PROPOSED NEW BASELINE AND MONITORING METHODOLOGY OR METHODOLOGICAL TOOL FORM
(Version 01.0)

INFORMATION TO BE COMPLETED BY THE SECRETARIAT AND METHODOLOGIES EXPERT PANEL	
Type of standard	New baseline and monitoring methodology
Unique reference number and title of the proposed new methodology or new methodological tool	>>
Date when this form was received at UNFCCC secretariat:	Click or tap to enter a date.
Date of posting in the UNFCCC A6.4 web site for global stakeholder consultation	Click or tap to enter a date.

SECTION A. Summary and applicability of the baseline and monitoring methodology or methodological tool

A.1. Title, submission date and version

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Methodology title	Version	Submission date
N_2O abatement from nitric acid production under Article 6.4 mechanism	01.0	12/05/2025

A.2. If this methodology or methodological tool is based on a previous submission or an approved Article 6.4 mechanism methodology or methodological tool, please state the reference numbers here. Explain briefly the main differences and their rationale.

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This methodology is not based on a previous submission or an approved Article 6.4 mechanism methodology.

A.3. Summary description of the methodology or methodological tool, including major baseline and monitoring methodological steps

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The baseline for N_2O emissions is calculated based on the amount of N_2O produced per ton of nitric acid (HNO_3) produced, following typical industry practice in the absence of abatement technology. The baseline considers pre-existing practices and the contribution of N_2O emissions that would otherwise be vented into the atmosphere without mitigation efforts.

Activity participants shall calculate the difference between the baseline emissions and the business-as-usual (BAU) emissions as an annual and total amount with respect to the crediting period.

Activity participants shall choose one of the baseline scenarios that are given by the methodology.

All data collected as part of monitoring should be archived electronically and be kept for two years after the end of the crediting period. One hundred per cent of the data should be monitored. All measurements should be conducted with calibrated measurement equipment according to relevant industry standards.

SECTION B. Proposed new baseline and monitoring methodology or methodological tool

B.1. Summary description and scope of the methodology or methodological tool

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Project types:

Typical projects	Project activities that introduce N_2O abatement measures in nitric acid plants can use this mechanism methodology
Type of GHG emissions mitigation action	Destruction of GHG: Destruction of N_2O emissions through abatement measures

Sectoral Scope: 5. Chemical Industries

B.2. Applicability conditions

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The methodology is applicable under the following conditions:

a) In case that the nitric acid plant started commercial operation before the implementation of the project activity, the activity participants shall demonstrate that there was no secondary or tertiary N_2O abatement technology installed in the respective nitric acid plant. In case of a new nitric acid plant, the activity participants shall demonstrate that no N_2O abatement technology was implemented in the design of the respective nitric acid plant.

b) Continuous real-time measurements of the N_2O concentration and the total gas volume flow can be carried out in the tail gas stream after the abatement of N_2O emissions throughout the crediting period of the project activity.

c) No law or regulation which mandates the complete or partial destruction of N_2O from nitric acid plants exists in the host country where the project activity is implemented.[1]

d) Sustainable development: The project should align with the host country's sustainable development goals (SDGs) and contribute to the achievement of the NDC of the host country, ensuring that activities are both environmentally and socially responsible.

e) Monitoring, Reporting and Verification (MRV) systems: Projects must have robust MRV systems in place to track emissions reductions, monitor project performance, and ensure that the environmental benefits are accurately accounted for.

In addition, the applicability conditions included in the tools referred to below apply.

B.3. Sources and references

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List of methodologies: This baseline and monitoring methodology is based on elements from the following approved methodologies:

a) Large-scale consolidated CDM methodology: ACM0019: N_2O abatement from nitric acid production, version 04.0

[1] The validity of the original baseline shall be reassessed at the time of each renewal of crediting period.

List of methodological tools: This methodology refers to the latest versions of approved Article 6.4 tools and/or CDM tools that were updated to be applicable under Article 6.4:

a) CDM methodological tool: Tool to determine the mass flow of a greenhouse gas in a gaseous stream

b) CDM methodological tool: Tool to calculate project or leakage CO2 emissions from fossil fuel combustion

c) Article 6.4 Sustainable development tool

Source of data or information: The following table summarizes the major sources:

Parameter	Unit	Source
N_2O baseline emission factor for nitric acid plants in year y	kg N_2O/t HNO_3	IPCC 2019 Refinement to the 2006 IPCC Guidelines for National GHG Inventories[2] (hereinafter called “IPCC 2019”)
Nitric acid produced in year y	t HNO_3	Automated Monitoring System
Number of hours of operation in year y	h	Automated Monitoring System
Number of hours (h) in year y where: a. Secondary N_2O abatement system was not installed, underperforming or failed; b. Tertiary N_2O abatement system is by-passed, underperforming or failed	h	Calculated
Global warming potential of N_2O	t CO_2e/t N_2O	Relevant decisions by the CMA

B.4. Definitions

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The definitions contained in the Article 6.4 Mechanism Glossary of Terms shall apply. For the purpose of this mechanism methodology the following definitions apply:

a) **Secondary N_2O abatement** refers to the installation of a catalyst inside the ammonia burner unit with the sole purpose of removing N_2O emissions from the stream.

b) **Tertiary N_2O abatement** refers to the installation of an abatement system in the tail-gas leaving the absorption column of a nitric acid plant to destroy the N_2O generated in the ammonia burner unit.

B.5. Baseline methodology

B.5.1. Activity boundary

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

If the project activity introduces only secondary and no tertiary N_2O abatement, then the only gas to be included as project emissions is the N_2O that is not destroyed and is still present in the tail gas stream of the plant. The secondary N_2O abatement takes place in the ammonia oxidation reactor (AOR). The situation using a secondary abatement technology is illustrated below in Figure 1.

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

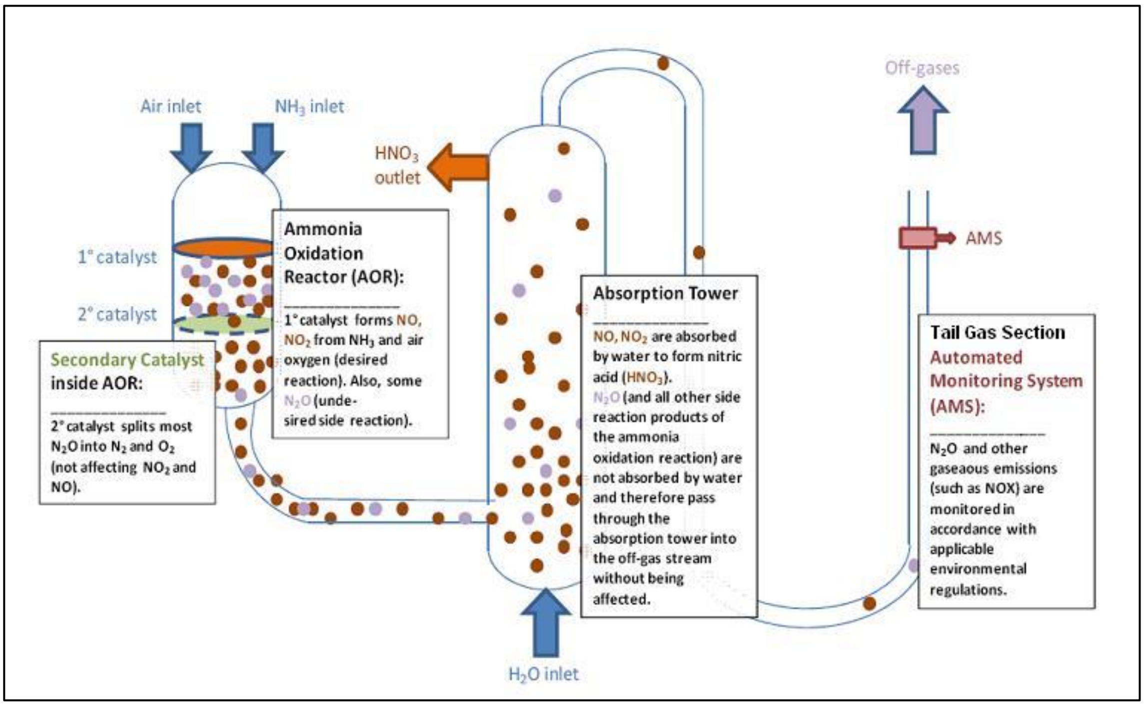

Figure 1. Project boundary if the project activity includes the introduction of a secondary N_2O abatement measure (simplified standard nitric plant layout displaying the location of the N_2O abatement catalyst, process sources of N_2O and the sampling point location for the Automated Monitoring System (AMS))

If the project activity introduces tertiary N_2O abatement, then any remaining N_2O emissions from the project plant and CO_2 emissions arising from the operation of the tertiary N_2O abatement system are included as project emissions in the project boundary. The tertiary N_2O abatement takes place in the tail gas stream. The situation using a tertiary N_2O abatement technology is illustrated below in Figure 2.

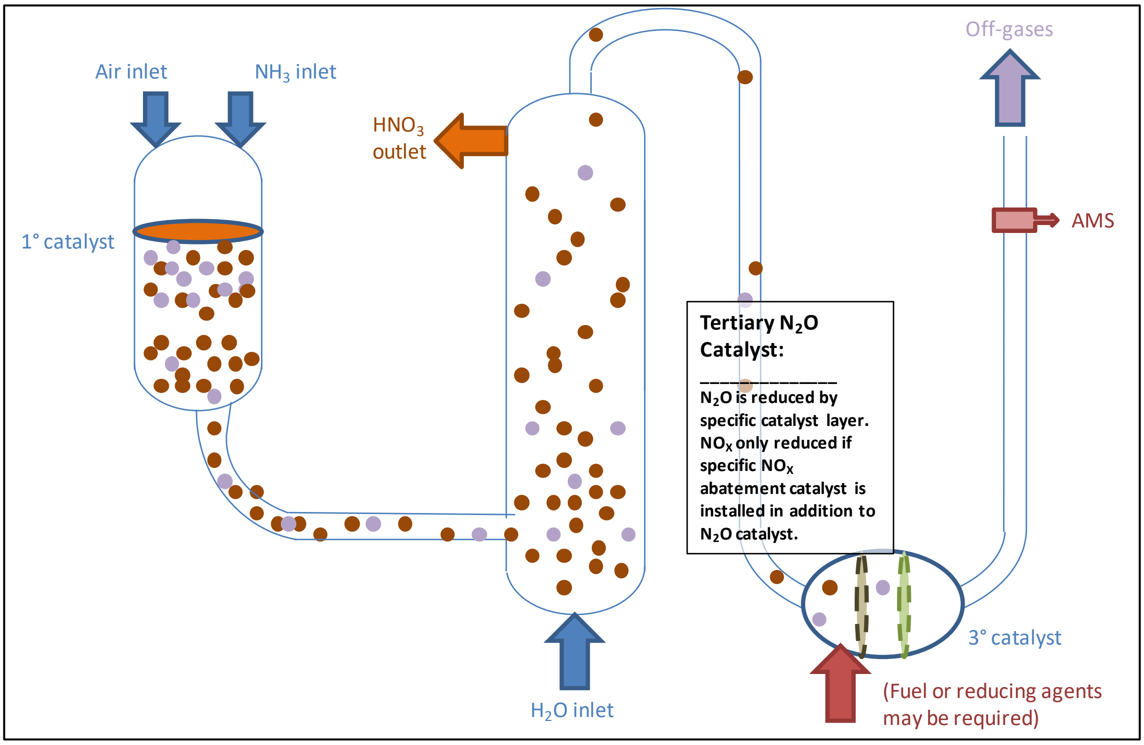

Figure 2. Project boundary if the project activity includes the introduction of a tertiary N_2O abatement measure (simplified standard nitric plant layout displaying the location of the N_2O abatement catalyst, process sources of N_2O and the sampling point location for the Automated Monitoring System (AMS))

B.5.2. Baseline emissions or removals

Source	GHG[3]		Justification/Explanation
NH_3 oxidation at the primary catalyst gauze	CO_2	☐ Included ☒ Not included	The project activity has no influence on these types of emissions, if present
	CH_4	☐ Included ☒ Not included	The project activity has no influence on these types of emissions, if present
	N_2O	☒ Included ☐ Not included	Included, main emission source

B.5.3. Activity emissions or removals

Source	GHG		Justification/Explanation
NH_3 oxidation at the primary catalyst gauze	CO_2	☐ Included ☒ Not included	The project activity has no influence on these types of emissions, if present
	CH_4	☐ Included ☒ Not included	
	N_2O	☒ Included ☐ Not included	Included, main emission source
Operation of a tertiary N_2O abatement facility	CO_2	☒ Included ☐ Not included	In some cases, fossil fuels are used as reducing agent and/or for decomposing the tail gas as part of a tertiary N_2O abatement facility. In this case the fossil fuels are mainly converted to CO_2. CO_2 emissions arising from the production of ammonia are assumed to be small and not taken into account.
	CH_4	☐ Included ☒ Not included	
	N_2O	☒ Included ☐ Not included	Included

B.5.4. 'Business-as-usual' (BAU) scenario

B.5.4.1. Identification of the BAU scenario

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Nitrous oxide (N_2O) is an unwanted by-product of the manufacture process of nitric acid (HNO_3), where it is formed alongside the main product nitric oxide (NO) during the catalytic oxidation of ammonia (NH_3). The plant operator has no economic incentives to take any N_2O abatement measures, because this entails significant capital and operating costs, but no financial benefits. Hence, the "business-as-usual" (BAU) scenario shall be calculated considering the following alternatives:

a) Continuation of the historical situation (pre-activity scenario);

b) Establishment of an economically viable technology and/or practice;

c) A scenario combining (a) for the remaining lifetime of the existing equipment and/or practice, followed afterwards by (b); or

d) Only when it is justified that the previous alternatives are not suitable, another relevant scenario in line with the applicable principles and requirements set out in setting the baseline in mechanism methodologies standard.

[3] Refer to Appendix 1 of A6.4-STAN-AC-002 and A6.4-STAN-AC-004.

B.5.4.2. Calculation of the BAU emissions or removals

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BAU baseline emissions are calculated as follows:

$$BE_{BAU,y} = P_{production,y} \times EF_{BAU} \times h_y \times GWP_{N2O} \times 10^{-3}$$ Equation (1)

Where:

Parameter		Description	Source of data
$BE_{BAU,y}$	=	BAU baseline emissions in year *y* (t CO_2e)	Calculated
$P_{production,y}$	=	Production of nitric acid in year *y* (t HNO_3)	Measured
EF_{BAU}	=	Default BAU baseline N_2O emission factor acc. to the operating pressure of ammonia burner (related to 100 % pure acid) (kg N_2O/t HNO_3)	IPCC 2019
GWP_{N2O}	=	Global Warming Potential of N_2O	Relevant decisions by the CMA
h_y	=	Number of hours in year *y* during which the plant was in operation (h)	Measured

To calculate BAU baseline emissions as per above equation, neither assumptions nor sampling were made.

B.5.5. Baseline scenario

B.5.5.1. Baseline approach from paragraph 36 of the RMPs

☐ 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.

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Step 0: Scope – Social, economic, environmental and technological circumstances

An N_2O abatement facility in nitric acid plants promotes environmental protection, offers technological innovations, and influences social welfare by creating jobs, improving air quality, and ensuring sustainability. Social, economic, environmental, and technological impacts of N_2O abatement facilities are interconnected, creating a holistic effect that benefits both the plant and the broader community.

Step 1: Best performable comparable activities

Activity	kg N_2O / t HNO_3	Reference	Best performable comparable activities with similar output
Low pressure NA plant	5.00	IPCC 2019	Production of nitric acid
Medium pressure NA plant	7.00	IPCC 2019	Production of nitric acid
High pressure NA plant	9.00	IPCC 2019	Production of nitric acid

Step 2: Ambitious benchmark justification

The proposed baseline scenario is achieving ambitious benchmark approach by considering potential future technology improvement that might take place in the nitric acid sector by decreasing the default baseline N_2O emission factor over time distinguishing between low, medium and high-pressure ammonia burners. Mitigation activities using these emission factors therefore might receive fewer credits than they reduce emissions, resulting in a net mitigation benefit. Further details are mentioned in table 2 below.

Step 3: Availability of data required

Ambitious benchmark approach is applied based on the IPCC 2019 taking into consideration technology development with gradual decreasing of N_2O emission factor over time. Nevertheless, no assumptions have been made to justify the selected baseline scenario.

B.5.5.2. Identification of the baseline scenario

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The following alternatives for the baseline scenario must be considered:

1) Scenario 1: Continued N_2O emissions without any abatement

   In the absence of legal regulations requiring the abatement of N_2O emissions, the operator of the nitric acid plant has no economic incentives to take any N_2O abatement measures, because this entails significant capital and operating costs, but no financial benefits.

2) Scenario 2: Installation and operation of secondary abatement technology to reduce N_2O emissions

3) Scenario 3: Installation and operation of tertiary abatement technology to reduce N_2O emissions

Activity participants shall identify and list, which of these alternatives comply with mandatory regulations for nitric acid production, air emission standards, or other relevant regulatory frameworks in the Host Party. Where Scenario 1 is not a plausible alternative and either secondary or tertiary abatement is the most likely alternative, the project is not considered additional. Where Scenario 1 is the most plausible scenario, it is identified as the baseline scenario, and activity participants shall proceed with the additionality analysis.

B.5.5.3. Calculation of baseline emissions or removals

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Baseline emissions are calculated as follows:

$$BE_y = P_{production,y} \times EF_y \times \frac{(h_y - h_{r,y})}{h_y} \times GWP_{N2O} \times 10^{-3} \quad \text{Equation (2)}$$

Where:

BE_y	=	Baseline emissions in year *y* (t CO_2e)
$P_{production,y}$	=	Production of nitric acid in year *y* (t HNO_3)
EF_y	=	Baseline N_2O emission factor for nitric acid production in year *y* (kg N_2O/t HNO_3)
GWP_{N2O}	=	Global Warming Potential of N_2O valid for the commitment period
h_y	=	Number of hours in year *y* during which the plant was in operation (h)

$h_{r,y}$ = Number of hours (h) in year *y* where:

a) Secondary N_2O abatement system was not installed, underperforming or failed;

b) Tertiary N_2O abatement system is by-passed, underperforming or failed

Determination of baseline emission factor (EF_y)

$$EF_y = Min(EF_{default\ adjusted,y};\ EF_{BAU}) \quad \text{Equation (3)}$$

Where:

EF_y = Baseline N_2O emission factor for nitric acid production in year *y* (kg N_2O/t HNO_3)

$EF_{default\ adjusted,y}$ = Adjusted default baseline N_2O emission factor for nitric acid production in year *y* (kg N_2O/t HNO_3)

EF_{BAU} = Default BAU baseline N_2O emission factor acc. to the operating pressure of ammonia burner (related to 100 % pure acid) (kg N_2O/t HNO_3)

Parameter $EF_{default\ adjusted,y}$ shall be determined as per section B.5.5.5.

Calculation of $h_{r,y}$

An abatement system is deemed to be by-passed, not working, underperforming or failed in the hour *h* in year *y* if:

$$F_{N2O,tail\ gas,h} > EF_{default,y} \times P_{NA,h} \quad \text{Equation (4)}$$

Where:

$P_{NA,h}$ = Nitric acid produced in the hour *h* (t HNO_3)

$EF_{default,y}$ = Default baseline N_2O emission factor for nitric acid production in year *y* (kg N_2O/t HNO_3)

$F_{N2O,tailgas,h}$ = Mass flow of N_2O in the gaseous stream of the tail gas in the hour *h* (kg N_2O/h)

B.5.5.4. Difference between BAU and baseline emissions or removals

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Activity participants shall calculate the difference between the ex-ante downward adjusted baseline emissions calculated based on section 5.5.3. and 5.5.5., and the conservative BAU baseline emissions calculated based on section 5.4.2. as an annual and total amount with respect to the crediting period. In case the conservative BAU baseline emissions are lower than the downward adjusted baseline emissions for any calendar year or cumulatively over the crediting period, activity participants are requested to increase the downward adjustment to ensure that the downward adjusted baseline emissions are at least as low as the conservative BAU baseline emissions for each calendar year and cumulatively for the crediting period.

Activity participants are further requested to compare ex-post for each individual calendar year during the crediting period, the ex-post calculated downward adjusted baseline emissions for the year and the ex-post calculated conservative BAU baseline emissions for the same year and confirm that the downward adjusted baseline emissions are lower than the conservative BAU baseline emissions. If it is not, then the conservative BAU baseline emissions shall be used for that calendar year.

B.5.5.5. Application of downward adjustment

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This mechanism methodology is considering potential future autonomous technology improvement that might take place in the nitric acid production sector by having introduced a decreasing emission factor ($EF_{default,y}$) over time. In detail, it incorporates a annual default emission factor that declines by 0.2 kg N_2O/t HNO_3 (distinguishing between low, medium or high-pressure ammonia burners), which taper off annually until they reach 2.5 kg N_2O/t HNO_3.

The applied downward adjustment shall achieve the following:

- The downward adjustment shall apply in all calendar years following the start date of the first crediting period, unless an exemption in specific circumstances is approved by the Supervisory Body.
- The downward adjustment applied in subsequent years shall increase over time to encourage ambition over time and ensure that the baseline is below BAU.
- The annual increase in the downward adjustment shall correspond to 1% of the baseline emissions in the calendar year of the start date of the first crediting period.

B.6. Activity emissions or removals

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Project emissions include emissions of N_2O, which have not been destroyed by the project activity, and in case of the installation of a tertiary N_2O abatement facility, CO_2 emissions resulting from the operation of the N_2O abatement facility. They are calculated as follows:

$$PE_y = PE_{N2O,y} + PE_{CO2,tertiary,y}$$ Equation (5)

Where:

PE_y	=	Project emissions in year *y* (t CO_2e)
$PE_{N2O,y}$	=	Project emissions of N_2O from the project plant in year *y* (t CO_2e)
$PE_{CO2,tertiary,y}$	=	Project emissions of CO_2 from the operation of the tertiary N_2O abatement facility in year *y* (t CO_2)

<u>Project emissions of N_2O from the project plant ($PE_{N2O,y}$)</u>

The amount of N_2O emissions from the project activity are emissions from the N_2O contained in the tail gas stream of the plant which is released to the atmosphere. Accordingly, $PE_{N2O,y}$ is determined as follows:

$$PE_{N2O,y} = \sum_{1}^{h_y - h_{r,y}} F_{N2O,tail\ gas,h} \times GWP_{N2O} \times 10^{-3}$$ Equation (6)

Where:

$PE_{N2O,y}$	=	Project emissions of N_2O from the project plant in year *y* (t CO_2e)
GWP_{N2O}	=	Global warming potential of N_2O valid for the commitment period
$F_{N2O,tailgas,h}$	=	Mass flow of N_2O in the gaseous stream of the tail gas in the hour *h* (kg N_2O/h)
h_y	=	Number of hours in year *y* during which the plant was in operation (h)

$h_{r,y}$ Number of hours (h) in year *y* where:

(a) Secondary N_2O abatement system was not installed, underperforming or failed;

(b) Tertiary N_2O abatement system is by-passed, underperforming or failed

Determination of $F_{N2O,tailgas,h}$:

The amount of N_2O emissions from the tail gas stream of the project plant shall be determined using the latest approved and/or under Article 6.4 updated version of "Tool to determine the mass flow of a greenhouse gas in a gaseous stream". In applying the tool, the following provisions apply:

(a) Throughout the crediting periods of the project activity, the N_2O concentration and volume or mass flow of the tail gas are to be monitored continuously. The monitoring system is to be installed and maintained throughout the crediting period based on the European Norm 14181 (2015) or any recent update of that standard, or any equivalent national standard;

(b) The monitoring system should provide separate hourly average values for the N_2O concentration and the volume or mass flow of the tail gas based on two seconds (or shorter) interval readings that are recorded and stored electronically. These N_2O data sets shall be identified by means of a unique time/date key indicating when exactly the values were observed;

(c) 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 EN14181 must be applied to both the N_2O concentration and the volume or mass flow of the tail gas. This can either be applied automatically to the raw data recorded by the data storage system at the plant or it can be applied to the calculated hourly averages as part of the calculation of project emissions;

(d) If data for either the N_2O concentration or the volume or mass flow of the tail gas are not available for more than 1/3 of any hour while the plant was in operation, the value for that hour shall be replaced with the maximum value of N_2O concentration or volume or mass flow of the tail gas observed during the monitoring period. If data for neither the N_2O concentration nor the volume or mass flow of the tail gas are available for more than 1/3 of any hour while the plant was in operation, the maximum value of mass flow of N_2O calculated during the monitoring period shall be applied to any such hour. Values observed during five operating hours before and after a plant start-up and shut-down shall not be used for the determination of the maximum values;

(e) 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 do not need to be monitored except, if applicable, for the purpose of determining the moisture content in the gaseous stream.

Project emissions from the operation of the tertiary N_2O abatement facility ($PE_{CO2,tertiary,y}$)

This emission source only needs to be estimated if a tertiary N_2O abatement facility is installed under the project activity and if fossil fuels are used to operate the facility or re-heat the gas after the facility. The emissions related to the operation of the N_2O destruction facility include only onsite emissions due to the fossil fuel use as input to the N_2O destruction facility:

$$PE_{CO2,tertiary,y} = PE_{FF,y} \quad \text{Equation (7)}$$

Where:

$PE_{CO2,tertiary,y}$	=	Project emissions of CO_2 from the operation of the tertiary N_2O abatement facility in year *y* (t CO_2)
$PE_{FF,y}$	=	Project emissions related to fossil fuel input to the destruction facility and/or re-heater in year *y* (t CO_2)

Activity participants shall use the latest approved and/or under Article 6.4 updated version of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" to calculate the project emissions related to fossil fuels used in year *y*. Specific guidance on the use of the tool:

(a) The parameter $PE_{FC,j,y}$ used in the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" corresponds to the parameter $PE_{FF,y}$ in this methodology; and

(b) The element process *j* in the tool corresponds to the consumption of fossil fuels for the operation of the tertiary N_2O abatement facility and/or the re-heating of the tail gas.

Assumptions and source of data

- This methodology doesn't include assumptions, all relevant parameters are included and fully described, and for unavailable data a conservative recalculation approach is given.
- Parameters are measured by calibrated instruments, which undergo maintenance and calibration routines based on the manufacturer specifications and in accordance with relevant approved standards (Article 6.4 validation and verification standards for projects, etc.).
- N_2O emission factors (e.g. $EF_{default,y}$) are based on IPCC guidelines.

B.7. Leakage

B.7.1. Identifying and addressing leakages

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Any leakage emissions sources are deemed to be negligible.

B.7.2. Estimation of emission leakages

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Any leakage emissions sources are deemed to be negligible.

B.8. Determination of emission reductions or net removals

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Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad \text{Equation (8)}$$

Where:

ER_y	=	Emission reductions in year *y* (t CO_2e)
BE_y	=	Baseline emissions in year *y* (t CO_2e)
PE_y	=	Project emissions in year *y* (t CO_2e)

B.9. Demonstration of additionality

STEP 1. Demonstration of prior consideration

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The activity participants of a proposed A6.4 project shall inform the UNFCCC secretariat of seeking registration of the proposed A6.4 project under Article 6.4 mechanism. If the project as already started, the activity participants shall submit the prior consideration notification no later than 180 days after the start date of the project.

If the start date of a proposed A6.4 project is after 31 December 2020 and prior to the date of entry into force of version 01.0 of the “Article 6.4 activity cycle procedure for projects”, the activity participants shall, if they wish to seek registration of the project under the Article 6.4 mechanism, provide a prior consideration notification through the dedicated interface on the UNFCCC website no later than 180 days after the entry into force of version 01.0 of “Article 6.4 activity cycle procedure for projects”.

STEP 2. Regulatory Analysis

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The activity participants shall submit an analysis of regulation in the host country based on credible and current evidence and shall demonstrate and justify that the emission reductions resulting from an Article 6.4 activity would not occur as a result of any law or regulation, unless the law or regulation refers to or formally integrates the mechanism as an instrument for implementation.

The respective analysis shall be conducted at each renewal of crediting period.

STEP 3. Avoidance of locking-in the level of emissions

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The lifetime of an N_2O abatement is longer than the crediting period of an Article 6.4 mitigation activity. Therefore:

- The host country will benefit from the installed N_2O abatement technology even beyond the end of the Article 6.4 activity´s crediting period.
- Does not lead to the adoption or the prolongation of the lifetime of technologies or practices that are incompatible with long term goals of the Paris Agreement, taking into account different national circumstances, approaches and pathways;
- This mechanism methodology has been developed based on actual and reliable data of nitric acid plants taking into consideration the technologies, which achieve lower N_2O emission levels. This leads to lower emissions nationally and globally and contributes to achieve the long-term goals of the Paris Agreement. Hence, it can be ensured that crediting levels won´t undermine the host country’s achievement of NDCs and Long-term Low-Emission Development Strategy (LT-LEDS).

OPTION 1: FINANCIAL ADDITIONALITY AND COMMON PRACTICE ANALYSIS

STEP 4. Financial additionality

Sub-step 4.1. Investment Analysis

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In the absence of regulations requiring the abatement of N_2O emissions in the host country, the operator of a nitric acid plant has no economic incentives to take any N_2O abatement measures, because this would entail significant capital and operating costs, but no financial benefits. Hence, the income from selling certified and approved emission reductions generated by an Article 6.4 activity is the only income stream and motivation for an operator of a nitric acid plant to invest in an N_2O abatement measure.

Therefore, the Article 6.4 project activity is considered additional and the baseline scenario is that the N_2O is emitted to the atmosphere with no N_2O abatement measure being implemented.

Sub-step 4.2. Barrier Analysis

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Not applicable.

STEP 5. Common practice analysis

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Activity participants shall perform a common practice analysis for the region where the project activity is situated, including the following:

- Define a suitable indicator to assess common practice based on the technology used,
- Define an appropriate geographical boundary for assessing common practice, and
- Define the specification of an appropriately conservative threshold that may not be surpassed for an Article 6.4 activity to be deemed additional taking into consideration economic incentives and type of technology.

OPTION 2: PERFORMANCE-BASED APPROACH

STEP 4. Performance-based approach

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Not applicable.

B.10. Methodologies principles

B.10.1. Encouraging ambition over time

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Encouraging ambition over time is achieved by considering potential future autonomous technology improvement that might take place in the nitric acid production sector by having introduced a decreasing emission factor over time. In detail, this methodology incorporates a declining default baseline emission factor distinguishing between low, medium and high-pressure ammonia burners. These default values taper off annually until they reach 2.5 kg N_2O/t HNO_3, afterwards they remain constant. These values aim to avoid perverse incentives to use technologies that may result in higher N_2O formation. Mitigation activities using these emission factors therefore might receive fewer credits than they reduce emissions, resulting in a net mitigation benefit.

The respective baseline is considering a continuous ambition level by a steady reduction of the N_2O baseline emission factor over time.

Deployed technology and GHG levels

This methodology deploys the use of secondary or tertiary technology (catalytic reduction) for reducing N_2O in nitric acid plants. The respective technologies achieve significant N_2O reductions, cost-effectiveness, ease of integration, and low maintenance. Catalytic reduction (secondary or tertiary) has following advantages:

- **High efficiency:** Catalytic reduction can achieve high removal efficiencies for N_2O. This makes it a very effective technology for nitric acid plants
- **Selective reduction:** The catalysts are highly selective, meaning they specifically target the N_2O molecules and convert them to nitrogen and oxygen, without affecting other components of the tail gases.

- **Integration with existing plant:** Catalytic reduction systems are typically retrofit to existing nitric acid plants; these systems can be integrated into the existing tail gas treatment system without major modifications to the core production processes.
- **Energy efficiency:** Catalytic reduction, operate at relatively low temperatures, making them more energy-efficient than alternatives like thermal decomposition. This reduces the overall energy consumption of nitric acid plants, improving their economic sustainability.

B.10.2. Contributing to the equitable sharing of mitigation benefits between participating Parties

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It shall be noted that the lifetime of an N_2O abatement is longer than the crediting period of an Article 6.4 mitigation activity. Therefore, the host country will benefit from the installed N_2O abatement technology even beyond the end of the Article 6.4 activity´s crediting period.

It is mandatory to use the Sustainable development Tool in the activity design and implementation phase in order to demonstrate that the Article 6.4 mitigation activity supports the achievement of the host country´s sustainable development objectives and negative environmental or social impacts are avoided.

Furthermore, activity participants shall check, if the host Party´s Designated National Authority (DNA) has specified conditions for the equitable sharing of mitigation benefits between the project Parties and ensure that the host party benefits have retained.

B.10.3. Aligning with the NDC of each participating Party, if applicable, its LT-LEDS, if it has submitted one, the long-term temperature goal of the Paris Agreement and the long-term goals of the Paris Agreement

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This methodology has been developed based on actual and reliable data of nitric acid plants taking into consideration the technologies, which achieve lower N_2O emission levels. This leads to lower emissions nationally and globally, and contributes to achieve the long-term goals of the Paris Agreement. Hence, it can be ensured that crediting levels won´t undermine the host country’s achievement of Nationally Determined Contributions (NDCs) and Long-term Low-Emission Development Strategy (LT-LEDS).

B.10.4. Encouraging broad participation

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This mechanism methodology encourages broad participation by achieving the following:

(a) **Accuracy**: Mechanism methodology doesn't include assumptions, all relevant parameters are included and fully described, and for unavailable data a conservative recalculation approach is given.

(a) **Simple and clear**: Mechanism methodology uses simple equations to calculate the baseline emissions, project emissions and emission reductions with few monitoring parameters.

(b) **No constrains**: Mechanism methodology is open to be applied by all nitric acid plant operators in eligible host countries.

(c) **Data sources**: Mechanism methodology doesn’t use single data sources for the respective methodology parameters with conservative recalculation approach.

B.10.5. Including data sources, accounting for uncertainty and monitoring

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Mechanism methodology contains all monitoring parameters, which achieve the following:

(a) Transparent and comprehensible data source of monitoring parameters;

(b) No assumptions are made under the mechanism methodology and methodological tools;

(c) Data source and emission factor to calculate emission reduction con-sider IPCC guidelines as reference.

(d) All monitoring parameters apply quality assurance and quality control (QC/QA) measures in terms of operation and maintenance requirements for monitoring instruments/equipment.

B.10.6. Taking into account policies and measures and relevant circumstances

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Environmental regulations in the host country are part of the applicability criteria and the additionality determination of project activity for this mechanism methodology. Please refer to section B.9 above.

B.11. Reversals

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Reversals are not applicable for N_2O reduction projects in nitric acid plants.

B.12. Monitoring methodology

B.12.1. Data and parameters not monitored

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Data / Parameter table 1.

Data/parameter	**Operating pressure**
Description	Operating pressure of the ammonia burner
Data unit	kPa
Equations referred	Equation (1), Equation (2); Determination of ammonia burner pressure
Purpose of data	☒ Baseline emissions / removals ☐ Project emissions / removals ☐ Leakage emissions
Value(s) applied	The following table provides the different ranges of the ammonia burner: **Low pressure**: 0 – 200 kPa; **Medium pressure**: 200 – 600 kPa; **High pressure**: > 600 kPa
Source of data	☐ Measured ☒ Other sources
Choice of data or measurement methods and procedures	Manufacturer specifications

Low pressure	Medium pressure	High pressure
0 – 200 kPa	200 – 600 kPa	> 600 kPa

Additional comments	The parameter is used to determine whether the nitric acid plant operates at a low, medium or high pressure.

Data / Parameter table 2.

Data/parameter	**$EF_{default,y}$**
Description	Default baseline N_2O emission factor according to the operating pressure of the ammonia burner in year y (related to 100 % pure acid)
Data unit	kg N_2O/t HNO_3
Equations referred	Equation (2), Equation (3), Equation (4)
Purpose of data	☒ Baseline emissions / removals ☐ Project emissions / removals ☐ Leakage emissions
Value(s) applied	The emission factors for all plant types will decrease until they reach a value of 2.5 kg N_2O/t HNO_3. Afterwards emission factors will remain constant over time: (see table below)
Source of data	☐ Measured ☒ Other sources
Choice of data or measurement methods and procedures	IPCC 2019
Additional comments	The decrease in the value for the baseline emission factor over time is to reflect the technological development. The parameter $EF_{default,\ adjusted,y}$ is based on parameter $EF_{default,y}$ and is determined based on section B.5.5.5. above.

Year	Low pressure (0 – 200 kPa)	Medium pressure (200 – 600kPa)	High pressure (Over 600 kPa)
2021	4.80	6.80	8.80
2022	4.60	6.60	8.60
2023	4.40	6.40	8.40
2024	4.20	6.20	8.20
2025	4.00	6.00	8.00
2026	3.80	5.80	7.80
2027	3.60	5.60	7.60
2028	3.40	5.40	7.40
2029	3.20	5.20	7.20
2030	3.00	5.00	7.00
2031	2.80	4.80	6.80
2032	2.60	4.60	6.60
2033	2.50	4.40	6.40
2034	2.50	4.20	6.20
2035	2.50	4.00	6.00
2036	2.50	3.80	5.80
2037	2.50	3.60	5.60
2038	2.50	3.40	5.40
2039	2.50	3.20	5.20
2040	2.50	3.00	5.00

Data / Parameter table 3.

Data/parameter	**EF_{BAU}**
Description	Default BAU baseline N_2O emission factor acc. to the operating pressure of ammonia burner (related to 100 % pure acid)

Data unit	kg N_2O/t HNO_3
Equations referred	Equation (1), Equation (3)
Purpose of data	☒ Baseline emissions / removals ☐ Project emissions / removals ☐ Leakage emissions
Value(s) applied	Low pressure (0 – 200 kPa): 5.00; Medium pressure (200 – 600kPa): 7.00; High pressure (Over 600 kPa): 9.00
Source of data	☐ Measured ☒ Other sources
Choice of data or measurement methods and procedures	IPCC 2019
Additional comments	N/A

Low pressure (0 – 200 kPa)	Medium pressure (200 – 600kPa)	High pressure (Over 600 kPa)
5.00	7.00	9.00

Data / Parameter table 4.

Data/parameter	**GWP_{N2O}**
Description	Global warming potential of N_2O valid for the commitment period
Data unit	t CO_2e/t N_2O
Equations referred	Equation (1), Equation (2), Equation (6)
Purpose of data	☒ Baseline emissions / removals ☒ Project emissions / removals ☐ Leakage emissions
Value(s) applied	265
Source of data	☐ Measured ☒ Other sources
Choice of data or measurement methods and procedures	Relevant decisions by the CMA
Additional comments	-

B.12.2. Data and parameters monitored

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Data / Parameter table 5.

Data/parameter	**$P_{production,y}$**
Description	Nitric acid produced in year *y*
Data unit	t HNO_3
Equations referred	Equation (1), Equation (2), Equation (4)
Purpose of data	☒ Baseline emissions / removals ☐ Project emissions / removals ☐ Leakage emissions
Measurement methods and procedures	Measurements by activity participants and production reports
Entity/person responsible for the measurement	Not specified on methodological level

Measuring instrument(s)	*Type of instrument*	Not specified on methodological level
	Accuracy class	Not specified on methodological level
	Calibration requirements	Not specified on methodological level
	Location	Not specified on methodological level
Measurement intervals	Not specified on methodological level	
QA/QC procedures	Measurement devices such as weight scales shall follow QA/QC supplier recommendations.	
Additional comment	$P_{NA,h}$ (nitric acid produced in hour h) represents the hourly value of $P_{production,y}$ and is used for determining $h_{r,y}$.	

Data / Parameter table 6.

Data/parameter	**h_y**		
Description	Number of hours of operation in year y		
Data unit	h		
Equations referred	Equation (1), Equation (2) Equation (6)		
Purpose of data	☒ Baseline emissions / removals	☒ Project emissions / removals	☐ Leakage emissions
Measurement methods and procedures	Not specified on methodological level		
Entity/person responsible for the measurement	Not specified on methodological level		
Measuring instrument(s)	*Type of instrument*	Not specified on methodological level	
	Accuracy class	Not specified on methodological level	
	Calibration requirements	Not specified on methodological level	
	Location	Not specified on methodological level	
Measurement intervals	Not specified on methodological level		
QA/QC procedures	-		
Additional comment	Records to be maintained during the crediting period.		

Data / Parameter table 7.

Data/parameter	**$h_{r,y}$**
Description	Number of hours (h) in year y where: (a) Secondary N_2O abatement system was not installed, underperforming or failed; (b) Tertiary N_2O abatement system is by-passed, underperforming or failed
Data unit	h
Equations referred	Equation (2), Equation (6)

Purpose of data	☒ Baseline emissions / removals ☒ Project emissions / removals ☐ Leakage emissions	
Measurement methods and procedures	Not specified on methodological level	
Entity/person responsible for the measurement	Not specified on methodological level	
Measuring instrument(s)	*Type of instrument*	Not specified on methodological level
	Accuracy class	Not specified on methodological level
	Calibration requirements	Not specified on methodological level
	Location	Not specified on methodological level
Measurement intervals	Not specified on methodological level	
QA/QC procedures	Not specified on methodological level	
Additional comment	Records to be maintained during crediting period.	

B.12.3. Monitoring for activities involving removals and emission reduction activities with reversal risks

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This project activity doesn’t involve removals and emission reduction with reversal risks.

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