action (with polluted water lost directly to streams and rivers) and b) advanced processes focused on nutrient recovery. In some parts of the UNECE, use of certain reference systems may be prohibited, e.g., because of the associated pollution levels.”
20. **Chapter 2 (para. 275; Manure Measure 11: Anaerobic Digestion).** An expert contributor has questioned the benefit of anaerobic digestion to reduce ammonia emissions, since the anaerobic digestion can increase ammonia emissions, while the benefit of the measure appears to be associated with its combination with other measures. This has been addressed by pointing out that a) it is the *closed system* required by anaerobic digestion that provides the opportunity to reduce emissions, and b) the production of digestate with high *ammoniacal nitrogen content* allows this to be used with higher nitrogen use efficiency than manures with higher carbon content.
- a. Accordingly, the following text is inserted into para. 275: “It should be noted that the process of anaerobic digestion itself does not reduce NH<sub>3</sub> emission, but rather provides the opportunity to reduce NH<sub>3</sub> emission by virtue of the requirement for a *closed system*. Similarly, aerobic digestion produces a digestate with high TAN content and low dry matter content, which is a more easily manageable to increase crop nitrogen use efficiency than manure with a high carbon content. These points mean that, while anaerobic digestion increases the *opportunity* to reduce NH<sub>3</sub> emissions, achieving this will depend on deploying an appropriate package of measures.”
  - b. The following requested point is also added into para. 271: “The value of products from anaerobic digestion (biogas produced, available nutrients) can

help provide an extra income to the farmers, enabling them to make investment (e.g., into adequate manure storage and application technology).”

21. **Executive Summary (para. 7).** It has been proposed to make specific reference to relevant sections of the Gothenburg to underpin the mandate of the guidance document. The following text about the nitrogen guidance has been added: “This is necessary to support the objectives of the Gothenburg Protocol (pre-amble 22<sup>nd</sup> para.; Article 4, para. 1; Article 6, para. 1(g); Annex IX, para. 2) and the revised Gothenburg Protocol (pre-amble 10<sup>th</sup> para.; Article 7, para. 3(d); Article 10, para. 4).”

## Other Comments

22. **Comment:** “To what extent is the information presented in the new ISNM Guidance document on NH<sub>3</sub> measures consistent (or inconsistent) with or complementary to the information presented in the Ammonia Guidance document? Does the new guidance document contain updated and new information on NH<sub>3</sub> measures compared to the Ammonia Guidance document? Can that information be identified?”

**Reply:** As stated at para. 19: “The present guidance document does not replace the UNECE Ammonia Guidance Document (ECE/EB.AIR.120), where much more detail is provided on quantitative abatement efficiency and the costs of measures for ammonia.” Since the nitrogen guidance document covers all N forms, it necessarily gives less detail to each nitrogen form. The information in the Nitrogen Guidance Document can therefore be considered as complementary to the Ammonia Guidance Document, especially in emphasizing the connections with different nitrogen forms. Additional resources would be required to conduct a detailed comparative analysis of the two documents. Since the Ammonia Guidance Document was last updated in 2012, it would be appropriate to revise it as part of the Gothenburg Protocol review for which resources would also be required.

23. **Comment:** “The new ISNM Guidance Document contains useful information on the effects of measures on methane emissions (trade-offs / synergies). In the context of the revised mandate of TFRN (and TFTEI) requesting ‘to initiate work to collect and assess information on emissions abatement technologies and measures for the reduction of methane emissions from the agricultural sector’ it could be useful to take into account the information on methane from the new ISNM Guidance Document as inputs and a starting point for further work on this topic.”

**Reply:** We agree that information in the Nitrogen Guidance Document is useful to inform future work on linking reduction of nitrogen and methane emissions. The Task Force would welcome resources to be able to give more attention to this topic.

24. **Comment:** “The graphics used in the Technical Summary, in line with the description, reflect only the UNECE category assigned to a given method/measure related to a given form of nitrogen occurring in the environment, but they do not show the scale/size of its impact (magnitude of effect), nor the potential effect on emission, described in Chapters 2-4 by arrows going up or down. Thus, the graphics do not illustrate situations where application of a given method/measure reduces emission of one of the forms of nitrogen and at the same time increases emission of another

[nitrogen form. Perhaps it would be useful to extend the graphics, e.g. to present graphic symbols for certain arrows placed on the background of the coloured fields which illustrate the assignment to the appropriate UNECE category.”](#)

**Reply:** We took a deliberate decision to show only the UNECE Categories in the simple graphics included in the Technical Summary. Including the up arrows and down arrows mentioned would result in these becoming complex graphics, when our purpose was to keep them as simple as possible.

25. It should be emphasized that the tendency for one measure to reduce emission of one form of nitrogen, while increasing emission of another form, is highly context dependent, and dependent on other issues. This is the reason why the tables in Chapters 2-4 also come with supporting footnotes. To present such arrows without these clarifications could mislead readers with an overly negative impression of the interactions.
26. According to Principle 6, a measure that achieves a substantial nitrogen saving will leave more nitrogen in the farming system. This can be presented negatively, i.e., implying a likelihood for increasing losses as another nitrogen form. Alternatively, it can be presented positively, emphasizing that reduction in N losses needs to be accompanied by reduced N inputs (or more storage or more agricultural outputs), meaning that economic savings, reduction of N losses and improved efficiency must go hand-in-hand. For these reasons, we consider it better to keep the graphics in the Technical Summary simple, while emphasizing such points in the text.
27. **Comment:** [“From a logical point of view it seems justified to re-consider the contents of chapter 3: „Field application of organic and inorganic fertilizers” with its subchapter 3.5.4 „Measures for grazing livestock” in relation to the inclusion of Field Measure 18 “Extend the grazing season for cattle”, because fertilisation of pastures is not the main purpose of grazing. That measure could be moved to Chapter 2 dedicated to livestock feeding and housing.”](#)

**Reply:** We consider that the logic could go either way depending on the perspective of the reader. Our preference is to leave Field Measure 18 in Chapter 4. However, we have aided the reader by including a cross-reference in Chapter 2 (para. 191): [“given the clear and well quantified effect on NH<sub>3</sub> emissions, increasing the period that animals are grazing all day can be considered as a strategy to reduce emissions \(see Chapter 3, Field Measure 18\)”](#). A similar cross-reference has also been added to Chapter 3 (para 386): [“Extension of grazing season should also be considered in relation to wider dietary considerations \(Chapter 2, Dietary Measure 1\)”](#).

28. **Comment:** [“Field Measures 10 and 14, described in Chapter 3 \(para. 320-323 and para. 334-338\) on field application of fertilisers, based on the application of nitrification inhibitors \(i.e. antibacterial substances\) during fertilisation with slurry \(10\) and inorganic fertilisers \(14\) raise doubts. As it has been observed in the draft ISNM Guidance Document, at present there is a lack of reliable data on the influence of using nitrification inhibitors on soils in the long-term, but these measures, according to UNECE categories, were classified as \(1\) for Field Measure 10, and \(1-2\) for Field Measure 14 \(classification was changed from 2\). Such measures affecting](#)



the bacterial environment and natural processes in soils require great caution and care with regard to broader implications than only the effect on emissions of different forms of nitrogen. Information on the lack of sufficient scientific data has not been given in their brief descriptions in the Technical Summary, which could be misleading.”

**Reply:** We recognize that some parties have concerns about the possible risks of nitrification inhibitors. Such concerns have also been raised in meetings of TFRN regarding potential long-term effects of using urease inhibitors. It is noted no substantive evidence substantiating such potential risks has been presented to the Task Force. Here it is important to draw a distinction between known environmental transfer of a specific nitrification inhibitor (DCD), for which specific guidance is given about avoiding its use in dairy pastures, as compared with evidence of actual adverse effects, including on soil health. The same issues apply concerning the use of available biological nitrification inhibitors used organic farming (e.g., neem oil, karanjin oil), where evidence from experimental studies would also be welcome.

29. Concerning the technical summary: a sentence has been added as noted in para 17 above. Footnote 8 also allows this to be connected with urease inhibitors.

30. Concerning the main text: this point already addressed (Field Measure 10, para 357): “There are a variety of inhibitor compounds and products that have been assessed for their effect on nitrification, but the few studies to date indicate no harmful side-effects on soil health (e.g. O’Callaghan *et al.*, 2010)” and (Field Measure 14, para 371): “There are a variety of inhibitor compounds and products that have been assessed for their effect on nitrification, but a comprehensive assessment of the impacts of inhibitors or their residues on soil functioning and on animal and human health is lacking. However, the limited studies to date indicate no negative impacts (e.g., O’Callaghan *et al.*, 2010)”.

31. **Comment:** “Considering the size of the Guidance Document (around 200 pages), publication of the illustrated version of the Executive Summary and Technical Summary would provide better and broader dissemination of the document among not only those directly interested but also beyond them.”

**Reply:** We fully agree that an illustrated version of the Executive Summary and Technical Summary would be useful to support wider dissemination.

The Task Force would welcome offers of resources to enable such wider dissemination.

32. **Comment:** “In relation to field measure 15 and the mention of polymer coatings to enable the slow release of fertilisers we think it is important that there is reference to potential wider environmental impacts eg the proliferation of micro plastics in the environment. We think there is a wider point here worth considering throughout the draft guidance regarding the need to ensure that the guidance references wider environmental impacts where this is applicable – though accepting that the primary concern of this guidance is nitrogen and references should not be expansive.”

**Reply:** We agree and have added the following text into Chapter 4 (para. 373, Field Measure 15): “The breakdown of the coating may rely on temperature, soil moisture

or microbial action, depending on product specification; residual polymer [insert: (or micro plastics)] in the soil has been tested to allow registration (e.g., Canada), but these are not fully acceptable in all countries [insert: and the potential effects from the degradation of polymer coatings to form microplastics remain to be demonstrated].

33. **Comment:** “On field measure 12 it would be useful to understand whether total reactive nitrogen is greater through ammonium nitrate than through urea plus urea inhibitors.”

**Reply:** Experience shows that this depends on context in relation to soil type, climate and application procedures etc. Therefore, it is not possible to give a general simple statement based on the current evidence. One way to examine this topic further would be to link experimental studies of total nitrogen loss (including denitrification to N<sub>2</sub>) with measurement of nitrogen use efficiency, including fertilizer recovery efficiency in harvested products.

34. Other textual corrections have been made, including providing necessary clarifications, adding of missing references and amending typographical errors.
35. Subsequent to these changes, the draft Guidance Document was edited by the Geneva Secretariat to match UNECE formatting requirements.

## **Part B: Comments from WSGR members related to the e-pre meeting of 3 November 2020.**

36. In the light of the COVID-19 pandemic, it was agreed to host an e-pre meeting for informal information sharing, ahead of WGSR-58. The e-pre meeting provided an opportunity for countries to offer further comments as an aid to timely adoption of the finalized document during WGSR-58. The pre-meeting was moderated by the UK co-chair of the Task Force on Reactive Nitrogen. The meeting was held with simultaneous interpretation into Russian and French, kindly provided on a voluntary basis by colleagues from the TFRN community. The meeting was attended by 64 delegates from 22 Member States (Albania, Austria, Belgium, Canada, Denmark, Estonia, Finland, France, Georgia, Germany, Italy, Malta, Moldova, Netherlands, Portugal, Slovakia, Spain, Sweden, Switzerland, Ukraine, United Kingdom, USA) plus the European Union and the UNECE Secretariat.
37. Following publication of the Draft Guidance Document (ECE/EB.AIR/2020/6-ECE/EB.AIR/WG.5/2020/5) on the UNECE website for WGSR-58:
- a. The UK co-chair of the TFRN was invited to present to the Civil Dialogue Group (CDG) on Environment and Climate of the European Union, giving an opportunity to draw attention to the published Draft Guidance Document. Members of the CDG were invited to offer comments to the TFRN Office by 16 October. No comments were received by this date, which is taken to indicate satisfaction with the document by this broad group of stakeholders. Most of the stakeholders were already involved during the earlier preparation phase (2016 to 2020), so this reaction is not a surprise, indicating that the stakeholder network is well-informed and happy with the document.
  - b. Additional comments were received by Switzerland on the Draft Guidance Document, which were then discussed during the e-pre meeting, as incorporated into the following sections together with comments from other parties.
38. The following items were raised during the e-pre meeting. The revisions have been incorporated into a “track changes” Inf. Doc. for WGSR-58, which also includes formatting and other corrections.
39. **Comment:** [The responses provided by TFRN to the comments in Part A \(above\) were welcomed during the e-pre meeting as being well-considered and appropriate.](#)
40. **Reply:** The Task Force co-chair expressed thanks for the statement.
41. **Comment:** [“In paragraph 7 of the document, it would be helpful for clarity to annotate the parts of the Gothenburg Protocol and Revised Gothenburg Protocol which are there noted.”](#)
42. **Reply:** We agree with this request and have annotated for clarity as follows: “This was deemed necessary to support the objectives of the Gothenburg Protocol (twenty-

second preambular para. [insert: [on consideration of the full biogeochemical nitrogen cycle](#)]; art. 4 (1) [insert: [on exchange of information and technology](#)]; art. 6 (1) (g) [insert: [on the implementation of management programmes to reduce emissions](#)]; annex IX, para. 2) [insert: [on reducing nitrogen losses from the whole nitrogen cycle](#)], and the revised Gothenburg Protocol (tenth preambular para. [insert: [on the influence of the nitrogen cycle and the potential synergies with and trade-offs between air pollution and climate change](#)]; art. 7 (3) (d) [insert: [on the calculation of nitrogen budgets, nitrogen use efficiency and nitrogen surpluses and their improvements](#)]; art. 10 (4) [insert: [on the need to revise annex IX](#)]).

43. **Comment:** [“The document identifies 76 specific measures to improve nitrogen management, increase nitrogen use efficiency and reduce polluting losses to the environment. However, five of the measures do not contribute to the reduction of any nitrogen compound. On the contrary, they may even lead to increased emissions.”](#) It is asked why include them (as further detailed below).
44. **Reply:** We are aware that stakeholders often propose well-known methods, but which are not demonstrated to have benefit. In this regard, we consider that it benefits transparency to be inclusive of such measures, while being clear where there is no agreement on any benefit. In addition, other measures may start at Category 3, but require further evidence and demonstration before being considered as appropriate for Category 2. To take account of these points an additional sentence is added to the end of paragraph 17: “This may mean that further research and development is needed. [Insert: [Some measures included in this document are assigned Category 3 for all forms of nitrogen pollution. These are included either, a\) because they are frequently discussed and an objective assessment is needed regarding their ineffectiveness, or b\) because further development is yet needed to demonstrate their potential.](#)]”
45. **Comment:** [“Manure Measure 2 identifies the natural crust as an effective measure for reducing ammonia emissions. In contrast to the existing Guidance Document on Preventing and Abating Ammonia Emissions, the document does not mention that such a crust can only form if stirring of slurry is minimized – which in practice is often not the case.”](#)
46. **Reply:** We agree that the caveat should be added to this effect as suggested. The following amendments have been made:
- a. Technical Overview, Table II.1.: Manure Measure 2: Covered storage of slurry (natural crust and impermeable base): “Where slurries have a high dry matter content, [\[insert: and stirring is minimized\]](#), these may form a natural crust during storage, which is associated with substantially reduced NH<sub>3</sub> emission, although N<sub>2</sub>O production may be enhanced.” The accompanying
  - b. Chapter IV, paragraph 237. The text is amended as follows: “Where slurries have a high dry matter content, [\[insert: and stirring is minimized\]](#), these may form a natural crust during storage”.
47. **Comment:** [“We think that it is important to mention this major shortcoming with the same wording as in the Guidance Document on Preventing and Abating Ammonia](#)

Emissions. We have to avoid that the often questionable effectiveness of this measure (due to frequent stirring) is raised as an argument to prevent construction of a solid cover (i.e. Manure Measure 1). Moreover, as a solid cover is effective in all cases and also more effective than a natural crust we consider it misleading to use the same colour code for both measures and recommend to use yellow or at least a yellow-green gradient.”

48. **Reply:** We have sympathy with this view, and at the same time we recognize that this has been already a point of debate with other stakeholders who wished to see natural crusting as Category 1 (green). In the light of this range of views, we agree that a Category 1-2 (i.e. yellow-green gradient) is appropriate. It matches well the known benefit, but with a clear caveat. The figure in Table II.1 has been corrected, as well as in Chapter IV, Table 4.26.
49. **Comment:** “What is the reason for listing the following measures, that are rated as category 3 for all N compounds?”
- a. Manure Measure 6: Slurry mixing
  - b. Manure Measure 9: Slurry aeration
50. **Reply:** These two measures are included to make it clear there is not a basis for claims of supposed benefit. See the amended text in paragraph 43, above.
51. **Comment:** “What is the reason for listing the following measures, that are rated as category 3 for all N compounds?”
- a. Nutrient Recovery Measure 1: Drying and pelletizing of manure solids
  - b. Nutrient Recovery Measure 2: Combustion, gasification or pyrolysis
  - c. Nutrient Recovery Measure 4: Concentration of nitrogen salts and solutions
52. **Reply:** These three measures are included to make it clear that there could be potential through further development, even if they have not yet made it out of Category 3. See the amended text in paragraph 43, above. In addition, the this has led to a useful discussion with the chapter lead authors leading to the following amendments:
- a. Nutrient Recovery Measure 1: Drying and pelletizing of manure solids. It is concluded that this measure can be considered as Category 2 for nitrate and overall nitrogen loss. Table II.1 and Table 4.37 have been amended accordingly.
  - b. Nutrient Recovery Measure 2: Combustion, gasification or pyrolysis. It is concluded that this measure can be considered as Category 2-3 NH<sub>3</sub>, NO<sub>x</sub> and nitrogen loss. The text in the Technical overview is revised to: “However, the method wastes manure N, which is converted into gaseous N<sub>2</sub> and NO<sub>x</sub> [Insert: (category 3). Systems under development to] minimize N<sub>2</sub> formation and recover the N<sub>r</sub> gases can be considered [Insert: as category 2] for abating overall N loss.” Table II.1 and IV.38 have been amended accordingly.
  - c. Nutrient Recovery Measure 2 at Chapter IV, paragraph 259. The text is amended as follows: “[Insert: In the absence of] systems to minimize N<sub>2</sub> formation and recover the N<sub>r</sub> gases, this measure cannot be considered

appropriate for abating overall N loss [Insert: (Category 3). Systems currently under development to recover N<sub>r</sub> gases can be considered as having high potential (Category 2).].”

- d. Nutrient Recovery Measure 4: Concentration of nitrogen salts and solutions. It is concluded that this measure can be considered as Category 2 for nitrate, ammonium and overall nitrogen loss. Table II.1 and Chapter IV, paragraph 262 have been amended accordingly. The following sentence in Table II.1 is no longer needed, and is now deleted: “As these technologies are still under investigation, they are set as UNECE category 3, pending further assessment.”

53. **Comment**, concerning the above paragraphs 42-51: “We hope you will be in a position to further explain or adjust the text in advance of the WGSR to facilitate the discussion and allow a smooth adoption of this document in December.

54. **Reply:** We very much appreciate the comments, which we have addressed in the paragraphs above. The comments have enabled us to improve the document as a basis to enable finalization of the document at WGSR-58.

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