ARTICLE 6.4 MECHANISM

A6.4-MEP012-A05

Draft Mechanism Methodology

N_2O abatement from nitric acid production

Version 01.0

Sectoral scope(s): 05

United Nations
Framework Convention on
Climate Change

COVER NOTE

1. Procedural background

1. The Supervisory Body of the Article 6.4 mechanism established by Article 6, paragraph 4, of the Paris Agreement (the Article 6.4 mechanism), at its 15th meeting,[1] approved the workplan for 2025 for the Methodological Expert Panel (MEP). The workplan includes the item “processing of new methodologies / tools, requests for revision, and requests for clarification”.

2. The present methodology is based on elements of the proposed new methodology “A6.4-PMM002: N_2O abatement from nitric acid production”, which was received on 12 May 2025 and which is based on elements of version 4.0 of the CDM methodology “ACM0019: N_2O abatement from nitric acid production”.[2]

3. A public consultation on the proposed mechanism methodology was open from 16 June to 6 July 2025, and one submission containing 11 comments was received. A summary of how these comments were addressed in the draft mechanism methodology is provided in section 4 of this cover note.

4. The MEP, at its 10th and 11th meetings, considered the draft mechanism methodology and amended it to ensure alignment with relevant standards under the Article 6.4 mechanism and to expand the range of applicable projects to include the restart and enhancement of N_2O abatement.

5. At its 12th meeting, the MEP continued the consideration of the draft mechanism methodology and also elaborated an Appendix which describes how some provisions are addressed at the methodology level (see Appendix of the mechanism methodology).

2. Purpose

6. The purpose of this mechanism methodology is to define requirements for Article 6.4 activities that involve the abatement of N_2O emissions at nitric acid production lines.

3. Key issues and proposed solutions

7. The following subsections outline the key elements of the mechanism methodology.

3.1. Applicability

8. The proposed mechanism methodology is applicable to Article 6.4 activities that abate N_2O emissions contained in the exhaust gases emitted in the productions of nitric acid. Whereas the CDM methodology ACM0019 was applicable only to the introduction of N_2O abatement in an existing nitric acid plant, the present methodology is also applicable to the restart or enhancement of N_2O abatement at a nitric acid production line (see section 4). This will enable a broader applicability of the mechanism methodology, in particular because some plants have discontinued their N_2O abatement due to the lack of incentives. Article 6.4 activities must clearly specify in which of these three categories the project falls.

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[1] See https://unfccc.int/sites/default/files/resource/A6.4-SBM015.pdf.

[2] See https://cdm.unfccc.int/UserManagement/FileStorage/RDX2Q6IWUVC8Y3H4MFLT7OJ1G05PEA.

9. This mechanism methodology is not applicable to new nitric acid production lines. Consultations conducted with industry experts indicated that new technological options to produce nitric acid that would nearly fully eliminate N_2O emissions are emerging. A proposed methodology for new nitric acid production lines would thus need to address whether the use of these new technologies is a plausible baseline scenario.

10. This mechanism methodology is restricted to contexts in which neither incentives nor penalties are in place that would drive the installation of secondary or tertiary abatements (see paragraph 18 of the mechanisms methodology). This is necessary since the mechanism methodology uses simplified approaches for the demonstration of additionality and the establishment of the baseline, for which it is assumed that secondary or tertiary N_2O abatement is not viable. This approach is further described in the Appendix to the mechanism methodology.

3.2. Demonstration of additionality

11. The analysis of the lock-in risk and investment analysis are conducted at the level of the mechanism methodology (see Appendix of the mechanism methodology). It is concluded that this type of Article 6.4 activity does not pose lock-in risks and is not economically viable under the applicability conditions of the methodology. Activity participants therefore only need to demonstrate regulatory analysis and common practice analysis for each individual Article 6.4 activity. To ensure the continued adequacy of the methodological approach for baseline setting (i.e., the assumption that no legal requirements would influence N_2O emission levels in the baseline), the regulatory analysis shall be repeated for each monitoring period.

3.3. Baseline emissions

12. Baseline emissions under this mechanism methodology are calculated as the product of:

    (a) The quantity of nitric acid production;

    (b) A baseline emission factor, expressed in kg of nitrous oxide (N_2O) emissions per tonne of nitric acid (HNO_3) production; and

    (c) An annual downward adjustment factor.

3.4. Quantity of nitric acid production

13. To avoid any potential increases in the nitric acid production level as a result of the implementation of the Article 6.4 activity, such as possible production shifts from non-Article 6.4 production lines to Article 6.4 production lines, this mechanism methodology caps the quantity of nitric acid production used for calculating baseline emissions to the maximum annual production in the last five years or, where such data is not available, to a default factor for the capacity utilization based on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.[3] This provision only affects the level of baseline emissions and does not impose any restriction how much nitric acid the plant may produce.

3.5. Baseline emission factors

14. The baseline is established based on best available technology (BAT) for primary catalysts, without using secondary or tertiary N_2O abatement (see paragraph 38 of the mechanism methodology).

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[3] See https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/3_Volume3/V3_3_Ch3_Chemical_Industry.pdf.

15. This version of the mechanism methodology includes indicative ranges for the values of BAT emission factors. The MEP is still in the process of analysing data to derive a more accurate BAT emission factors, including from plants under the CDM and Joint Implementation. The Appendix to the mechanism methodology provides further information on the approach taken.

3.6. Application of the downward adjustment

16. Since the mechanism methodology applies a BAT approach for the calculation of baseline emissions, in accordance with the provisions in the “Standard: Setting the baseline in mechanism methodologies” (A6.4-STAN-METH-004)[4], no downward adjustment applies to the calendar year of the start of the first crediting period.

17. With regard to downward adjustment in subsequent years, three different levels of annual downward adjustments are proposed: 1, 3 and 5 per cent, depending on the extent to which the Article 6.4 activity reduces N_2O emissions (see section 7.2.3 of the methodology). This approach aims to provide incentives for moving towards more advanced N_2O abatement technologies, noting that the most advanced systems can abate up to 99% of N_2O emissions.

3.7. Identification of conservative business as usual (BAU) scenario

18. The BAU scenario assuming no secondary or tertiary N_2O abatement is installed is also determined at the level of the mechanism methodology. A conservative BAU emission factor is derived based on data by the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories[5] and the baseline measurement campaigns from CDM and JI plants. The MEP is still in the process of analysing this data. Further information on this approach is included in the Appendix.

3.8. Project emissions

19. Project emissions include any remaining N_2O emissions and emissions from the operation of tertiary N_2O abatement, including electricity consumption, fossil fuel consumption, steam consumption and use of other inputs, such as urea or ammonia. The emissions from tertiary N_2O abatement are small compared to the remaining N_2O emissions. Therefore, simplified default emission factors are used to determine these emissions. The MEP is still in the process of reviewing information on these factors. Although the CDM methodology ACM0019 excluded emissions during the down-time of N_2O abatement equipment, this proposed mechanism methodology includes those emissions to provide an incentive to reduce the downtime of N_2O abatement equipment (see equation 5 of the mechanism methodology).

3.9. Leakage

20. The mechanism methodology does not require accounting for leakage emissions related to the transfer of used equipment since these are avoided through the applicability condition contained in paragraph 18(a). Leakages from production and transportation of the abatement equipment are accounted for through the use of a default value as contained in equation 13.

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[4] See https://unfccc.int/sites/default/files/resource/A6.4-STAN-METH-004.pdf.

[5] See https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/3_Volume3/19R_V3_Ch03_Chemical_Industry.pdf.

3.10. Avoidance of double-counting

21. Consistent with the requirements in he “Standard: Setting the baseline in mechanism methodologies” (A6.4-STAN-METH-004), the mechanism methodology contains provisions to avoid double counting of emission reductions.

3.11. Alignment with NDCs, LT-LEDS, and long-term goals of the Paris Agreement

22. Activity participants shall provide the designated operational entity (DOE) with a confirmation from the designated national authority (DNA) of the host Party that the DNA has undertaken an assessment of the activity’s consistency with the provisions of Decision 3/CMA.3 paragraph 40 (c) and paragraph 27 (a), as part of the host Party’s approval.

4. Consideration of public comments

23. A call for input on the submission A6.4-PMM002 was open from 16 June to 6 July 2025. One submission containing 11 inputs was received in response to the call for public inputs on this proposed new methodology.

24. The comments that are considered of technical nature are summarized below, including the proposed assessment and action by the MEP (if any):

(a) One comment suggested allowing for upgrades from secondary to tertiary abatement technology. The MEP considered the proposal and revised the applicability conditions (see section 4 of the mechanism methodology) and scope (see section 1.1 of the mechanism methodology) accordingly.

(b) One comment recommended expanding the eligibility criteria of the mechanism methodology to allow combining secondary and tertiary abatement. The MEP considered the proposal and revised the applicability conditions of the mechanism methodology accordingly (see section 4 of the mechanism methodology).

(c) One comment recommended that the mechanism methodology differentiate baseline emission factors between existing and greenfield plants. The MEP noted the comment; however, no corresponding changes were implemented since the current version of this proposed mechanism methodology excludes greenfield plants.

(d) One comment addressed the alignment of the proposed baseline default N_2O emission values with the “Standard: Setting the baseline in mechanism methodologies” (A6.4-STAN-METH-004). The MEP noted the comment and decided to select an approach based on BAT for this parameter (see section 7.2.2). Specifically, the MEP is seeking input on the determination of such values.

(e) One comment identified a potential discrepancy between the IPCC 2006 and IPCC 2019 values for N_2O emissions at nitric acid plants. The MEP noted the comment; however, the comment is no longer relevant, as the MEP proposes to set the baseline emission factor on BAT values.

(f) One comment addressed the equation for calculating the downward adjustment in subsequent years (see section 7.2.3). The MEP noted the comment and revised the corresponding formula as part of a broader overhaul of the proposed mechanism methodology submission.

(g) One comment suggested that monitored values should be allowed in addition to default values for setting the baseline emission factor. The MEP noted the comment but decided to take an approach similar to the CDM methodology ACM0019, where the baseline emission factor is set based on default values.

(h) One comment suggested to that, in the case of tertiary abatement, N_2O emissions should be measured before and after the abatement device to inform the treatment of uncertainty in baseline emissions. The comment further noted that in the case of secondary abatement such a measurement is not possible and a correction factor should therefore be applied. The MEP noted the comment. Since the MEP intends to determine the baseline N_2O emission factor based on BAT, it is expected that the stringency of the approach use will make it unnecessary to conduct such measurements and apply respective correction factors.

(i) One comment suggested that the annual decrease of the baseline emission factor starts with the start of the crediting period, rather than a fixed year. Based on further analysis of data and the second call for public inputs, the MEP will explore whether an annual change in the BAT emission factors is necessary, beyond the applied downward adjustment.

(j) One comment expressed concerns on potential double counting between Article 6.4 activities under this proposed methodology and the EU Climate Border Adjustment Mechanism (CBAM). The comment was considered but not incorporated. However, the risk of double counting is addressed in the mechanism methodology, consistent with the “Standard: Setting the baseline in mechanism methodologies” (A6.4-STAN-METH-004).

5. Impacts

25. Approval of this mechanism methodology will enable the development of Article 6.4 activities that abate N_2O emissions at existing nitric acid production lines.

6. Subsequent work and timelines

26. Noting that the draft of the proposed mechanism methodology was amended and revised in several keys aspects to align it with requirements under the Article 6.4 mechanism, the MEP agreed, on an exceptional basis, to open a second call for public inputs from stakeholders on this methodology.

27. The MEP is particularly interested to receive inputs on values to be applied as BAT in the baseline. The MEP will analyse the inputs and consider them in preparation of a revised mechanism methodology at its next meeting for consideration of the Supervisory Body.

7. Recommendations to the Supervisory Body.

28. This is not applicable (Document is published for a call for public inputs.).

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1. Introduction

1.1. Scope

1. This mechanism methodology applies to Article 6.4 activities that introduce, restart, or enhance nitrous oxide (N_2O) abatement measures in existing nitric acid production lines.

1.2. Entry into force

2. This mechanism methodology enters into force on XX Month 2026.

3. This mechanism methodology remains valid for five years, until XX Month 2031, unless an earlier date applies if the mechanism methodology is revised or withdrawn in accordance with the “Procedure: Development, revision and clarification of methodologies and methodological tools” (A6.4-PROC-METH-001).[1]

1.3. Applicability of sectoral scopes

4. Designated operational entities validating and verifying Article 6.4 activities that use this mechanism methodology shall apply sectoral scope five.

2. Definitions

2.1. General terms

5. The following general terms apply in this mechanism methodology:

   (a) “Shall” is used to indicate requirements that must be followed;

   (b) “Should" is used to indicate that, among several options, one course of action is recommended as particularly suitable; and

   (c) "May" is used to indicate what is permitted.

2.2. Methodological terms and definitions

6. The following methodological terms and definitions apply to this mechanism methodology:

   (a) **Existing nitric acid production line:** A nitric acid production line that has started operation not later than 31 December 2025 and at least one nitric acid production campaign has been completed prior to the earlier of (i) the start of operation of the Article 6.4 activity and (ii) the submission of the project design document (PDD) for validation;

   (b) **Nitric acid production plant:** A plant for producing nitric acid, consisting of one or more nitric acid production lines;

   (c) **Nitric acid production line:** A set of components that can be operated independently to produce nitric acid;

   (d) **Secondary N_2O abatement:** The installation of a catalyst inside an ammonia reactor with the sole purpose of removing N_2O from the gaseous stream; and

[1] See https://unfccc.int/sites/default/files/resource/A6.4-PROC-METH-001.pdf.

(e) **Tertiary N_2O abatement:** The installation of an abatement system in the tail gas downstream from the absorption column of a nitric acid production line to destroy the N_2O generated in an ammonia reactor. This may include, inter alia, selective catalytic reduction (SCR) of N_2O, non-selective catalytic reduction (NSCR), or thermal decomposition of N_2O.

7. Furthermore, the terms in the “Glossary: Article 6.4 mechanism terms” (A6.4-GLOS-GOV-001)[2] and the definitions and terms in the methodological tools referred to in section 3 shall apply.

3. Normative references

8. This mechanism methodology is based on elements from version 4.0 of the Clean Development Mechanism (CDM) methodology “ACM0019: N_2O abatement from nitric acid production”. [3]

9. The following normative documents are indispensable for the application of this mechanism methodology. When applying this methodology, a valid version of the documents listed below shall be used:

(a) “Methodological tool: Common practice analysis” (A6.4-AMT-001);[4]

(b) “Methodological tool: Mass flow of a greenhouse gas in a gaseous stream” (A6.4-AMT-005);[5] and

(c) “Methodological tool: Emissions from electricity generation and/or consumption” (A6.4-AMT-007).[6]

10. The following documents provide supporting information that may assist in the application of this mechanism methodology:

(a) Intergovernmental Panel on Climate Change (IPCC) 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories;[7] and

(b) IPCC (2019). 2019 Refinement to the 2006 IPCC guidelines for national greenhouse gas inventories.[8]

[2] See https://unfccc.int/sites/default/files/resource/A6.4-Glossary.pdf.

[3] See https://cdm.unfccc.int/UserManagement/FileStorage/RDX2Q6IWUVC8Y3H4MFLT7OJ1G05PEA.

[4] See https://unfccc.int/process-and-meetings/the-paris-agreement/article-6/article-64-pacm/mechanism-process/methodologies/a64-amt-001.

[5] See https://unfccc.int/process-and-meetings/the-paris-agreement/article-6/article-64-pacm/mechanism-process/methodologies/a64-amt-005.

[6] See https://unfccc.int/process-and-meetings/the-paris-agreement/article-6/article-64-pacm/mechanism-process/methodologies/a64-amt-007-emissions-from-electricity-generation-and-consumption.

[7] See https://www.ipcc-nggip.iges.or.jp/public/2006gl/.

[8] See https://www.ipcc.ch/report/2019-refinement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/.

4. Applicability

11. This mechanism methodology is applicable to Article 6.4 activities that involve the introduction, restart, or enhancement of secondary and/or tertiary abatement of N_2O at an existing nitric acid production line.

12. The mechanism methodology is only applicable where the respective conditions for the respective type of activity are satisfied (see Table 1):

(a) **Type 1: Introduction of N_2O abatement.** Prior to the implementation of the Article 6.4 activity, no secondary or tertiary N_2O abatement has been installed at the nitric acid production line at any point in time since the start of operation of the nitric acid production line. The Article 6.4 activity introduces secondary N_2O abatement and/or any type of tertiary N_2O abatement;

(b) **Type 2: Restart of N_2O abatement.** Prior to the implementation of the Article 6.4 activity, secondary and/or tertiary N_2O abatement has been installed at the nitric acid production line but it can be demonstrated that these abatement system(s) have not been in operation at any point in time since 1 January 2021. The Article 6.4 activity restarts secondary N_2O abatement and/or any type of tertiary N_2O abatement. The discontinuation of the abatement before 1 January 2021 shall be demonstrated by one of the following means:

(i) Documented evidence that a secondary or tertiary catalyst has been removed prior to 1 January 2021 and that no secondary or tertiary catalyst has been installed since then;[9] or

(ii) Automatically generated plant recordings are available that demonstrate that a tertiary N_2O abatement system has been by-passed continuously since 1 January 2021.[10]

(c) **Type 3: Enhancement of N_2O abatement.** Prior to the implementation of the Article 6.4 activity, one of the following two forms of N_2O abatement (but not a combination thereof) has been in operation at any point in time since 1 January 2021 at the nitric acid production line: secondary N_2O abatement or NSCR abatement system. Under the Article 6.4 activity, the existing abatement system is either complemented with an additional N_2O abatement system or replaced by a new form of N_2O abatement system that reduces N_2O emissions below the level of the existing abatement system.[11] This may, for example, include:

(i) Introduction of secondary N_2O abatement system to complement an existing NSCR abatement system;

(ii) Replacing an existing secondary N_2O abatement system by a new tertiary catalytic N_2O abatement system.

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9 Non-replacement of an existing catalyst is not considered as a discontinuation of abatement since installed catalysts may still abate some N_2O emissions.

10 For other types of verifiable proofs of discontinuation of abatement, activity participants are invited to propose a revision to this mechanism methodology.

11 The replacement of an existing N_2O abatement system by a new N_2O abatement system of the same form but with a higher performance is not eligible under this mechanism methodology. For example, the replacement of an existing secondary N_2O abatement by a new secondary N_2O abatement with higher performance is not eligible. For such type of activities, activity participants may submit a proposed revision to this methodology or propose a new mechanism methodology.

Table 1. Summary of types of Article 6.4 activities that are eligible under the mechanism methodology

	Historical situation	**Project scenario conditions**
Type 1: Introduction of N_2O abatement	No secondary or tertiary N_2O abatement has been installed at any point in time since the start of operation of the nitric acid production line	Introduction of secondary and/or any type of tertiary N_2O abatement
Type 2: Restart of N_2O abatement	Secondary and/or tertiary N_2O abatement has been installed at the nitric acid production line but has not been in operation since 1 January 2021	Introduction of secondary and/or any type of tertiary N_2O abatement
Type 3: Enhancement of N_2O abatement	One of the following two forms of N_2O abatement (but not a combination thereof) has been in operation at any point in time since 1 January 2021: secondary N_2O abatement or NSCR abatement	Introduction of a new form of N_2O abatement with lower N_2O emissions than the one used in the historical situation

13. Activity participants shall describe in the project design document (PDD) the following elements and provide appropriate evidence:

    (a) The historical conditions at the nitric acid production line prior to the implementation of the Article 6.4 activity, including:

        (i) Whether any N_2O abatement systems were installed;

        (ii) Where applicable, what type of system(s) were installed;

        (iii) Where applicable, when the system(s) were installed, discontinued, or decommissioned; and

        (iv) Where available, what level of N_2O emissions were achieved with the system(s);

    (b) What type of new N_2O abatement system is installed under the Article 6.4 activity and whether this complements or replaces any existing N_2O abatement system; and

    (c) To which of the three cases above (introduction, restart or enhancement of N_2O abatement) the Article 6.4 activity belongs pursuant to paragraph 12).

14. A6.4ERs issued based on this mechanism methodology represent emission reductions.

15. This version of the mechanism methodology is applicable to Article 6.4 activities implemented at the project level. The mechanism methodology may be amended in the future to also cover activities implemented at other scales (e.g., programmes of activities, policies, sectoral approaches, etc.).

16. [Under this mechanism methodology, a project design document (PDD) and registered Article 6.4 activity shall only include a single nitric acid production line.[12]]

    Note: The MEP notes that the complexity and transaction costs for verification may be higher if more than one production line is included in a monitoring report, in particular as

[12] Once this mechanism methodology becomes applicable to programmes of activities (PoA), a PoA may include several nitric acid production lines as separate component project activities (CPAs).

different plants may have different starts and ends of nitric acid production campaigns, and would like to seek public input on this matter.

17. This mechanism methodology is only applicable on a standalone basis and shall not be applied in combination with other methodologies, unless one or more of the other methodologies specifies how the interaction with this mechanism methodology is taken into account.

18. Furthermore, the mechanism methodology is only applicable if the following conditions apply:

(a) The N_2O abatement equipment installed under the Article 6.4 activity has previously not been used in any other plant but is newly produced;[13]

(b) No policies that may affect N_2O emissions from nitric acid production[14] are active or scheduled to take effect within the crediting period, unless they refer to or formally integrate the mechanism as an instrument for implementation;[15]

(c) There are no specific national or sub-national targets for the sector or the type of activity that are supported by policy frameworks for implementation;[16]

[13] This condition is introduced to avoid any leakage from baseline equipment transfer, consistent with paragraph 14(a) of version 01.0 of the "Standard: Addressing leakage in mechanism methodologies" (A6.4-STAN-METH-005).

[14] Such policies may, for example, include taxes or fees on N_2O emissions or the inclusion of N_2O emissions in an emissions trading system.

[15] This condition is introduced for two reasons: First, the mechanism methodology demonstrates investment analysis at the level of methodology (see the Appendix). In this demonstration, it is assumed that Article 6.4 activities do not generate revenues or cost savings from the installation of secondary or tertiary N_2O abatement. However, policies could potentially generate such revenues or cost savings (see footnote 14). Second, the mechanism methodology determines the business-as-usual (BAU) scenario and quantifies the BAU emission factor at the level of the methodology (see the Appendix). According to paragraph 76 in version 01.0 of the "Standard: Setting the baseline in mechanism methodologies" (A6.4-STAN-METH-004), policies shall be incorporated in the BAU scenario and in quantifying BAU emissions. In determining the BAU scenario and quantifying the BAU emission factor at the mechanism methodology level in the Appendix, this mechanism methodology does not incorporate any such policies. Further note that the establishment of a baseline emission factor by the host Party in accordance with paragraph 38 below is not considered to be a policy that affects N_2O emissions.

[16] This condition is introduced because the mechanism methodology determines the business-as-usual (BAU) scenario and quantifies the BAU emission factor at the level of the methodology (see the Appendix). According to paragraph 76 in version 01.0 of the "Standard: Setting the baseline in mechanism methodologies" (A6.4-STAN-METH-004), any specific national or sub-national targets for the sector or the type of activity, as long as these are supported by policy frameworks for implementation, but not general goals that are not specific to the sector or type of activity, shall be incorporated in the BAU scenario and in quantifying BAU emissions. In determining the BAU scenario and quantifying the BAU emission factor at the mechanism methodology level in the Appendix, this mechanism methodology does not consider specific national or sub-national targets. Further note that specific national or sub-national targets are (i) only relevant if the policy frameworks in place are sufficient to enable the achievement of the targets and (ii) not relevant if they refer to or formally integrate the mechanism as an instrument for implementation. Further note that the establishment of a baseline emission factor by the host country in accordance with paragraph 38 below is not considered to be a target in the context of this applicability condition.

(d) The activity participants do not receive any subsidies or funding other than revenues from A6.4ERs for abating N_2O emissions;[17] and

(e) To ensure that the technology installed under the Article 6.4 activity is environmentally sound, the Article 6.4 activity shall have been designed in a manner that ensures that implementation of the Article 6.4 activity does not lead to an increase in emissions of nitrogen oxides (NO_x) and that the Article 6.4 activity is designed to contain emissions of NO_x, ammonia, carbon monoxide and hydrocarbons in accordance with any legal requirements.

19. The above provisions shall be demonstrated as follows:

(a) The provisions in paragraphs 11, 12, 13, and 14 shall be demonstrated in the Project Design Document (PDD) and be assessed at the initial validation as well as in the case of a change in abatement design over the activity lifetime (e.g. addition of secondary abatement to a tertiary abatement or vice-versa);

(b) The provisions in paragraphs 15, 16, 17 and 18 shall be demonstrated in each monitoring report and be assessed at each verification.

20. The applicability conditions included in the methodological tools referred to in paragraph 9 also apply.

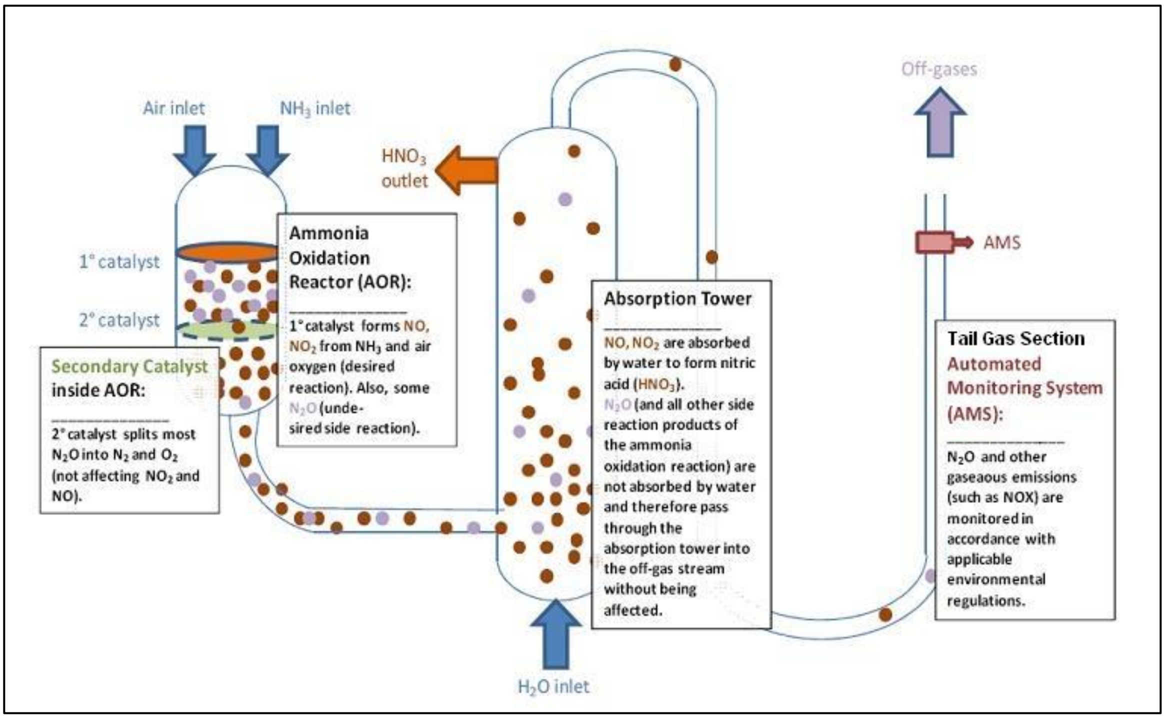
5. Project boundary

21. The spatial extent of the project boundary shall encompass the facility and equipment for the nitric acid production process from the inlet of the ammonia reactor to the outlet of the tail gas section.

22. If the A6.4 activity operates only secondary and no tertiary N_2O abatement, then the only gas that shall be included as project emissions is the N_2O that is not destroyed and still present in the tail gas stream of the plant. The situation using a secondary N_2O abatement technology is illustrated in figure 1.

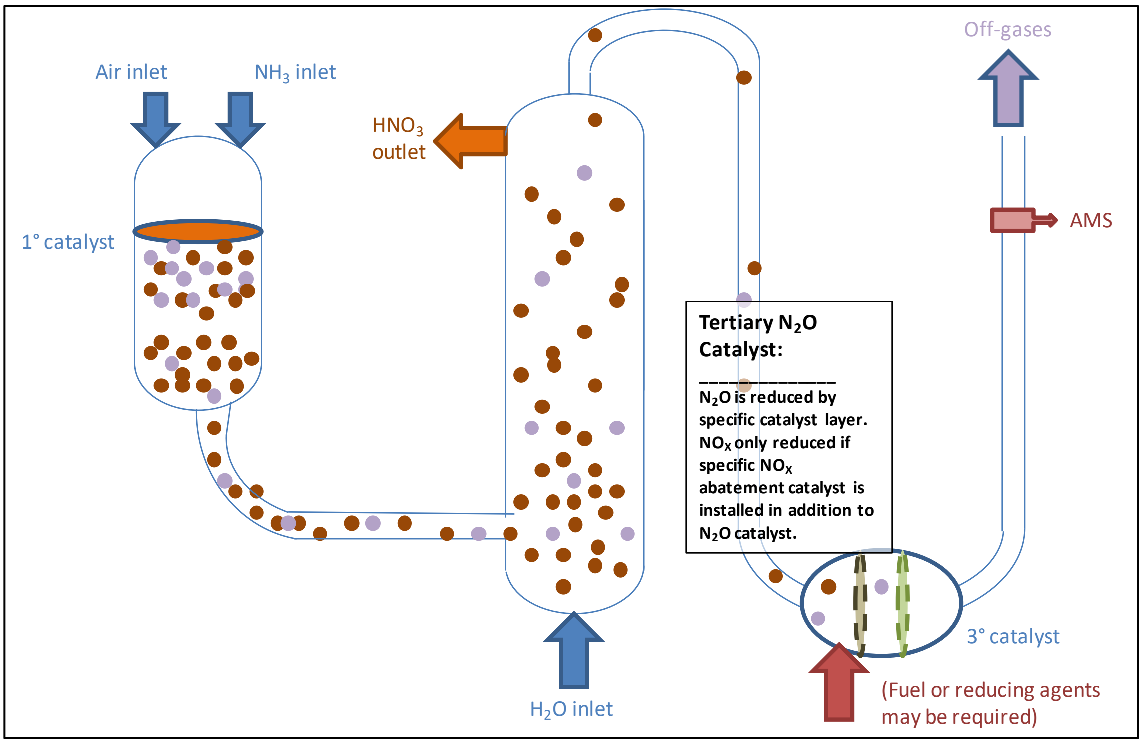
[17] This condition is introduced because the mechanism methodology demonstrates investment analysis at the level of methodology (see the Appendix). In this demonstration it is assumed that Article 6.4 activities do not generate revenues or cost savings from the installation of secondary or tertiary N_2O abatement. However, subsidies or funding other than revenues from A6.4ERs for abating N_2O emissions could make the installation of secondary or tertiary N_2O abatement economically viable.

Figure 1. Project boundary for an Article 6.4 activity with secondary N_2O abatement only



23. If the Article 6.4 activity operates only tertiary and no secondary N_2O abatement, then any remaining N_2O emissions from the plant and the greenhouse gas (GHG) emissions arising from the operation of the tertiary N_2O abatement system shall be included as project emissions in the project boundary. The situation using a tertiary N_2O abatement technology is illustrated in figure 2.

Figure 2. Project boundary for an Article 6.4 activity with tertiary N_2O abatement only



24. If the A6.4 activity operates a combination of secondary and tertiary N_2O abatement, the gases to be included as project emissions in the project boundary shall be the N_2O that is not destroyed and is still present in the tail gas stream of the plant and the GHG emissions arising from the operation of the tertiary N_2O abatement system. The situation using a combined operation of secondary and tertiary N_2O abatement technology is illustrated below in figure 3.

Figure 3. Project boundary for an Article 6.4 activity with a combination of secondary and tertiary N_2O abatement

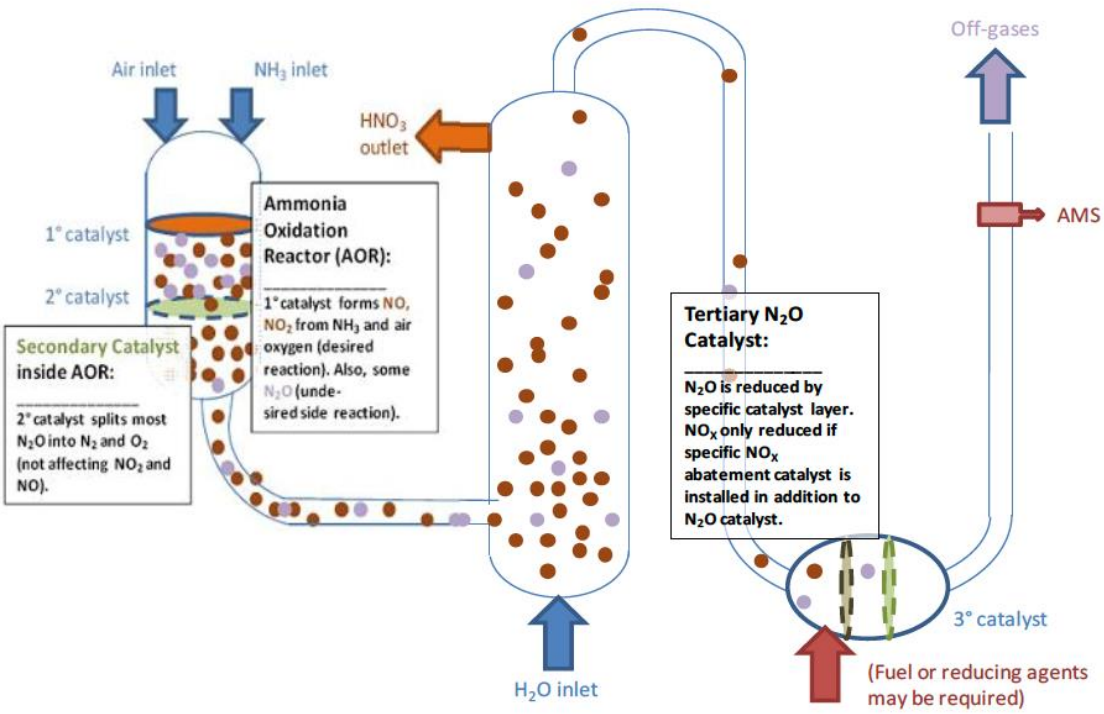


Table 2. Emissions sources and sinks included in or excluded from the project boundary

	Source	Greenhouse gases			Justification / Explanation
BASELINE	NH_3 oxidation at the primary catalyst gauze	CO_2	Not included		Not occurring
		CH_4	Not included		
		N_2O	Included	Controlled	Included, main emission source

	Source	Greenhouse gases			Justification / Explanation
PROJECT	NH_3 oxidation at the primary catalyst gauze	CO_2	Not included		Not occurring
		CH_4	Not included		
		N_2O	Included	Controlled	Included, main emission source
	Operation of a tertiary N_2O abatement system	CO_2	Included	Controlled Related to	Included. The operation of a tertiary N_2O abatement may entail emissions from consumption of electricity, fossil fuels, steam (e.g. for reheating the tail gas) and input materials (e.g. urea or ammonia as reducing agents).
		CH_4	Included	Controlled Related to	
		N_2O	Included	Controlled Related to	
		CH_4	Not included		
		N_2O	Not included		
LEAKAGE	Production and transport of equipment and catalysts	CO_2	Included	Related to	Included, minor emission source
		CH_4	Not included		
		N_2O	Not included		

25. Activity participants shall include in the PDD the location of the Article 6.4 activity in the form of Keyhole Markup Language (KML) files or similar formats as one or more polygon(s), by specifying the coordinates of the geographic boundary using a known coordinate system or any other established method.

6. Demonstration of additionality

26. To demonstrate additionality, activity participants shall apply:

(a) A regulatory analysis (section 6.1); and

(b) A common practice analysis (section 6.2).

27. The proposed Article 6.4 activity shall only be considered additional if the two analyses are concluded positively. The investment analysis and analysis of lock-in risk are conducted at the level of methodology (see Appendix).

6.1. Regulatory analysis

28. Activity participants shall review relevant legal requirements applicable to the host country and to the nitric acid plant and demonstrate and justify, for each relevant legal requirement, that either:

(a) That the law or regulation refers to or formally integrates the mechanism as an instrument for implementation;[18] or

(b) That the emission reductions resulting from the Article 6.4 activity would not occur as a result of the legal requirement, by confirming that all of the following conditions are true:

(i) The legal requirement does not explicitly require nitric acid production lines or plants to install a secondary and/or tertiary N_2O abatement system;

(ii) The legal requirement does not include direct or indirect requirements regarding any flue gases from nitric acid production lines or plants which can only be achieved by installing secondary and/or tertiary N_2O abatement systems, such as:

a. Absolute or relative GHG or N_2O emission performance standards for nitric acid plants;

b. Legal requirements for the N_2O concentration in the flue gases;

c. Absolute or relative N_2O or GHG performance standards to produce nitric acid or downstream products obtained from nitric acid, (e.g., fertilizers); or

d. Legal requirements concerning gases other than N_2O, such as requirements for NOx emissions which may require the installation of an non-selective catalytic reduction (NSCR) system; and

(iii) The Article 6.4 activity does not participate a support scheme or is subject to a penalty scheme that:

a. Is applicable to N_2O emissions from nitric acid production and their abatement;

b. Is designed to achieve a quantitative target or outcome; and

c. Would likely result in the same amount of emission reductions if the activity was not implemented as an Article 6.4 activity.

29. If one or more of the legal requirements identified in paragraph 28 fail the requirements of that paragraph, then A6.4ERs cannot be claimed, except for any emission reductions in excess of those emission reductions that would be achieved by an NSCR abatement installed to comply with relevant regulations (e.g., regarding the abatement of NOx emissions).

30. Activity participants shall assess the requirements of paragraphs 28 and 29 for each monitoring period. Crediting shall cease on the date when a new relevant legal requirement enters into force.

6.2. Common practice analysis

31. Activity participants shall use a valid version of the "Methodological tool: Common practice analysis" (A6.4-AMT-001) to conduct the common practice analysis. In applying the tool, activity participants shall implement all of the following specifications:

[18] For example, if the regulations explicitly mention that utilizing the Article 6.4ERs and its generated revenues are to be used as incentives to achieve the emission reductions in a specific sector.

(a) **Approach for common practice analysis:** Approach A, (which is based on the identification of existing "comparable activities" and differentiation between "similar" and "different" activities) shall be applied;

(b) **Indicator of common practice:** The nameplate capacity of nitric acid production lines, expressed in metric tonnes of nitric acid per year shall be used;

(c) **Stock-based or time-bound approach:** A stock-based approach shall be used, (i.e., considering all nitric acid production lines that are in operation at the earlier of (i) the start of operation of the Article 6.4 activity or (ii) the submission of the PDD for validation);

(d) **Applicable geographical area:** The host country shall be used.[19] Where the applicable geographical must be widened in accordance with Step 4 of the tool, the widening shall be conducted as follows:

(i) For Article 6.4 activities implemented in a least developed country (LDC) or small island developing state (SIDS): the applicable geographical area shall consist of all LDCs and SIDS;

(ii) For Article 6.4 activities implemented in countries other than LDCs or SIDS: the applicable geographical area shall correspond to the relevant [continent][regional group under the UNFCCC];

(iii) Where the widening based on sub-paragraphs (i) and (ii) above is not sufficient in n accordance with Step 4 of the tool, the applicable geographical area shall be global (i.e., including all countries).

(e) **Consideration of scale of output or capacity of the technology, measure, or practice:** All scales of nitric acid plants shall be considered.

(f) **Common practice threshold:** The common practice factor thresholds to be applied under this mechanism methodology shall be:

(i) 16 per cent of nitric acid production capacity for Article 6.4 activities located in countries other than LDCs or SIDS; and

(ii) 20 per cent of nitric acid production capacity for Article 6.4 activities located in LDCs or SIDS; and

(g) **Comparable, similar and different activities:**

(i) Comparable activities shall be all nitric acid production lines;

(ii) Similar activities shall be nitric acid production lines where secondary and/or tertiary N_2O abatement other than NSCR is in operation; and

(iii) Different activities shall be nitric acid production lines whether neither secondary nor tertiary N_2O abatement other than NSCR is in operation.

[19] While the baseline scenario, the BAU scenario and the analysis of lock-in risk are conducted at the global level, the common practice is conducted at the level of the host country, as the actual deployment of secondary or tertiary N_2O abatement could be influenced by country-specific factors.

7. Baseline emissions

32. This mechanism methodology applies the following steps of the provisions in the "Standard: Setting the baseline in mechanism methodologies" (A6.4-STAN-METH-004)[20] at the level of the mechanism methodology:

(a) The application of the best available technology (BAT) approach to derive a BAT emission factor;

(b) The determination of a conservative business as usual baseline; and

(c) The comparison of the downward adjusted baseline and the conservative BAU baseline.

33. The application of these elements is specified in this methodology.

7.1. Selection of the baseline approaches from paragraph 36 of the rules, modalities and procedures

34. The following approach from the Rules, Modalities and Procedures (RMPs) as per decision 3/CMA.3 is used to determine the baseline in this mechanism methodology:[21]

☒ Best available technologies that represent an economically feasible and environmentally sound course of action, where appropriate.

☐ An ambitious benchmark approach where the baseline is set at least at the average emission level of the best performing comparable activities providing similar outputs and services in a defined scope in similar social, economic, environmental and technological circumstances.

☐ An approach based on existing actual or historical emissions, adjusted downwards to ensure alignment with paragraph 33 of the RMP.

7.2. Calculation of the downward adjusted baseline emissions

35. The downward adjusted baseline emissions shall be calculated as follows:

$$BE_{adj,y} = MIN\left[BE_{adj,BAT,y}; BE_{legal,y}\right] \quad \text{Equation (1)}$$

and

$$BE_{adj,BAT,y} = MIN\left(P_{NA,y}, P_{NA,cap}\right) \times EF_{BL,y} \times GWP_{N2O} \times 10^{-3} \times [1 - INDA \times (y - y1)] \quad \text{Equation (2)}$$

Where:

$BE_{adj,y}$	=	Downward adjusted baseline emissions in year *y* (t CO_2eq)

[20] See https://unfccc.int/sites/default/files/resource/A6.4-STAN-METH-004.pdf.

[21] The approach is selected considering that the power plant construction is highly site-specific, depending on local natural resources and the emission intensity of each power generation technology is highly activity-specific, depending on the energy resources and technology employed.

$BE_{adj,BATy}$	=	Downward adjusted baseline emissions determined based on best available technology in year *y* (t CO_2eq)
$BE_{legal,y}$	=	Baseline emissions that occur due to any legal requirements in year *y* (t CO_2eq), where applicable
$P_{NA,y}$	=	Amount of nitric acid produced in the Article 6.4 nitric acid production line in year *y* (t HNO_3)
$P_{NA,cap}$	=	Cap on the nitric acid production level used for determining baseline emissions (t HNO_3)
$EF_{BL,y}$	=	BAT baseline N_2O emission factor in year *y* (kg N_2O / t HNO_3)
GWP_{N2O}	=	Global warming potential of N_2O (t CO_2eq / t N_2O)
10^{-3}	=	A unit conversion factor (10^{-3} t CO_2eq / kg CO_2eq)
$INDA$	=	Annual increase in the downward adjustment for calendar years following the calendar year of the start date of the first crediting period (dimensionless)
y	=	Calendar years of the crediting period
$y1$	=	Calendar year of the start date of the first crediting period

36. The following sections describe how the relevant parameters shall be determined.

7.2.1. Determination of the cap on the nitric acid production level used for determining baseline emissions ($P_{NA,cap}$)

37. The cap on the nitric acid production level used for determining baseline emissions ($P_{NA,cap}$) is introduced to avoid the possibility that A6.4ERs are claimed from any increases in nitric acid production levels as a result of the incentives from A6.4ERs. $P_{NA,cap}$ shall be determined as follows:

(a) Where the nitric acid production line has been in operation for at least five years prior to the start date of the Article 6.4 activity, the maximum annual production across these five years shall be used; or

(b) Where the nitric acid production line has not been in operation for at least five years prior to the start date of the Article 6.4 activity, $P_{NA,cap}$ shall be determined as follows:

$$P_{NA,cap} = P_{NA,NPC} \times CF_{default} \quad \text{Equation (3)}$$

Where:

$P_{NA,cap}$	=	Cap on the nitric acid production level used for determining baseline emissions (t HNO_3)
$P_{NA,NPC}$	=	Nameplate capacity of the nitric acid production line at the time of the start date of the Article 6.4 activity (t HNO_3/year)
$CF_{default}$	=	Default value for the capacity utilization factor (dimensionless)

7.2.2. Determination of the BAT baseline N_2O emission factor ($EF_{BL,y}$)

38. To determine the baseline N_2O emission factor ($EF_{BL,y}$), activity participants shall apply the lowest of the following value(s):

(a) The applicable value in Table 3 below;[22] and

(b) Where applicable, any value for the baseline emission factor specified by the host Party.

[22] The Appendix describes how these values have been derived.

Table 3. BAT baseline emission factors (kg N_2O / t HNO_3)

	Type 1 or 2: Introduction or restart of N_2O abatement	**Type 3: Enhancement of N_2O abatement**	
		Existing secondary abatement	**Existing NSCR abatement**
Low pressure	[3 – 4]	[0.3 – 0.4]	[0.6 – 0.8]
Medium pressure	[3 – 4.5]	[0.3 – 0.45]	[0.6 – 0.9]
High pressure	[3 – 6]	[0.3 – 0.6]	[0.6 – 1.2]
Dual low/medium pressure	[3 – 4]	[0.3 – 0.4]	[0.6 – 0.8]
Dual middle/high pressure	[3 – 4.5]	[0.3 – 0.45]	[0.6 – 0.9]

Note: The MEP is conducting further analysis on appropriate BAT values and would like to seek feedback on the indicative ranges under consideration in the above table. The MEP intends to select one value for each cell in the table above. The MEP is also considering whether to differentiate BAT values by plant pressure or whether possibly a single value may be used. The values for secondary and NSCR abatement are based on the assumption of an abatement level of 90% and 80% on average throughout a nitric acid production campaign, respectively. The MEP encourages stakeholders to provide data that supports BAT emission factors without secondary or tertiary N_2O abatement. Given the sensitivity of data that may not be publicly available, stakeholders may also submit confidential data to the UNFCCC secretariat (a6.4mechanism-meth@unfccc.int). The secretariat will ensure the confidentiality of submission by not disclosing any confidential documents received and marked as such.

7.2.3. Determination of annual increase in the downward adjustment (*INDA*)

39. An initial downward adjustment is not applicable under this mechanism methodology because the mechanism methodology uses the BAT approach to determine baseline emissions.

40. The choice of the annual increase in downward adjustment in subsequent years (INDA) is informed by the principles and considerations referred to in paragraph 70 in version 1.0 of the “Standard: Setting the baseline in mechanism methodologies” (A6.4-STAN-METH-004). The chosen approach aims to set incentives for activity participants to adopt N_2O abatement practices that lead to lower remaining emissions. Accordingly, a relatively higher downward adjustment is applied where the remaining N_2O emissions are higher. It is also noted that achieving a high N_2O abatement level is generally economically viable with support of A6.4ERs. Based on these considerations, the parameter INDA shall be determined as follows:

    (a) Where the project emissions of N_2O in the period covered by a monitoring report divided by the amount of nitric acid produced in that period are lower than [0.20] kg N_2O / t HNO_3, then INDA = 0.01 shall apply;[23]

[23] The value of 0.2 kg N_2O / t HNO_3 was derived based on best performing plants that abate N_2O emissions through secondary and/or tertiary N_2O abatement. This data was derived from information on CDM and JI plants.

(b) Where the project emissions of N_2O in the period covered by a monitoring report divided by the amount of nitric acid produced in that period are higher than [0.60][1.00] kg N_2O / t HNO_3, then INDA = 0.05 shall apply;[24] and

(c) Otherwise, INDA = 0.03 shall apply.

Note: The MEP is seeking feedback on this approach and the proposed thresholds.

41. Notwithstanding the provisions in paragraph 40 above, where the DNA of the host country has specified a more ambitious value for INDA to be used under this mechanism methodology, this value shall be used.

42. The annual increase in the downward adjustment shall be applied starting on 1 January of a calendar year. The first increase shall be applied in the calendar year following the calendar year of the start date of the first crediting period. A pro-rata approach may be used to apply this minimum value to periods other than a full calendar year.[25] Further note that the value for INDA shall be determined for each monitoring period, and may thus differ from one monitoring period to another.[26]

8. Project emissions

43. Project emissions include emissions of N_2O in the tail gas of the nitric acid production line ($PE_{N2O,y}$) and, where applicable, emissions from the operation of a tertiary N_2O abatement system. They shall be calculated as follows:

$$PE_y = PE_{N2O,y} + PE_{tertiary,y} \qquad \text{Equation (4)}$$

Where:

PE_y = Project emissions in year *y* (t CO_2eq)

[24] The value of 0.6 kg N_2O / t HNO_3 was derived based on approximately the median performance of plants that abate N_2O emissions through tertiary N_2O abatement. The value of 1.0 kg N_2O / t HNO_3 was derived based on approximately the median performance of plants that abate N_2O emissions through secondary or tertiary N_2O abatement. This data was derived from information on CDM and JI plants.

[25] The pro-rata approach is illustrated through the following numerical example: The first crediting period of an Article 6.4 activity starts on 1 October 2025. The unadjusted baseline emissions correspond to 500 t CO_2eq in all years of the crediting period. Consistent with this methodology, no initial downward adjustment is applied. The downward adjustment for subsequent calendar years is calculated based on an increase of 1 percent per year (i.e., the parameter INDA in equation 2 equals to 0.01). In this example, no downward adjustment is applied for the period 1 October 2025 to 31 December 2025 (i.e., in equation 2 the parameter *y* is equal to y_1 and the term [1 – INDA × (y – y_1)] is equal to 1). For the calendar year 2026 (i.e., the period from 1 January 2026 to 31 December 2026), a downward adjustment of 1.26 t CO_2eq shall be applied, calculated as the sum of (i) 273 days divided by 365 days multiplied by 0 t CO_2eq and (i) 92 days divided by 365 days multiplied by 5 t CO_2eq. Starting in 2027, the annual downward adjustment is increased by 5 t CO_2eq on 1 January of each year, resulting in a value of 5.26 t CO_2eq for 2027, 10.26 t CO_2eq for 2028, and so forth.

[26] This is illustrated through the following example: An Article 6.4 activity starts operation on 1 January 2027. In a monitoring report covering the period from 1 July 2030 to 31 December 2030 (i.e., in the fourth calendar year of the crediting period), the nitric acid plant has an average performance of 0.4 kg N_2O / t HNO_3. Therefore, *INDA* corresponds to 0.03. The total downward adjustment (i.e., the term *INDA* × (y – y_1) corresponds to 0.12 for that monitoring period (0.03 × 4). In the subsequent monitoring period from 1 January 2031 to 30 June 2031, the nitric acid plant has an average performance of 0.1 kg N_2O / t HNO_3. Therefore, *INDA* corresponds to 0.01. The total downward adjustment (i.e., the term *INDA* × (y – y_1) corresponds to 0.05 for that monitoring period (0.01 × 5).

$PE_{N2O,y}$	=	Project emissions of N_2O from the tail gas of the nitric acid production line in year *y* (t CO_2eq)
$PE_{tertiary,y}$	=	Project emissions from the operation of the tertiary N_2O abatement system in year *y* (t CO_2eq)
y	=	Calendar years of the crediting period

8.1. Project emissions of N_2O from the tail gas of the nitric acid production line

44. The project emissions of N_2O from the tail gas of the nitric acid production line ($PE_{N2O,y}$) shall be calculated based on the mass flow of N_2O in the gaseous stream of the tail gas in each hour *h* that the nitric acid production line was in operation ($F_{N2O,tailgas,h}$) and the global warming potential of N_2O (GWP_{N2O}), as follows:

$$PE_{N2O,y} = \sum_{h} F_{N2O,tailgas,h} \times GWP_{N20} \times 10^{-3}$$ Equation (5)

Where:

$PE_{N2O,y}$	=	Project emissions of N_2O from the tail gas of the nitric acid production line in year *y* (t CO_2eq)
$F_{N2O,tailgas,h}$	=	Mass flow of N_2O in the gaseous stream of the tail gas in hour *h* (kg N_2O)
GWP_{N20}	=	Global warming potential of N_2O (t CO_2eq / t N_2O)
10^{-3}	=	A unit conversion factor (10^{-3} t CO_2eq / kg CO_2eq)
h	=	Hours in calendar year *y* that the nitric acid production line was in operation
y	=	Calendar years of the crediting period

45. The mass flow of N_2O in the gaseous stream of the tail gas for each hour *h* during which the nitric acid production line was in operation ($F_{N2O,tailgas,h}$) shall be determined using a valid version of the “Methodological tool: Mass flow of a greenhouse gas in a gaseous stream” (A6.4-AMT-005). In applying the tool, the following provisions apply:

    (a) Throughout the crediting periods of the Article 6.4 activity, the N_2O concentration and volume or mass flow of the tail gas shall be monitored continuously. The monitoring system shall be installed and maintained throughout the crediting periods based on the European Norm 14181 “Stationary source emissions - Quality assurance of automated measuring systems” (2015) or any update of that standard, or any equivalent national or international standard;

    (b) An automatic monitoring system (AMS) shall be used for the measurements. The AMS shall provide hourly average values for the N_2O concentration and the volume or mass flow of the tail gas, based on intervals readings that occur no less frequently than every two seconds and that are recorded and stored electronically. These measurement records sets shall be identified by means of a unique time/date key indicating when exactly the values were measured;

    (c) The simplification offered for calculating the molecular mass of the gaseous stream in Equations (3) or (17) in version 01.0 of the methodological tool, may be applied;

    (d) The correction factors derived from the calibration curve of the QAL2 audit for the monitoring components as determined during the QAL2-test in accordance with chapter 6 of European Norm 14181 shall be applied to both the N_2O concentration and the volume or mass flow of the tail gas. This may either be applied automatically to the raw data recorded by the AMS at the plant or it may be applied to the calculated hourly averages as part of the calculation of project emissions;

(e) If data for the N_2O concentration and/or the volume or mass flow of the tail gas are not available for more than one third of any hour while the nitric acid production line was in operation, the value for that hour shall be replaced with the maximum hourly value of the N_2O concentration and/or volume or mass flow of the tail gas observed since the start of operation of the Article 6.4 activity. Values observed during the five operating hours following the start-up of the nitric acid production line and during the five operating hours before a shut-down of the nitric acid production line shall not be used for the determination of the maximum values;

(f) If data for either the N_2O concentration or the volume or mass flow of the tail gas are not available for more than 10 days, then no emission reductions shall be claimed in the period thereafter until the measurements have been resumed;

(g) In the case that the N_2O concentration and the volume or mass flow of the tail gas and by-pass are automatically converted to normal conditions by the AMS during the monitoring process, the parameters P_t and T_t in the methodological tool do not need to be monitored except, if applicable, for the purpose of determining the moisture content in the gaseous stream; and

(h) In determining the mass flow of N_2O in the gaseous stream of the tail gas in each hour h that the nitric acid production line was in operation ($F_{N2O,tailgas,h}$), activity participants shall use the average value for each hour, adjusted upwards based on the upper bound of the uncertainty interval at a 95% confidence. The uncertainty shall be determined using error propagation in accordance with the provisions in the methodological tool.

8.2. Project emissions from the operation of the tertiary N_2O abatement system

46. Project emissions from the operation of the tertiary N_2O abatement system ($PE_{tertiary,y}$) shall be estimated if:

(a) A tertiary N_2O abatement system is installed or restarted under the Article 6.4 activity; and

(b) Fossil fuels, steam, electricity or other inputs (e.g., ammonia or urea) are used to operate the tertiary N_2O abatement system or re-heat the tail gas.

47. Project emissions from the operation of the tertiary N_2O abatement system ($PE_{tertiary,y}$) shall include, where applicable:

(a) Project emissions from fossil fuel use for the operation of the tertiary N_2O abatement system in year y ($PE_{FF,y}$);

(b) Project emissions from electricity consumption for the operation of the tertiary N_2O abatement system in year y ($PE_{EC,y}$);

(c) Project emissions from steam consumption for the operation of the tertiary N_2O abatement system in year y ($PE_{steam,y}$); and

(d) Project emissions from the use of inputs i for the for the operation of the tertiary N_2O abatement system in year y ($PE_{input,i,y}$).

48. Activity participants shall document and justify in the PDD which of the project emission sources listed in paragraph 47 are applicable to the tertiary N_2O abatement system used under the Article 6.4 activity, including which inputs *i* are used (e.g., ammonia, urea, etc.) and how the quantity of fossil fuels, electricity consumption, steam and any other inputs is monitored and quantified in accordance with the monitoring tables in section 14.

49. Project emissions from the operation of the tertiary N_2O abatement system ($PE_{tertiary,y}$) shall be calculated as follows:

$$PE_{tertiary,y} = PE_{FF,y} + PE_{EC,y} + PE_{steam,y} + \sum_i PE_{input,i,y} \qquad \text{Equation (6)}$$

Where:

$PE_{tertiary,y}$	=	Project emissions of CO_2 from the operation of the tertiary N_2O abatement system in year *y* (t CO_2eq)
$PE_{FF,y}$	=	Project emissions from fossil fuel use for the operation of the tertiary N_2O abatement system in year *y* (t CO_2), where applicable
$PE_{EC,y}$	=	Project emissions from electricity consumption for the operation of the tertiary N_2O abatement system in year *y* (t CO_2), where applicable
$PE_{steam,y}$	=	Project emissions from steam consumption for the operation of the tertiary N_2O abatement system in year *y* (t CO_2), where applicable
$PE_{input,\mathrm{i}\ y}$	=	Project emissions from the use of input *i* for the for the operation of the tertiary N_2O abatement system in year *y* (t CO_2), where applicable
i	=	Inputs used for the for the operation of the tertiary N_2O abatement system in year *y*

8.2.1. Project emissions from fossil fuel use for the operation of the tertiary N_2O abatement system ($PE_{FF,y}$)

50. This source of project emissions shall be calculated as follows:

$$PE_{FF,y} = \sum_i \left(FC_{i,y} \times EF_{FC,CO2,i,y}\right) \times \left(1 + F_{CH4/N2O,i} + F_{upstream,i}\right) \qquad \text{Equation (7)}$$

Where:

$PE_{FF,y}$	=	Project emissions from fossil fuel use for the operation of the tertiary N_2O abatement system in year *y* (t CO_2eq)
$FC_{i,y}$	=	Quantity of fuel type *i* combusted in process *j* during the year *y* (mass or volume unit / year)
$EF_{FC,CO2,i,y}$	=	CO_2 emission factor of fuel type *i* in year *y* (t CO_2 / mass or volume unit)
$F_{CH4/N2O,i}$	=	Factor to account for CH_4 and N_2O emissions in relation to CO_2 emissions for fuel type *i* (dimensionless)
$F_{upstream,i,y}$		Factor to account for upstream emissions in relation to CO_2 emissions for fuel type *i* (dimensionless)
i	=	Fuel types combusted

51. The emission factor may be calculated using one of the following three options, depending on the availability of data on the fossil fuel type *i*, as follows:

(a) Option A.1: Calculated based on the chemical composition of the fossil fuel type *i*, if $FC_{i,y}$ is measured in a mass unit:

$$EF_{FC,CO2,i,y} = w_{c,i,y} \times 44/12 \qquad \text{Equation (8)}$$

Where:

$EF_{FC,CO2,i,y}$	=	CO_2 emission factor of fuel type *i* in year *y* ($t\ CO_2$ / mass or volume unit)
$w_{c,i,y}$	=	Mass fraction of carbon in fuel type *i* in year *y* (t C / mass unit of the fuel)

(b) Option A.2: Calculated based on the chemical composition of the fossil fuel type *i*, if $FC_{i,y}$ is measured in a volume unit:

$$EF_{FC,CO2,i,y} = w_{c,i,y} \times \rho_{,i,y} \times 44/12 \qquad \text{Equation (9)}$$

Where:

$EF_{FC,CO2,i,y}$	=	CO_2 emission factor of fuel type *i* in year *y* ($t\ CO_2$ / mass or volume unit)
$w_{c,i,y}$	=	Mass fraction of carbon in fuel type *i* in year *y* (tC/mass unit of the fuel)
$\rho_{,i,y}$	=	Density of fuel type *i* in year *y* (mass unit/volume unit of the fuel)

(c) Option B: Calculated based on net calorific value and CO_2 emission factor of the fuel type *i*, as follows:

$$EF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y} \qquad \text{Equation (10)}$$

Where:

$EF_{FC,CO2,i,y}$	=	CO_2 emission factor of fuel type *i* in year *y* ($t\ CO_2$ / mass or volume unit)
$NCV_{i,y}$	=	Net calorific value of the fuel type *i* in year *y* (GJ / mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fuel type *i* in year *y* ($t\ CO_2$ / GJ)

52. Activity participants shall use Options A.1 or A.2, unless they can demonstrate that the necessary data are unavailable. If the necessary data are unavailable, activity participants may use Option B.

53. Given the small size of this emission source and given that a conservative BAT baseline emission factor is used, the uncertainty for this emission source should be quantified and accounted for.

8.2.2. Project emissions from electricity consumption for the operation of the tertiary N_2O abatement system in year *y* ($PE_{EC,y}$)

54. Activity participants shall use a valid version of the "Methodological tool: Emissions from electricity generation and/or consumption" (A6.4-AMT-007) to calculate the project

emissions from electricity consumption for the operation of the tertiary N_2O abatement system in year *y* ($PE_{EC,y}$). In applying the tool, the following provisions shall apply:

(a) **Electricity generation or consumption sources *s*:** The electricity consumption sources *s* shall include any electricity consumption from the operation of the N_2O destruction system and from reheating the flue gas;

(b) **Determination of the amount of electricity generated or consumed:** The amount of electricity consumption for each consumption source *s* shall be directly metered, consistent with the provisions of the methodological tool;

(c) **Type of electricity generation or consumption source *s*:** The electricity consumption sources shall be deemed to be non-intermittent;

(d) **Applicable scenarios:** Where a captive power plant at the site of the industrial facility uses fossil fuels, scenario B shall apply. Otherwise, scenario A shall apply;

(e) **Whether Case 1 or Case 2 applies:** Case 1 in Step 4 of the methodological tool shall apply;

55. Given the small size of this emission source and that a conservative baseline emission factor is used, the uncertainty for (i) the emission factor; (ii) the transmission and distribution losses; and (iii) the electricity consumption does not need to be quantified and accounted for.

8.2.3. Project emissions from steam consumption for the operation of the tertiary N_2O abatement system ($PE_{steam,y}$)

56. This source of project emissions shall be calculated based on the monitored amount of steam consumption for the operation of the tertiary N_2O abatement system and an emission factor for steam consumption, as follows:

$$PE_{steam,y} = ST_{PJ,y} \times EF_{steam} \quad \text{Equation (11)}$$

Where:

$PE_{steam,y}$	=	Project emissions from steam consumption for the operation of the tertiary N_2O abatement system in year *y* (t CO_2eq)
$ST_{PJ,y}$	=	Amount of steam consumed for the operation of the tertiary N_2O abatement system in year *y* (GJ)
EF_{steam}	=	Emission factor for steam consumption (t CO_2eq / GJ)

57. For the emission factor for steam consumption (EF_{steam}), the conservative default values in Table 4 shall be used. Activity participants shall select the value for based on the most carbon intensive fuel type used at the industrial facility where the nitric acid production line is located.

Table 4. Conservative default values for the emission factor for steam consumption (EF_{steam}), expressed in t CO_2eq / GJ

Fuel type	Emission factor
Natural gas	[X]
Oil	[X]
Coal	[X]

Note: The MEP will provide conservative default values in the final version of this methodological tool.

8.2.4. Project emissions from the use of inputs *i* for the for the operation of the tertiary N_2O abatement system ($PE_{input,i,y}$)

58. This source of project emissions shall be calculated based on the monitored amount of inputs *i* used for the operation of the tertiary N_2O abatement system and a respective emission factor. For each input, it shall be calculated as follows:

$$PE_{input,i,y} = IN_{PJ,i,y} \times EF_{IN,i} \times 10^{-3} \quad \text{Equation (12)}$$

Where:

$PE_{input,i,y}$	=	Project emissions from the use of input *i* for the for the operation of the tertiary N_2O abatement system in year *y* (t CO_2eq)
$IN_{PJ,i,y}$	=	Amount of input *i* consumed for the operation of the tertiary N_2O abatement system in year *y* (kg input)
$EF_{IN.i}$	=	Emission factor for input *i* (kg CO_2eq / kg input)
10^{-3}	=	A unit conversion factor (10^{-3} t CO_2eq / kg CO_2eq)

59. For the emission factor for inputs *i* (EF_i), the conservative default values in Table 5 shall be used.

Table 5. Conservative default emission factors for inputs i ($EF_{IN,i}$), expressed in kg CO_2eq / kg input)

Input type	*Emission factor*
Ammonia	[X]
Urea	[X]

Note: The MEP will provide conservative default values in the final version of this methodology.

9. Leakage

60. Leakage emissions include emissions arising from manufacturing, transportation, and installation of secondary and/or tertiary N_2O abatement systems under the Article 6.4 activity.[27] They shall be determined as follows:

$$LE_y = 0.0001 \times BE_{adj,y} \quad \text{Equation (13)}$$

Where:

LE_y	=	Leakage emissions in year *y* (t CO_2eq)
0.0001	=	Factor to account for leakage emissions (t CO_2eq)

Note: The MEP will further explore alternative ways of calculating these emissions and reassess the suitability of the value.

[27] Leakage emissions from diversion of baseline equipment are addressed through an applicability condition.

10. Emission reductions

61. Emission reductions shall be determined as follows:

$$ER_y = BE_{adj,y} - PE_y - LE_y \quad \text{Equation (14)}$$

Where:

ER_y	=	Emission reductions in year *y* (t CO_2eq)
$BE_{adj,y}$	=	Downward adjusted baseline emissions in year *y* (t CO_2eq)
PE_y	=	Project emissions in year *y* (t CO_2eq)
LE_y	=	Leakage emissions in year *y* (t CO_2eq)

62. This mechanisms methodology addresses uncertainty in the determination of individual parameters or through conservative assumptions. It is therefore not necessary to determine on overall uncertainty of the aggregated emission reductions.

11. Avoidance of double counting

63. Activity participants shall demonstrate that the Article 6.4 activity will not result in double counting by:

(a) Providing evidence, in each monitoring report, that the outcomes from the Article 6.4 activity (N_2O abatement in the production of nitric acid) for which they intend to request issuance of A6.4ERs are not also claimed in other environmental markets or accounting framework, except for outcomes not related to reducing greenhouse gases emissions (e.g., social impacts); and

(b) Demonstrating that the reported GHG emission reductions that they intend to request issuance of A6.4ERs do not overlap with mandatory domestic mitigation schemes (e.g., emissions trading systems), or that measures are in place to ensure that any relevant impacts of the activity (i.e., the N_2O emission reductions achieved) are not counted towards the achievement of targets or obligations under the mandatory domestic mitigation scheme (e.g. by cancelling allowances from the emissions trading system before issuing carbon credits) if the overlap exists, by:

(i) Declaring and providing evidence in each monitoring report that the Article 6.4 activity does not fall within the scope of any mandatory domestic mitigation scheme; or

(ii) Where the Article 6.4 activity falls within the scope of a mandatory domestic mitigation scheme, activity participants shall provide evidence in each monitoring report that the mitigation outcomes of the Article 6.4 activity are not counted in the mandatory mitigation scheme to reduce the obligations by the entities covered by the scheme. For example, in the case of an emissions trading system covering N_2O emissions from nitric acid production, a confirmation from the operator of the emissions trading system may be sought that a number of allowances equal to the difference between the downward adjusted baseline emissions ($BE_{adj,y}$) and the project emissions of N_2O from the tail gas of the nitric acid production line in year *y* project ($PE_{N2O,y}$) were cancelled before the issuance of the A6.4ERs.

(c) Notwithstanding paragraph 64 above, where the policy for establishing the framework or environmental market or for establishing the mandatory domestic mitigation scheme refers to or formally integrates the mechanism as an instrument for implementation, participation in such a framework or environmental market or domestic mitigation scheme does not result in double counting.

12. Demonstration of alignment with the policies, options and implementation plans with regard to the NDC and LT-LEDS of the host Party and the long-term temperature goal of the Paris Agreement and long-term goals of the Paris Agreement

64. Activity participants shall attach to the PDD presented to the DOE performing the validation a confirmation from the DNA of the host Party that the DNA has undertaken an assessment of the activity's consistency with the provisions in Decision 3/CMA.3 paragraph 40 (c) and paragraph 27 (a), as part of the host Party's approval, to demonstrate that the activity does not constrain, but aligns with the policies, options and implementation plans of the host Party with regard to the nationally determined contribution (NDC) of the host Party, its long-term low greenhouse gas emission development strategies (LT-LEDS) if it has submitted one, and the long-term temperature goal of the Paris Agreement and long-term goals of the Paris Agreement.

13. Data and parameters not monitored

Data / Parameter table 1.

<table>
<tr><td>Data/parameter</td><td>Operating pressure and plant classification</td></tr>
<tr><td>Description</td><td>Operating pressure of nitric acid plant (Ammonia oxidation reactor and absorber) and the classification of the plant based on the operating pressure</td></tr>
<tr><td>Data unit</td><td>Bar / plant types specified below</td></tr>
<tr><td>Equations referred</td><td>N/A</td></tr>
<tr><td>Purpose of data</td><td>☒ Baseline emissions ☐ Project emissions ☐ Leakage emissions</td></tr>
<tr><td>Value(s) applied</td><td>The following table provides the different ranges of nitric acid plant pressure (according to the IPCC 2019 Refinement):
<table>
<tr><td rowspan="2">Operating conditions</td><td colspan="2">Applied pressure in Bar</td></tr>
<tr><td>Oxidation</td><td>Absorption</td></tr>
<tr><td>Single low pressure</td><td colspan="2">0 – 1.7</td></tr>
<tr><td>Dual low/medium (L/M) pressure</td><td><1.7</td><td>1.7 – 6.5</td></tr>
<tr><td>Single medium pressure</td><td colspan="2">1.7 – 6.5</td></tr>
<tr><td>Dual medium/high (M/H) pressure</td><td>1.7 – 6.5</td><td>6.5 – 13</td></tr>
<tr><td>Single high pressure</td><td colspan="2">6.5 – 13</td></tr>
</table></td></tr>
<tr><td>Source of data</td><td>☐ Measured ☒ Other sources</td></tr>
<tr><td>Choice of data or measurement</td><td>Manufacturer specifications</td></tr>
</table>

methods and procedures	
Treatment of uncertainty	Not applicable (The operating pressure of the nitric acid plant is solely used for classification of the plant´s pressure category in accordance with IPCC 2019 guidelines)
Additional comments	The parameter is used to determine the nitric acid plant´s operating pressure classification

Data / Parameter table 2.

<table>
<tr><td>Data/parameter</td><td>EF$EF_{BL,y}$</td></tr>
<tr><td>Description</td><td>BAT baseline N_2O emission factor in year y (kg N_2O / t HNO_3)</td></tr>
<tr><td>Data unit</td><td>kg N_2O/t HNO_3</td></tr>
<tr><td>Equations referred</td><td>Equation (2)</td></tr>
<tr><td>Purpose of data</td><td>☒ Baseline emissions ☐ Project emissions ☐ Leakage emissions</td></tr>
<tr><td>Value(s) applied</td><td>The emission factors for all plant types are given below:
<table>
<tr><th rowspan="2">Year</th><th colspan="3">Single pressure</th><th colspan="2">Dual pressure</th></tr>
<tr><th>Low</th><th>Medium</th><th>High</th><th>Low/Medium</th><th>Medium/High</th></tr>
<tr><td>n</td><td>[3 – 4]</td><td>[3 – 4.5]</td><td>[3 – 6]</td><td>[3 – 4]</td><td>[3 – 4.5]</td></tr>
</table>
[The values provided are solely indicative, pending public input]</td></tr>
<tr><td>Source of data</td><td>☐ Measured ☒ Other sources</td></tr>
<tr><td>Choice of data or measurement methods and procedures</td><td>[Pending public input]</td></tr>
<tr><td>Treatment of uncertainty</td><td>Not applicable (No further adjustment for uncertainty are applied to best available technology (BAT) values)</td></tr>
<tr><td>Additional comments</td><td>-</td></tr>
</table>

Data / Parameter table 3.

Data/parameter	GWP_{N2O}
Description	Global warming potential of N_2O
Data unit	t CO_2eq / t N_2O
Equations referred	Equation (2), Equation (5)
Purpose of data	☒ Baseline emissions ☒ Project emissions ☐ Leakage emissions
Value(s) applied	265
Source of data	☐ Measured ☒ Other sources
Choice of data or measurement methods and procedures	Default value taken from IPCC Fifth Assessment Report (AR5). The use of this value is subject to any further decisions by the CMA or the Supervisory of the Article 6.4 mechanism

Treatment of uncertainty	N/A
Additional comments	-

Data / Parameter table 4.

Data/parameter	$P_{NA,NPC}$
Description	Nameplate capacity of the nitric acid production line at the time of the start date of the Article 6.4 activity
Data unit	t HNO_3 / year
Equations referred	Equation (3), Equation (5)
Purpose of data	☒ Baseline emissions ☐ Project emissions ☐ Leakage emissions
Value(s) applied	Variable (depends on the production line)
Source of data	Project operator and/or technology provider
Choice of data or measurement methods and procedures	As per design specification and/or permitting documents
Treatment of uncertainty	Not applicable
Additional comments	-

Data / Parameter table 5.

Data/parameter	$CF_{default}$
Description	Default value for the capacity utilization factor
Data unit	(dimensionless)
Equations referred	Equation (3)
Purpose of data	☒ Baseline emissions ☐ Project emissions ☐ Leakage emissions
Value(s) applied	80%
Source of data	☐ Measured ☒ Other sources
Choice of data or measurement methods and procedures	2006 IPCC Guidelines on National GHG Inventories as found in: Chapter 3: Chemical Industry Emissions, page 23
Treatment of uncertainty	Not applicable
Additional comments	-

Data / Parameter table 6.

Data/parameter	$F_{CH4/N2O,i}$
Description	Factor to account for CH_4 and N_2O emissions in relation to CO_2 emissions for fuel type *i*
Data unit	dimensionless
Equations referred	Equation (7)
Purpose of data	☐ Baseline emissions ☒ Project emissions ☐ Leakage emissions
Value(s) applied	1.002
Source of data	☐ Measured ☒ Other sources
Choice of data or measurement methods and procedures	This value was derived from Table 2.2 of Volume 2, Chapter 1 of the IPCC (2006)
Treatment of uncertainty	Not applicable (Uncertainty is taken into account in determining a conservative default value)
Additional comments	-

Data / Parameter table 7.

Data/parameter	$F_{upstream,i}$
Description	Factor to account for upstream emissions in relation to CO_2 emissions for fuel type *i* (dimensionless)
Data unit	dimensionless
Equations referred	Equation (7)
Purpose of data	☐ Baseline emissions ☒ Project emissions ☐ Leakage emissions
Value(s) applied	Variable (depends on the type of fuel)
Source of data	☐ Measured ☒ Other sources
Choice of data or measurement methods and procedures	A global value of [0.2]
Treatment of uncertainty	Not applicable (Uncertainty has been taken into account in determining the conservative default value)
Additional comments	-

Data / Parameter table 8.

Data/parameter	EF_{steam}
Description	Emission factor for steam consumption
Data unit	t CO_2eq / GJ

Equations referred	Equation (10)
Purpose of data	☐ Baseline emissions ☒ Project emissions ☐ Leakage emissions
Value(s) applied	Variable (depends on the type of fuel)
Source of data	☐ Measured ☒ Other sources
Choice of data or measurement methods and procedures	Use the applicable conservative default value specified in Table 4
Treatment of uncertainty	N/A (Uncertainty has been taken into account in determining the conservative default values)
Additional comments	-

Data / Parameter table 9.

Data/parameter	$EF_{IN,i}$
Description	Emission factor for input *i*
Data unit	kg CO_2eq / kg input
Equations referred	Equation (2)
Purpose of data	☐ Baseline emissions ☒ Project emissions ☐ Leakage emissions
Value(s) applied	Variable (depends on the type of input)
Source of data	☐ Measured ☒ Other sources
Choice of data or measurement methods and procedures	Use the conservative default values specified in Table 5
Treatment of uncertainty	N/A
Additional comments	-

14. Data and parameters monitored

65. Under this mechanism methodology, monitoring periods shall cover the full duration of a nitric acid production campaign. Several nitric acid production campaigns may be included in one monitoring period.

Data / Parameter table 10.

Data/parameter	$P_{NA,y}$
Description	Amount of nitric acid produced in the Article 6.4 nitric acid production line in year *y*
Data unit	t HNO_3

Equations referred	Equation (2)	
Purpose of data	☒Baseline emissions ☐ Project emissions ☐Leakage emissions	
Measurement and updating frequency	Measurements by activity participants and production reports	
Measurement methods and procedures		
Entity/person responsible for the measurement	Activity participants	
Measuring instrument(s)	*Type of instrument*	- Instruments for determining the mass or volumetric flow of the nitric acid solution; - Instrument for determining the HNO_3 concentration of that solution.
	Accuracy class	As per manufacturer specification
	Calibration requirements	As per manufacturer specification
	Location	N/A
Measurement intervals	Continuous	
QA/QC procedures	For measurement devices (e.g. as weight scales), the QA/QC procedures specified by the supplier of the measurement devices shall be followed	
Treatment of uncertainty	• For measurement devices, the uncertainty specified by the supplier of the measurement devices shall be used; • Apply the higher bound of the uncertainty to the measured value for the purpose of determining this parameter in equation (2)	
Additional comment	-	

Data / Parameter table 11.

Data/parameter	$F_{N2O,tailgas,h}$
Description	Mass flow of N_2O in the gaseous stream of the tail gas in hour *h*
Data unit	kg N_2O
Equations referred	Equation (5)
Purpose of data	☐ Baseline missions ☒ Project emissions ☐ Leakage emissions
Measurement and updating frequency	As per the provisions in section 8.1 above
Measurement methods and procedures	*As per the requirements of the mass flow tool*

Entity/person responsible for the measurement	Activity participants	
Measuring instrument(s)	*Type of instrument*	*As per the requirements of the mass flow tool*
	Accuracy class	*As per the requirements of the mass flow tool*
	Calibration requirements	*As per the requirements of the mass flow tool*
	Location	*As per the requirements of the mass flow tool*
QA/QC procedures	As per the calibration requirements	
Treatment of uncertainty	Uncertainties shall be determined based on the measuring instruments	
Additional comment	-	

Data / Parameter table 12.

Data/parameter	$EF_{CO2,i,y}$	
Description	CO_2 emission factor of fuel type *i* in year *y*	
Data unit	t CO_2 / GJ	
Equations referred	Equation (7)	
Purpose of data	☐ Baseline emissions ☒ Project emissions ☐ Leakage emissions	
Measurement and updating frequency	Option 1: At each fuel delivery; Option 2: At each fuel delivery; Option 3: Annually; Option 4: Updated based on future revisions of the IPCC Guidelines	
Measurement methods and procedures	Option 1: Values provided by the fuel supplier (preferred source), in line with national or international fuel standards; Option 2: Measurements by activity participants undertaken in line with national or international fuel standards (if supplier-provided values are not available); Option 3: Regional or national default values (if supplier-provided values are not available and only for liquid fuels). Values shall be reviewed annually; Option 4: Upper bound for case 1 and lower bound for case 2, at a 95 per cent confidence interval, from IPCC default values provided in the 2019 Refinement to the 2006 IPCC Guidelines on National GHG Inventories (if supplier-provided values are	
Entity/person responsible for the measurement	Activity participants	
Measuring instrument(s)	*Type of instrument*	As per the national or international standard if the parameter is measured by activity participants

	Accuracy class	As per the national or international standard if the parameter is measured by activity participants
	Calibration requirements	As per the national or international standard if the parameter is measured by activity participants
	Location	N/A
QA/QC procedures	• The recorded data must be stored monthly in a central database with backup; • Laboratories in Options 1 and 2 shall have ISO17025 accreditation, or justify compliance with equivalent quality standards	
Treatment of uncertainty	Verify whether the values under options 1, 2, and 3 fall within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2019 Refinement to the 2006 IPCC Guidelines. If the values fall outside of this range, collect additional information from the testing laboratory to justify the outcome or conduct additional measurements	
Additional comment	For option 1, if the fuel supplier provides both the NCV and CO_2 emission factor on the invoice and these values are based on measurements for the specific fuel delivered, the provided CO_2 emission factor shall be used. If another source is used for the CO_2 emission factor, or no CO_2 emission factor is provided, Options 2, 3, or 4 shall be used.	

Data / Parameter table 13.

Data/parameter	***$FC_{i,y}$***	
Description	Quantity of fuel type i combusted in process *j* during the year *y*	
Data unit	Mass or volume unit/year	
Equations referred	Equation (7)	
Purpose of data	☐ Baseline emissions ☒ Project emissions ☐ Leakage emissions	
Measurement and updating frequency	Continuously	
Measurement methods and procedures	• Use either mass or volume meters. • In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: the ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift); • Accessories such as transducers, sonar and piezoelectronic devices are accepted if they are properly calibrated with the ruler gauge and receiving reasonable maintenance. • In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions	
Entity/person responsible for the measurement	Activity participants	
Measuring instrument(s)	*Type of instrument*	Mass or volume meters, ruler gauge (that is part of daily tanks), transducers, sonar and piezoelectronic devices
	Accuracy class	As per manufacturer specification

	Calibration requirements	Ruler gauge must be calibrated at least once a year. Transducers, sonar and piezoelectronic: calibrated with the ruler gauge and subject to reasonable maintenance
	Location	N/A
QA/QC procedures	The recorded data must be stored monthly in a central database with backup	
Treatment of uncertainty	Uncertainties are determined based on the measuring instruments	
Additional comment	- The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes; Where the purchased fuel invoices can be identified specifically for the Article 6.4 activity, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial record Article 6.4 activities faced with data gaps due to meter failure or other reasons unforeseen, may estimate the quantity of fuel, using one of the following options, provided the gap period does not exceed 30 consecutive days within six consecutive months: • The purchased fuel/energy invoices/bills, where the purchased fuel can be identified specifically for the Article 6.4 activity; • The energy produced by the equipment, adjusted by efficiency. A conservative value for efficiency of the equipment is of 40 per cent for combustion engines and generator and 80 per cent for thermal heaters shall be used, while energy produced is measured directly or calculated based on operation hours; • The highest value of the parameter for the same calendar period of the previous years	

Data / Parameter table 14.

Data/parameter	$\rho_{i,y}$
Description	Density of fuel type *i* in year *y*
Data unit	Mass unit/volume unit of the fuel
Equations referred	Equation (8), Equation (9)
Purpose of data	☐ Baseline emissions ☒ Project emissions ☐ Leakage emissions
Measurement and updating frequency	Continuously, or for each fuel batch
Measurement methods and procedures	• Values provided by the supplier of the fuel (preferred source); • Measurements by activity participants undertaken in line with national or international fuel standards (if the values provided by the supplier of the fuel are not available); • Regional or national default values (if the values provided by the supplier of the fuel are not available and only for liquid fuels)
Entity/person responsible for the measurement	Activity participants

Measuring instrument(s)	*Type of instrument*	As per the national or international standard if the parameter is measured by activity participants
	Accuracy class	As per the national or international standard if the parameter is measured by activity participants
	Calibration requirements	As per the national or international standard if the parameter is measured by activity participants
	Location	N/A
QA/QC procedures	The recorded data must be stored monthly in a central database with backup	
Treatment of uncertainty	Apply uncertainties based on the IPCC (2019 Refinement)	
Additional comments	For values provided by the supplier of the fuel: The density of the fuel should be obtained for each fuel delivery, from which weighted average annual values should be calculated	

Data / Parameter table 15.

Data/parameter	$w_{c,i,y}$	
Description	Mass fraction of carbon in fuel type *i* in year *y*	
Data unit	t C / mass unit of the fuel	
Equations referred	Equation (8), Equation (9)	
Purpose of data	☐ Baseline emissions ☒ Project emissions ☐ Leakage emissions	
Measurement and updating frequency	Continuously, or for each fuel batch	
Measurement methods and procedures	• Values provided by the supplier of the fuel (preferred source); • Measurements by activity participants undertaken in line with national or international fuel standards; • Regional or national default values (if the values provided by the supplier of the fuel are not available and only for liquid fuels)	
Entity/person responsible for the measurement	Activity participants	
Measuring instrument(s)	*Type of instrument*	As per the national or international standard if the parameter is measured by activity participants
	Accuracy class	As per the national or international standard if the parameter is measured by activity participants
	Calibration requirements	As per the national or international standard if the parameter is measured by activity participants
	Location	N/A
QA/QC procedures	The recorded data must be stored monthly in a central database with backup	
Treatment of uncertainty	Uncertainties are determined based on the measuring instruments	

Additional comments	Verify if the values measured or sourced from the fuel supplier or from measurements are within the uncertainty range of the product of the IPCC default values as provided in Table 1.2 and Table 1.3, Vol. 2 of the IPCC (2006). If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in (b) should have ISO17025 accreditation or justify that they can comply with similar quality standards

Data / Parameter table 16.

Data/parameter	***$NCV_{i,y}$***	
Description	Net calorific value of the fuel type *i* in year *y*	
Data unit	GJ / mass or volume unit	
Equations referred	Equation (10)	
Purpose of data	☐ Baseline emissions ☒ Project emissions ☐ Leakage emissions	
Measurement and updating frequency	Option 1: At each fuel delivery; Option 2: At each fuel delivery; Option 3: Annually; Option 4: Updated based on future revisions of the IPCC Guidelines	
Measurement methods and procedures	• Option 1: Values provided by the supplier of the fuel (preferred source). The density of the fuel should be obtained for each fuel delivery, from which weighted average annual values should be calculated; • Option 2: Measurements by activity participants undertaken in line with national or international fuel standards (if the values provided by the supplier of the fuel are not available). The NCV of the fuel should be obtained for each fuel delivery, from which weighted average annual values should be calculated; • Option 3: Regional or national default values (if the values provided by the supplier of the fuel are not available and only for liquid fuels). Values shall be reviewed annually; • Option 4: Upper bound of the 95 per cent confidence interval from IPCC default values provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the IPCC (2019 Refinement) if the values provided by the supplier of the fuel are not available). Update based on future revisions of the IPCC Guidelines	
Entity/person responsible for the measurement	Activity participants or fuel supplier	
Measuring instrument(s)	*Type of instrument*	As per the national or international standard if the parameter is measured by activity participants
	Accuracy class	As per the national or international standard if the parameter is measured by activity participants
	Calibration requirements	As per the national or international standard if the parameter is measured by activity participants
	Location	As per the national or international standard if the parameter is measured by activity participants
QA/QC procedures	The recorded data must be stored monthly in a central database with backup	

Treatment of uncertainty	Verify if the values under Options 1, 2 and 3 are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2019 Refinement to the IPCC (2006). If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements – the laboratories in Options 1, 2 and 3 should have ISO17025 accreditation or justify that they can comply with similar quality standards
Additional comments	-

Data / Parameter table 17.

Data/parameter	***$ST_{PJ,y}$***	
Description	Amount of steam consumed for the operation of the tertiary N_2O abatement system in year *y*	
Data unit	GJ	
Equations referred	Equation (11)	
Purpose of data	☐ Baseline emissions ☒ Project emissions ☐ Leakage emissions	
Measurement and updating frequency	Continuous measurement and at least monthly recording	
Measurement methods and procedures	Measured via log books and maintenance reports of the plant	
Entity/person responsible for the measurement	Activity participants	
Measuring instrument(s)	*Type of instrument*	Steam meter
	Accuracy class	According to the national, international, or meter supplier's instructions
	Calibration requirements	Calibration shall be conducted according to the national, international, or manufacturer's instructions
	Location	At the outlet of the equipment providing/generating the steam to be used for reheating the tail gas for the tertiary abatement system
QA/QC procedures	The recorded data must be stored daily in a central database with backup	
Treatment of uncertainty	Uncertainties are determined based on the specifications for the measuring instruments	
Additional comment	If applicable: cross-check with fuel use records for steam production or calculated amount of steam diverted from other processes	

Data / Parameter table 18.

Data/parameter	***$IN_{PJ,l,y}$***

<table>
<tr><td>Description</td><td colspan="2">Amount of input i consumed for the operation of the tertiary N_2O abatement system in year y</td></tr>
<tr><td>Data unit</td><td colspan="2">kg input</td></tr>
<tr><td>Equations referred</td><td colspan="2">Equation (12)</td></tr>
<tr><td>Purpose of data</td><td colspan="2">☐ Baseline emissions ☒ Project emissions ☐ Leakage emissions</td></tr>
<tr><td>Measurement methods and procedures</td><td colspan="2">• Use either mass or volume meters. In cases where the input is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: the ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift);
• Accessories such as transducers, sonar and piezoelectronic devices are accepted if they are properly calibrated with the ruler gauge and receiving a reasonable maintenance;
• In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions.</td></tr>
<tr><td>Entity/person responsible for the measurement</td><td colspan="2">Activity participants</td></tr>
<tr><td rowspan="4">Measuring instrument(s)</td><td>Type of instrument</td><td>Mass or volume meters, ruler gauge (that is part of daily tanks), transducers, sonar and piezoelectronic devices</td></tr>
<tr><td>Accuracy Class</td><td>N/A</td></tr>
<tr><td>Calibration requirements</td><td>- Ruler gauge: calibrated at least once a year;
- Transducers, sonar and piezoelectronic: calibrated with the ruler gauge and subject to reasonable maintenance</td></tr>
<tr><td>Location</td><td>N/A</td></tr>
<tr><td>QA/QC procedures</td><td colspan="2">The recorded data must be stored daily in a central database with backup</td></tr>
<tr><td>Treatment of uncertainty</td><td colspan="2">Uncertainties are determined based on the measuring instruments</td></tr>
<tr><td>Additional comment</td><td colspan="2">The consistency of metered input consumption quantities should be cross-checked by an annual mass/flow balance that is based on purchased quantities and stock changes.
Where the purchased input invoices can be identified specifically for the Article 6.4 activity, the metered input consumption quantities should also be cross-checked with available purchase invoices from the financial record.
Article 6.4 activities faced with data gaps due to meter failure or other reasons unforeseen, may estimate the quantity of inputs, using one of the following options, provided the gap period does not exceed 30 consecutive days within six consecutive months:
• The purchased input invoices/bills, where the purchased inputs can be identified specifically for the Article 6.4 activity;
• The highest value of the parameter for the same calendar period of the previous years</td></tr>
</table>

Appendix. Demonstration of requirements at the level of the mechanism methodology

1. This section describes how specific requirements in the provisions of the “Standard: Demonstration of additionality in mechanism methodologies” (A6.4-STAN-METH-003)[1] and in the “Standard: Setting the baseline in mechanism methodologies” (A6.4-STAN-METH-004) are demonstrated at the level of the mechanism methodology.

1. Analysis of lock-in risk

2. Article 6.4 activities using this mechanism methodology are not deemed to cause a lock-in risk. This is based on the following assessment:

    (a) The installation of secondary or tertiary abatement is very unlikely to prolong the technical lifetime of existing nitric acid plants. Therefore, the Article 6.4 activities do not prolong N_2O emissions;

    (b) [Secondary N_2O abatement systems has a technical lifetime of less than 10 years. Therefore, it may be assumed that these abatement systems do not cause any lock-in risk with regard to GHG emissions intensity;]

    (c) Tertiary N_2O abatement systems can have a technical lifetime of more than 10 years. However, these systems can achieve high abatement levels and often exceed the performance of secondary N_2O abatement. Tertiary N_2O abatement at existing plants is therefore the technology with the lowest GHG emissions intensity and can also be deemed not to cause any lock-in risk with regard to GHG emissions intensity.

    (d) Article 6.4 activities using this methodology are not expected to result in an inefficient use of a resource that is important for mitigating climate change or achieving other policy objectives.

2. Investment analysis

3. As per applicability conditions in paragraph 18 in the mechanism methodology, Article 6.4 activities eligible to apply this methodology do not have any incentive, in the form of either a financial incentive or a penalty, for reducing their N_2O emissions from the production of nitric acid. At the same time, the installation of secondary or tertiary N_2O abatement involves costs and does not generate cost savings or revenues other than from A6.4ERs.

4. For this specific project type, the simple cost analysis is applied. It is found that:

    (a) The implementation of the Article 6.4 activity does not generate any cost savings or revenues other than from A6.4ERs (this is ensured through the applicability conditions); and

    (b) Possible alternative scenarios to the Article 6.4 activity also do not generate cost savings or revenues, since the installation of secondary or tertiary N_2O abatement involves capital and/or operational expenditures and does not generate cost savings or revenues other than from A6.4ERs.

[1] See https://unfccc.int/sites/default/files/resource/A6.4-STAN-METH-005.pdf.

5. The simple cost analysis is therefore concluded positively.

3. Determination of the best available technology (BAT)

Note: The MEP is still conducting data analysis for BAT values. This section sets out a proposed general approach and will be amended respectively. Stakeholders are invited to provide feedback to the approach indicated here.

3.1. Level of aggregation at which best available technology is determined

6. In this mechanism methodology, the BAT emission factor is determined at the global level, as the type of technologies used to produce nitric acid and abate N_2O emissions do not differ between countries.

7. The values determined here are applicable throughout the entire validity of this mechanism methodology. As the type of technologies used to abate N_2O emissions has not changed significantly over the past 20 years, it is expected that similar type of technologies will be applied over the next five years. This holds for existing nitric acid production lines, noting that new technologies may be employed in new nitric acid facilities that could result in significantly lower N_2O formation.

3.2. Determination of the best available technology baseline scenario

8. The available technologies with regard to N_2O emissions from nitric acid production include primary, secondary and tertiary N_2O abatement.

9. All these technologies can be considered to be environmentally sound under the applicability conditions of this mechanism methodology, in particular with regard to emissions other than N_2O.

10. Among the three technologies, only primary abatement is considered to be economically viable under the applicability conditions of this mechanism methodology, for the following reasons:

(a) Operators of nitric acid production plants commonly have incentives to pursue primary N_2O abatement as this can enhance the yield and may also reduce NO_x emissions; and

(b) Under the applicability conditions of this mechanism methodology, secondary and tertiary N_2O abatement are not economically viable because these technologies involve costs (capital expenditure and/or operating expenditure) but do not generate any revenue or cost savings other than revenues from A6.4ERs in the absence or relevant legal requirements, policies or targets.

3.3. Determination of the BAT emission factor

11. The emission performance of nitric acid plants depends on the plant design, such as the type of primary catalyst and the plant pressure, and, for activities enhancing N_2O abatement, on any pre-existing N_2O abatement. The IPCC 2019 Refinement differentiates between the following types of plants:

(a) Single low pressure (0 – 1.7 bar);

(b) Single medium pressure (1.7 – 6.5 bar);

(c) Single high pressure (6.5 – 13 bar);

(d) Dual low/medium pressure, with low pressure in the ammonia reactor and medium pressure in the absorption column;

(e) Dual medium/high pressure, with medium pressure in the ammonia reactor and high pressure in the absorption column.

12. The plant pressure has two effects on the N_2O emission factor. A high plant pressure in the ammonia burner generally leads to higher N_2O formation, whereas lower pressures lead to lower N_2O formation. By contrast, a higher pressure in the absorption column leads to a higher nitric acid yield and thus a relatively lower N_2O emission factor per tonne of nitric acid production. For this reason, dual pressure plants with low pressure in the ammonia reactor and medium pressure in the absorption column can be expected to have the lowest N_2O emission per tonne of nitric acid production.

13. The IPCC default values are not considered for determining the BAT emission factor, as these commonly intend to refer to the average performance of plants and may thus represent business-as-usual (BAU) emission factors and not BAT emission factors.

14. Data on best performing primary abatement technologies is scarce. One reason is that many plants only perform N_2O measurements if secondary or tertiary abatement is applied, in the context or legal requirements or incentives to pursue N_2O abatement. There is also only limited data available from the literature.

15. One available data source are baseline measurement campaigns conducted under CDM projects using the CDM methodologies "AM0028: N2O destruction in the tail gas of Caprolactam production plants"[2] and "AM0034: Catalytic reduction of N2O inside the ammonia burner of nitric acid plants"[3] prior to the installation of secondary or tertiary N_2O abatement. Similar data is also available from some JI projects. Data from other carbon crediting programmes was found to either not be publicly available or not sufficiently complete to derive baseline emission factors. Table 6 below shows the lowest baseline emission factor reported among CDM and JI plants for the respective plant pressure.

Note: Initial numbers were collected but are still subject to further checks. The numbers for the table will be provided in the final version of the methodology.

Table 6. Lowest baseline emission factor reported among CDM and JI nitric acid production plants (kg N_2O / t HNO_3)

Plant pressure	Lowest observed baseline emission factor	Number of plants for which data is available
Single low pressure		
Single medium pressure		
Single high pressure		
Dual low/medium pressure		
Dual medium/high pressure		

16. The data on CDM and JI plants dates back to the time when these projects were registered, mostly in the first commitment period of the Kyoto Protocol, and is therefore

[2] See https://cdm.unfccc.int/UserManagement/FileStorage/IV326LBA5XCTF04RUQ7MWDKG8SPNZ1.

[3] See https://cdm.unfccc.int/UserManagement/FileStorage/XY91IV0P6MU5L782WQ4C3AOZHGJDBE. This methodology was later consolidated under the CDM methodology "ACM0019: N2O abatement from nitric acid production".

rather outdated. According to industry experts, no major technological changes were achieved since this period but one industry expert reported that the efficiency of primary catalysts has been further increased since that time which could lead to a further reduction in N_2O emissions of about 10-15%.

17. A review of information from manufacturers of primary catalysts and the literature also provides limited data:

(a) An article by Jantsch and Hesse (2024) of Heraeus Precious Metals reports on the process performance results achieved for N_2O reduction in nitric acid production using FTC gauze systems.[4] Figure 3 in the article shows a low-pressure plant running with a Heraeus FTC-Flex gauze and yielding tail-gas concentrations around 200 ppm without a secondary catalyst or tertiary abatement. The gas flow is not specified. Assuming a gas flow of 10.000 Nm^3/h, this would correspond to a performance of about 3.9 kg N_2O / t HNO_3 (200 x 1.96 x 10.000 x 10^{-6}). In the case of a dual pressure plant, the performance could be somewhat higher; assuming a 2% higher yield for a dual pressure plant, this would result in an emission factor of about 3.8 kg N_2O / t HNO_3.

(b) A vendor brochure by Heraeus Precious Metals indicates that the FTC-Flex gauze can reduce N_2O formation by up to 70% and indicates in a figure on page 8 a 30% reduction compared to a "standard gauze" system but only illustrates a schematic plot of a nitric acid production campaign and does not provide absolute numbers. Assuming that a "standard gauze" for low pressure delivers about 5 kg N_2O / t HNO_3, this broadly confirms the literature source in sub-paragraph (a) above.[5]

Note: The MEP is in particular seeking public input on further data on the best available performance of plants without secondary or tertiary N_2O abatement.

18. For the purpose of determining BAT emission factors for Article 6.4 activities that enhance N_2O abatement, it is also necessary to determine BAT values for the abatement level achieved through secondary N_2O abatement and tertiary N_2O abatement using NSCR.

19. The IPCC default emission values are not suitable for this purpose as they do not intend to reflect BAT but rather average performance. Moreover, they do not differentiate by the type of N_2O abatement technology. The default values for emission factors with abatement are also significantly higher compared to values reported by countries with policies for abating N_2O emissions in their national GHG inventories.[6]

Note: The MEP is in particular seeking public input on the degree of abatement achieved through secondary N_2O abatement and tertiary N_2O abatement using NSCR.

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4 Jantsch, U. & Hesse, J (2024): Catalyst systems for N_2O abatement. In: Nitrogen+Syngas Issue 391. Pages 22-23. September-October 2024. https://www.bcinsight.crugroup.com/wp-content/uploads/sites/7/2024/11/NS_391.pdf.

5 Heraeus Precious Metals. Ammonia oxidation — Solutions to avoid and reduce N_2O emissions — vendor brochure. https://www.heraeus-precious-metals.com/dam/jcr%3Ae7d35b52-568c-40ed-b97c-41aa20ed0483/avoid-n2o-emissions.pdf.

6 For example, the European Union has included N_2O emissions from nitric acid production in its emissions trading system. For this reason, nitric acid production plants generally have secondary and/or tertiary N_2O abatement installed. In its GHG inventory submitted to the UNFCCC, the European reports N_2O emissions of 7.036 kt N_2O and nitric acid production of 11599,617 kt HNO3. This corresponds to an emission factor of 0.61 kg N_2O / t HNO_3. This is significantly lower than the IPCC default values of 1.5 and 2.5 kg N_2O / t HNO_3 indicated in the IPCC 2019 Refinement for plants with abatement.

4. Determination of a conservative BAU scenario and BAU emissions

20. Based on applicability condition 18 as well as section 6 of the mechanism methodology, the conservative BAU scenario is assumed to be no installation of secondary or tertiary N_2O abatement.

21. The respective conservative BAU emission factor is derived from different data sources, including IPCC default values and data from CDM and JI plants. Consistent with the "Standard: Setting the baseline in mechanism methodologies" (A6.4-STAN-METH-004), the lower bound of the uncertainty interval relative to the central estimate is used to derive the conservative BAU emission factor. Table 7 below summarizes this information.

Table 7. Conservative BAU emission factors derived from different data sources (kg N_2O / t HNO_3)

Plant pressure	IPCC default values adjusted for uncertainty	Mean values from CDM and JI plants adjusted for the uncertainty at a 95% confidence interval
Single low pressure	4.50	
Single medium pressure	6.40	
Single high pressure	5.40	
Dual low/medium pressure	6.30	
Dual medium/high pressure	5.60	

4.1. Comparison of the downward adjusted emissions baseline with the BAU emissions

Note: This section will be complemented after completion of the above analysis.

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Document information

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