UNFCCC

CDM: Proposed new methodology expert form (version 04)

(To be used by methodology experts providing desk review for a proposed new methodology)

Name of expert responsible for completing and submitting this form	Urs Brodmann
Related F-CDM-NM document ID number	NM0117

Note to those completing this form, as applicable: Please provide recommendations on the proposed new baseline and monitoring methodologies based on an assessment of CDM-NMB and CDM-NMM and of their application in sections A to E of the draft CDM-PDD, desk reviews and public input. Please ensure that the form is entirely filled and that arguments and expert judgements are substantiated.

A. Evaluation of the proposed new methodologies by desk reviewers:

I. Evaluation of the porposed new baseline methodology:

Title of new baseline methodology:>>
Baseline methodology for catalytic N2O destruction in the reactor gas of nitric acid plants

Note: The proposed methodology is very similar to NM0111. *Text in italics* below denotes quotes from the desk review of NM0111 by U. Brodmann.

i. Conditions under which this methodology is applicable to other potential projects (e.g. project type, region, data availability):

>>The methodology is applicable across regions for projects which reduce N2O emissions at existing nitric acid plants through catalysts placed anywhere between the platinum gauzes of the ammonia burner and the inlet of the absorption tower ("secondary approaches"). The methodology is not applicable to activities which prevent N2O formation in the ammonia burner ("primary approaches"), or destruct N2O in the tail gas ("tertiary approaches").

The conditions specified in NMB Section A.3 apply, but should be modified as follows:
"4. The project activity (...) will not lead to an increase in any other GREENHOUSE gases present in the waste gas stream."

As it stands, the methodology should be restricted to existing nitric acid production capacity. It should not be applicable to new plants, nor to capacity expansions at existing plants, due to the following reasons:
– In the case of new nitric acid production lines, the methodology does not provide sufficient guidance for defining the baseline scenario with respect to production technology.
– Applicability to new capacity could result in a shift of nitric acid production from Annex 1 to non-Annex 1 countries, due to the relevant impact of CERs on overall revenues.

ii. Strengths and weaknesses of the methodology:

>> Strengths:
– Ex-post approach accounts for variations in N2O formation between plants and over time.

Weaknesses:
– Methodology fails to account for decomposition of N2O in the baseline scenario, downstream of the platinum gauzes due to high temperatures, pressure and presence of catalyst traces (platinum depositions).

– The proposed ex-post determination of the baseline based on monitored N2O streams opens room for gaming:
** At existing facilities, operational parameters (pressure, temperature, type and renewal rate of catalysts, plant load factor, etc.) may be changed so at to maximize N2O formation in the ammonia burner.*
** At new facilities, the possibility to earn CER revenues may influence the investment decision towards technologies with higher specific N2O formation rates in the ammonia burner.*

iii. Any changes needed to improve the methodology:

a. Minor changes:>>

– All formulas should be numbered.
– The formulas for calculation of N2O mass flows are misleading, because they imply that mass flows for a year may be calculated by multiplying the average tail gas volume flow rate with the average N2O concentration and the operation time of the destruction facility in that period. However, this would not be mathematically correct. Instead, annual mass flows must be calculated by summation of the mass flows in each monitoring interval of the online analyzer, which could be e.g. every 5 minutes. All formulas in the NMB relating to N2O mass streams (especially Section D.6) should be changed accordingly. In addition, the methodology should provide a better definition of the operation hours (M_h) (operation of what?). Operation hours may be removed from the formulas if summation is done only over those intervals for which measurements are available.

Regarding additionality test (Section D.3):
– The methodology should refer to the relevant sections of the additionality tool, rather than reproducing whole sections.
– The role of national or sectoral policies and regulations for control of NOx emissions should be addressed in more detail. Ensure that the selected baseline scenario complies with existing NOx regulation. In cases where new NOx regulation is introduced after the project start, it should only be accounted for once the baseline is re-validated. Revision of the baseline during the crediting period for NOx policies should not be required.

The description of the leakage section should be improved (Section D.8):
– Explain the term “utility usage”, distinguishing fuels, electricity and reducing agents;
– Delete unnecessary leakage terms in formulas of Section D.9

b. Major changes:>>

1) Adjust the baseline emissions level in a transparent and accurate way for decomposition of N2O after formation, i.e. downstream from the platinum gauzes of the ammonia burner.

2) The baseline N2O emissions rate per tonne of nitric acid produced should be capped at a conservative level, in order to minimize the incentive for plant operators for increasing N2O formation in the ammonia burner via operational parameters. Specify the time period for which the cap applies (e.g. cap on yearly average emissions rate). Caps should be differentiated by production technology.

3) Explicitly restrict the methodology to existing production capacity of nitric acid. In order to become applicable to project activities in new facilities, the methodology would need to be modified as follows:
– The methodology should provide for a convincing demonstration that no other production technology with lower N2O formation would be installed in the absence of the project activity. Only then will the proposed ex post measurement of N2O formation result in an adequate baseline for new plants.
– Alternatively, the baseline N2O emissions rate for new plants may be predefined ex ante, based on a convincing identification of the most likely technology scenario in the absence of the project activity.
– In any case, the risk of CER revenues leading to a shift of nitric acid production from Annex-1 to non-Annex-1 countries should be addressed.

II. Evaluation of the proposed new monitoring methodology:

Title of new monitoring methodology: >>
Monitoring methodology for catalytic N2O destruction in the reactor gas of nitric acid plants.

i. Conditions under which this methodology is applicable to other potential projects (e.g. project type, region, data availability):

>> Applicable to other projects for secondary destruction of N2O in existing nitric acid plants. Applicability to project activities in new nitric acid plants remains to be determined in the light of an improved NMB. Not applicable to primary and tertiary approaches for N2O abatement.

ii. Strengths and weaknesses of the methodology:

>> No particular strengths and weaknesses identified.

iii. Any changes needed to improve the methodology:

a. Minor changes:>>

– The calculation of the reactor gas flow from ammonia and air flows should account for the impact of chemical reaction (combustion) on gas flows.
– The location of the tail gas sampling point should be described more precisely. If an SCR DeNOx unit is installed, sampling must occur downstream to account for possible increases in N2O.

– Formulas for quantification of N2O mass streams should be changed as required for the NMB.
– If a cap rate on the baseline N2O emission (in kg /t nitric acid) is introduced, indicate QA/QC procedures required to ensure that nitric acid production is quantified accurately for short time periods (monitoring intervals).

– Relics from NM0117 should be removed. E.g., DF_O_E_p should be deleted in Section B.2.2.
– Parameter B2 in Section B.2.3 should be re-named from N2O_co_RG_O to

N2O_co_RG_I, to ensure consistency with formulas in Section B.2.4.
– The term (L_N2O_p * GWP_N2O) in Section B.5 should be deleted or explained.

b. Major changes:>>

Adjust in line with the major changes requested for the NMB.

The uncertainty of N2O analysis in the reactor gas should be addressed in more detail:
– Is it possible to reliably sample and analyze reactor gas at the prevailing harsh conditions (high temperature, pressure, corrosiveness)?
– Specify minimum availability rate for the sampler and on-line analyzer;
– Location and minimum number of sampling points, since reactor gas will not necessarily be well-mixed immediately after the gauzes.
– Uncertainty of N2O analyses as well as gas flow measurements and calculations should be substantiated in Section B.7. How low (in % at given confidence interval) is "low" uncertainty?

B. Details of the evaluation of the proposed new methodology by the desk reviewer:

I. Proposed new baseline methodology *(specify title here):* >>
Baseline methodology for catalytic N2O destruction in the reactor gas of nitric acid plants

(1) Short description of the methodology, including an assessment of which approach from paragraph 48 of the CDM modalities and procedures was used:

a) Describe the methodology:

\>> *The proposed project activity aims at reducing nitrous oxide (N2O) emissions at a nitric acid plant. Production of nitric acid typically involves three main steps:*
1) Oxidation of ammonia (NH3) with oxygen (O2) to produce nitric oxide (NO)
2) Oxidation of NO with O2 to produce nitrogen dioxide (NO2)
3) Reacting NO2 with water ("absorption) to produce nitric acid (HNO3)

N2O is formed as an unintended by-product of step 1. According to the methodology, N2O is an inert gas which passes through the subsequent steps unchanged and is released to the atmosphere with the tail gas, unless adequate control equipment is installed. Please note Section 2.b) below for reservations regarding the alleged stability of N2O in the subsequent steps.

The proposed methodology is intended for project activities which aim at destructing N2O in the reactor gas of nitric acid plants by installing a special catalyst anywhere between the platinum gauzes of the ammonia burner and the entry of the absorption tower (="secondary" approach for N2O destruction). The catalyst decomposes N2O into N2 and O2. In the underlying project activity, the catalyst is placed in the ammonia burner, immediately after the platinum gauzes.

The methodology assumes that the project activity has no influence on the amount of N2O formed. Consequently, baseline emissions are quantified ex post based on the volume and N2O content of the reactor gas stream entering the destruction facility. To this end, continuous online monitoring of the reactor gas is required.

Project emissions are determined based on the monitored volume and N2O content of the tail gas after the destruction facility. Operation of the destruction facility is assumed not to result in any other emissions (e.g., no consumption of fuels, electricity, or reducing agents).

Emission reductions are calculated as the difference between the baseline and project emissions. No leakage of emissions outside the project boundary is expected.

b) State the approach selected:

>>*48.a), existing actual or historical emissions*

c) Indicate (in summary form) why the approach selected is the most appropriate. Please provide your expert judgement on the appropriateness of the selected approach to the project category:

>> *The proposed approach of quantifying the baseline emissions ex post, based on the monitored volume and N2O content of the reactor gas entering the destruction facility, indeed falls under 48.a).*

For existing nitric acid plants, this approach seems appropriate for two reasons:
– It accurately reflects the specific N2O formation level in the project plant, and variations in N2O formation over time; and
– In cases where the project activity displaces an existing SCR DeNOx unit, it is conservative because it does not account for the slight increase in N2O formation which can result from application of the SCR technology.

For new installations, however, 48.a) and the chosen ex-post approach is probably not the most appropriate, because CDM registration may have a relevant impact on the investment decision, i.e. on the type of nitric acid production technology installed. Therefore, 48.b) may be more appropriate for new installations. This is further discussed below.

(2) Basis for determining the baseline scenario:

a) State whether the documentation explains how the baseline scenario is to be chosen and identified:

>>*The methodology does not involve a proper selection of a "most likely" baseline scenario from a range of possible scenarios. Rather, the "existing technology" (without any N2O abatement) seems effectively pre-defined as the baseline scenario.*

NMB Section D.1 describes the process for selecting the baseline scenario. It states: "The first step in determining the baseline scenario is to analyse all options available to project participants. (...) The first step includes the continuation of the status quo, the proposed project scenario, and any other scenario that might be applicable" (emphasis added by reviewer). However, the methodology does not provide any guidance on how such "other applicable scenarios" should be identified, and based on which criteria they should be assessed, except for a statement in the additionality test section (D.3, Sub-step 2.b) that "All other plausible and credible alternatives to the project activity that deliver outputs and / or services with comparable quality, properties and application areas" should be identified for the purpose of analyzing the financial viability of the project activity.

In line with this, the basic approach of quantifying baseline emissions from the ex post-monitored N2O stream at the destruction facility essentially precludes any baseline scenarios other than the "existing technology" or "status quo". As mentioned above, this may well be appropriate for existing nitric acid plants, but it is probably less so for new facilities (or new production capacity).

b) State the basic underlying rationale for algorithms/formulae used (e.g. marginal vs. average basis) (see also section 4 below):

>>

1) The basic underlying rationale is that ex post measurement of N2O formation and N2O destruction rates is the most accurate and conservative approach, given the relatively large variations of N2O formation between plants and over time.

2) Another key assumption is that N2O, once formed in the ammonia burner, is 100% stable and passes through all subsequent steps of the production line unchanged. This assumption seems not plausible for the following reasons:

– N2O decomposes into N2 and O2 at temperatures over 575°C and atmospheric pressure. Pressurized N2O can already decompose at temperatures equal or greater than 300° (Source: S12, Section 10). In nitric acid production, ammonia is typically oxidized at temperatures between 750 and 900 °C (S9, p.8.8-1), and tail gas temperature is reported to be 420°C in the case of NM0111 (S14, p.7). Pressures can vary in a wide range depending on the plant design. For mono-pressure processes, technology supplier UHDE (S8 p.6) indicates 4–12 bar while EPA (S9 p.8.8-3) indicates 1–14 bar. For the first stage in dual-pressure processes, UHDE indicates 4-6 bar and EPA indicates <1- 4 bars.

– Traces of the platinum used as catalyst in the ammonia burner are likely to be deposited downstream (see e.g. S13, p.39). Platinum can accelerate the decomposition of N2O (S12).

Overall, the environment (temperature, pressure, traces of catalysts) in and downstream of the ammonia burner of nitric acid plants seems clearly conducive to a partial decomposition of N2O after formation, i.e. after the platinum gauzes of the ammonia burner. This puts into question whether the measurement of N2O concentrations immediately after the platinum gauzes, as proposed by the methodology, provides an adequate indicator of the baseline emissions at the stack. In the absence of any corrections for downstream decomposition, this approach is likely to lead to an overstatement of the baseline emissions.

c) State whether the documentation explains how, through the use of the methodology, it can be demonstrated that a project activity is additional and therefore not the baseline scenario. If so, what are the tools provided by the project participants?

>>*The methodology (Section D.3) provides an additionality test which heavily draws on the tool adopted by EB 16. Four conditions must be fulfilled:*

Condition:	*Corresponding step of EB Additionality Tool*
1. Compliance with N2O regulation at project start.	*Step 1 (w/o identifying lawful alternatives)*
2. Project activity is not common practice.	*Step 4 (largely literal quote)*
3. Project activity not commercially viable w/o CERs	*Steps 2 and 1a (largely literal quote)*
4. CER revenue makes project activity financially viable.	*Step 5*

As an additional key element, the methodology provides for monitoring of N2O regulation during the crediting period. Regulatory requirements to control N2O emissions will be incorporated in the baseline from the moment where implementation of such control becomes mandatory.

d) State whether the basis for determining the baseline scenario and for assessing additionality is appropriate and adequate:

>>

BASELINE SCENARIO

The basis for selection of the baseline scenario is adequate for project activities in existing nitric acid plants. However, the issue of N2O decomposition must be addressed.

As regards activities in new plants, the basis for selection of the baseline scenario is not adequate, because the technical design of a nitric acid plant can have a relevant influence on the amount of N2O formed (before any N2O destruction). N2O formation depends, in particular, on the pressure, temperature and type of catalyst used in the ammonia burner ¨(S4 p. 2.17 and S9 p.8.8-1). These parameters can vary depending on the technical design of a nitric acid plant. For example, UHDE offers a medium pressure process, a high pressure process, and a dual-pressure process (S8). A high-pressure process leads ceteris paribus to higher N2O formation than the other two processes (see PDD p.8).

Under these circumstances, identification of the technology which would most likely be installed in the absence of the project activity is crucial for new nitric acid plants. This baseline technology will not necessarily be the same as the one installed in a project activity, because CER revenues may have a material influence on the technology investment decision. The proposed approach of measuring baseline N2O formation ex post will create an incentive to install technology which maximizes N2O formation in the ammonia burner, and associated revenues from N2O destruction.

The relevance of this incentive to game the baseline is illustrated by the size of the potential CER revenue streams. According to rough estimations of the reviewer, gross CER revenues (before abatement and transaction costs) could correspond to 4–21% of the market value of the main product nitric acid. N2O formation rates, CER price and nitric acid prices are the key parameters determining this range (see Section 13.b below for details). This illustrates that CER revenues will likely have a material influence on investment decisions, although the influence need not be decisive in all situations.

The conclusion for new nitric acid plants is the following:

1. The methodology should be explicitly restricted to existing capacity; OR

2. If the methodology is to be applicable to new capacity, it should provide for a convincing demonstration that no other production technology with lower N2O formation would be installed in the absence of the project activity. Only then will the proposed ex post measurement of N2O formation result in an adequate baseline. Alternatively, the baseline N2O emissions rate for new plants may be predefined ex ante, based on a convincing identification of the most likely technology scenario in the absence of the project activity. The current methodology does not attempt meet these requirements.

ADDITIONALITY

The basis for assessing the additionality of the project activity is adequate in principle. Some minor points to consider include the following:

1) The methodology should refer to the relevant sections of the additionality tool, rather than reproducing whole sections (in line with report of EB 18, §20).

2) The role of national or sectoral policies and regulations for control of NOx emissions should be addressed in more detail. Key technologies to control NOx emissions from nitric acid plants include SCR, NSCR, and increased absorption. NSCR has the co-benefit of largely eliminating N2O in addition to NOx. Consequently, regulation of NOx can have an impact on the baseline for N2O in cases where NSCR is the most attractive technology for NOx control. Hence, the methodology should provide for the following:

– Ensure that the selected baseline scenario complies with existing NOx regulation (as is done in the PDD, p.9). This may be done by requiring identification and assessment of "lawful alternatives" with respect to NOx, in accordance with Step 1 of the EB Additionality Tool.

– In cases where new NOx regulation is introduced after the project start, it should only be accounted for once the baseline is re-validated. Revision of the baseline during the crediting period for NOx policies (as required in case of new N2O regulation) would seem excessively strict, given that not all NOx control technologies also reduce N2O emissions.

(3) Assessment of the description of the proposed methodology and its applicability

a) State whether the methodology has been described in an adequate manner:

>>

– Delete reference to ammonia consumption in Section D.6 and D.7 (relic from NM0111, from which the methodology seems to have largely been copy-pasted);

– All formulas should be numbered.

– The formulas for calculation of N2O mass flows are misleading, because they imply that mass flows for a year (or some other period) may be calculated by multiplying the average tail gas volume flow rate with the average N2O concentration and the operation time of the destruction facility in that period. However, this would not be mathematically correct. Instead, annual mass flows must be calculated by summation of the mass flows in each monitoring interval of the online analyzer, which could be e.g. every 5 minutes. This applies for several formulas, especially in Section D.6, for example for the calculation of Q_N2O_I_DF_m_p.

All formulas in the NMB relating to N2O mass streams should be changed accordingly. In addition, the methodology should provide a better definition of the operation hours (M_h) (operation of what?). Operation hours may be removed from the formulas if summation is done only over those intervals for which measurements are available.

b) State whether the proposed methodology is appropriate for the referred proposed project activity and the referred project context (described in Sections A - E of the draft CDM-PDD and submitted along with CDM-NMB):

>> Yes, subject to the reservations described below.

c) State whether the application of the methodology could result in a baseline scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases that would occur in the absence of the proposed project activity.

>>No.

Please explain:

>>*For project activities in new installations, the methodology is not adequate, as discussed in Section 2.*

For project activities in existing installations such as the one described in the PDD, the proposed methodology is adequate in principle. However, it has two main shortcomings:

1) Failure to account for downstream decomposition of N2O, as described above.

2) Gaming of baseline: N2O formation in the ammonia burner depends also on operational parameters (pressure, temperature, type and replacement rate of catalysts, plant load factor), and not just on technical design parameters (S9). For example, the PDD (p.11) shows variations in N2O content of the reactor gas between 750 and 1250 ppmv. *Consequently, the ex post-monitoring of N2O formation invites for gaming the baseline by "optimizing" the operational parameters of the ammonia burner for maximum N2O formation.*

This weakness should be mitigated by capping the baseline N2O formation rate at a conservative level of e.g. 7 or 8 kg N2O per tonne of pure nitric acid. The actual baseline emissions level would still depend on the monitored N2O stream entering the destruction facility, but only up to the cap rate. Note that the methodology itself (Case 2.2 in Section D.6) foresees the application of such a N2O cap rate if corresponding N2O regulation is introduced. The cap would probably have to apply for the yearly average emissions rate. A cap on the average emissions rate for shorter periods (e.g. hourly) would require reliable information on the nitric acid production rate in any given period. Such information may not always be available.

(4) Assessment of algorithms/formulae and type of data needed:

a) State whether the description of the methodology includes algorithms and generic formulae that can be applied to other potential project activities (if not, the proposed new methodology will be considered as a project-specific methodology):

>>Yes.

b) Explain the spatial scope of data used to determine the baseline and whether the scope is appropriate:

>>Yes, adequate:

Site: N2O formation (measured at inlet of destruction facility) and emissions (at DF outlet);
National: National regulations (on N2O control)

c) Explain the vintage of data used (in relation to the duration of the project crediting period) and whether the vintage of data is appropriate, indicating the period covered by the data:

>>Yes, adequate:

N2O formation and destruction are defined ex post, throughout the crediting period.
Same for development of new regulation on N2O control.
No other data is required.

(5) Definition of the project boundary related to the baseline methodology:

a) State how the project boundary is defined in terms of:

i) Gases and sources

\>> N2O in the reactor and tail gas stream (pre- and post destruction facility);

ii) Physical delineation

\>> N2O destruction facility at the nitric acid plant

b) Indicate whether this project boundary is appropriate:

\>>Yes in principle.

The precise boundary downstream of the destruction facility is not clear. It should be clarified whether the tail gas is to be monitored immediately after the destruction facility, or further downstream.

The boundary will have to be expanded to cover the whole nitric acid plant if a cap on the baseline N2O emissions rate per tonne of nitric acid is applied.

(6) Key assumptions/parameters (including emission factors and activity levels) and data sources:

a) List the implicit and explicit key assumptions. Identify those, if any, which are problematic and explain:

\>>

1) Assumed stability of N2O (see above).

2) The methodology implicitly assumes that CDM registration will have no influence on the amount of N2O formed in the ammonia burner, which define the baseline emissions. This assumption is not adequate, since CER revenues may provide an incentive to maximize N2O formation (within the limits defined by other operational parameters), both in the context of technology investment decisions and in day-to-day operations. See Sections 2 and 3 above for details.

b) State whether the key assumptions are arrived at in a transparent manner:

\>>No.

c) Give your expert judgement on whether the assumptions/parameters are adequate:

\>>No, see above.

d) Indicate which data sources are used and how the data are obtained (e.g. official statistics, expert judgement):

\>>Most data are either site-specific. Regarding national regulations of NOx and N2O, no specific sources are indicated.

e) Give your expert judgement on whether the data used are adequate, consistent, accurate and reliable:

\>>Yes

f) State possible data gaps:

\>> None identified.

(7) Assessment of uncertainties:

a) State whether the methodology includes an assessment of uncertainties regarding:

i) The basis for determining the baseline scenario:

>>No.

ii) Algorithms/formulae:

>>No.

iii) Key assumptions:

>>No.

iv) Data:

>>No.

b) State whether the uncertainties presented are reasonable:

>>*The methodology (Section F) firstly states, in essence, that the proposed approach with on-line analysis of the reactor and tail gas and ex-post definition of the baseline results in a reasonable uncertainty level. This statement seems correct, with the exception of the possibilities for gaming the baseline described above.*

The second part of Section F (from "In summary...") is not to the point, because it relates to the uncertainty of CER production volumes rather than the uncertainty of the baseline.

(8) Leakage:

a) State how the baseline methodology addresses any potential leakage due to the project activity:

>>No relevant source of leakage is identified.

b) Indicate whether the treatment for leakage is appropriate and adequate:

>>Adequate in principle.

The description of the leakage section should be improved (Section D.8):
– Explain the term "utility usage", distinguishing fuels, electricity and reducing agents;
– Delete unnecessary leakage terms in formulas of Section D.9

(9) Transparency and "conservativeness":

a) Indicate whether the baseline methodology was developed in a transparent way:

>>Yes.

b) State whether the baseline methodology is conservative:

>>Conservative elements include:
– The ex post-approach provides an accurate picture of actual N2O formation. It avoids the need to define N2O emission rates based on historical data or a reference period, which could be inaccurate or subject to gaming.
– Increased baseline emissions of N2O due to the operation of SCR DeNOx equipment (if applicable) is neglected.
– Baseline is adjusted during the crediting period without delay if new regulation for control of N2O is introduced.

Nevertheless, the methodology is currently not conservative overall, due to the two issues described above:
– Baseline decomposition of N2O, and
– Scope for gaming the baseline.

(10) Potential strengths and weaknesses of the proposed baseline methodology *(please explain)***:**

>>Strengths:

– Ex-post approach accounts for variations in N2O formation between plants and over time.

Weaknesses:
– Decomposition of N2O in baseline must be accounted for.
– Scope for gaming of the baseline must be eliminated or reduced.

(11) Other considerations, such as a description of how national and/or sectoral policies and circumstances have been taken into account *(please explain)***:**

>>*National and sectoral regulations and policies for control of N2O will be taken into account:*
– Project facility must be in compliance at the start of the project activity;
– N2O regulation is part of the monitoring and baseline will be adjusted during the crediting period if such regulation is introduced.

(12) Applicability of the proposed methodology across project types and regions *(please indicate)***:**

>> The methodology is applicable across regions for projects which reduce N2O emissions at existing nitric acid plants through catalysts placed between the ammonia burner and the inlet of the absorption tower (“secondary approaches” according to NMB Section B).

The methodology is not applicable to activities which prevent N2O formation in the ammonia burner (“primary approaches”), or destruct N2O in the tail gas (“tertiary approaches”).

As it stands, the methodology should be restricted to existing nitric acid production capacity. It should not be applicable to new plants, nor to capacity expansions at existing plants, due to the following reasons:
– In the case of new nitric acid production lines, the methodology does not provide sufficient guidance for defining the baseline scenario with respect to production technology.
– Applicability to new capacity could result in a shift of nitric acid production from Annex 1 to non-Annex 1 countries, due to the relevant impact of CERs on overall revenues.

(13) Any other comments:

a) State whether any other source of information (i.e. other than documentation on this proposed methodology available on the UNFCCC CDM web site) has been used by you in evaluating this methodology. If so, please provide specific references:
>>

(S1) IPCC (2001): *Mitigation - Contribution of WG III to the TAR, Section 3.5.4.1 "Nitrous Oxide Emissions from Industrial Processes*". http://www.grida.no/climate/ipcc_tar/wg3/110.htm

(S2) IPCC (2000): *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. http://www.ipcc-nggip.iges.or.jp/public/gp/english/

(S3) IPCC (2000): *N2O Emissions From Adipic Acid And Nitric Acid Production.* Background paper to the Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories. http://www.ipcc-nggip.iges.or.jp/public/gp/bgp/3_2_Adipic_Acid_Nitric_Acid_Production.pdf

(S4) IPCC (1996): *Guidelines for National Greenhouse Gas Inventories*. Vol 3, Reference Manual

(S5) U.S. EPA (2001): *U.S. Adipic Acid and Nitric Acid N2O Emissions 1990-2020: Inventories, Projections, and Opportunities for Reductions.*

http://www.epa.gov/nitrousoxide/pdfs/adipic_nitric_n2o.pdf

(S6) U.S. Department of Commerce (2004): *U.S. Trade Quick Reference Tables, December 2003 Imports, Nitric acid, sulfonitric acids.* http://www.ita.doc.gov/td/industry/otea/Trade-Detail/Latest-December/Imports/28/280800.html

(S7) The Innovation Group (web publication, not dated): http://www.the-innovation-group.com/ChemProfiles/Nitric%20Acid.htm

(S8) UHDE (2005): *Nitric Acid*. http://www.uhde.biz/cgi-bin/byteserver.pl/pdf/broschueren/Duengemittel/Nitric_acid.pdf

(S9) EPA (1998): AP42, Fifth Edition: *Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Chapter 8, Final Section.* http://www.epa.gov/ttn/chief/ap42/ch08/final/c08s08.pdf

(S10) CEH Report (2004): *Nitric Acid* (Abstract) by Donald H. Lauriente and Kazuo Yagi. http://www.sriconsulting.com/CEH/Public/Reports/757.8000/

(S11) ECN (2002): *Combined Catalytic Removal of NOx and N2O in a Single Reactor from the Tail Gas of a Nitric Acid Plant.* http://www.ecn.nl/docs/library/report/2002/c02009.pdf

(S12) Air Liquide (2002): *Safety Data Sheet – Nitrous Oxide. Version 1.01.* http://www.airliquide.com/safety/msds/en/093A_AL_EN.pdf

(S13) Sami, T.M. (2005): Reduction of Nitrous Oxide at Egyptian Fertilizer Plants. Workshop Presentation. http://www.cd4cdm.org/countries%20and%20regions/North%20Africa%20and%20Middle%20East/Egypt/Workshop%20Fertilizers%20Industry/9-ReductionNitrousOxideEgyptianFacilities_Tarek.ppt

(S14) Project design document for NM0111. http://cdm.unfccc.int/methodologies

b) Indicate any further comments:

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Nitric Acid: Market Volume and Price:

– The estimated global production capacity for nitric acid in 2002 was about 46 million metric tonnes. The majority of the capacity was located in industrialized countries (S10).
– Several hundred nitric acid plants exist worldwide (PDD p.2: 700; S3: up to 600).
– The market price of nitric acid is approx. 180–250 USD per metric tonne. S7 indicates a price between 210 and 250 USD/t for the period 1995-2000. S6 indicates about 180 USD/t for imports to U.S. in 2003.

N2O Emissions and Abatement in the Nitric Acid Industry:

– IPCC (2000) indicates an emissions range of <2 – 19 kg N2O /t nitric acid for different plant types and control technologies in various countries (S2, p.3.34).
– The nitric acid industry controls NOx emissions using both non-selective catalytic reduction (NSCR) and selective catalytic reduction (SCR) technologies. NSCR has the co-benefit of largely destroying N2O, typically to a degree of 80-90% (S5, p.7).
– In the U.S., NSCR units were widely installed in nitric acid plants built between 1971 and 1977. Today, NSCR units are generally not preferred because of high-energy costs and associated high gas temperatures (S5, p.7 and S11 p.7).
– IPCC (2001) cites sources indicating abatement costs for N2O in nitric acid plants of between 0.5

and 2.7 USD/t (S1). For the U.S., costs have been estimated at 1.22–2.59 USD/t (S5, p.9).
– Recently, new technology has become available. For example, the UHDE technology foreseen for the proposed project involves a two-stage catalytic reactor. The first stage involves a catalytic decomposition of N2O ==> N2 + ½ O2. The second stage involves a catalytic reduction (S8).

CER Revenues:
– The following table provides some illustrative estimates of CER revenues for the proposed type of project activities.
– Gross CER revenues (before abatement costs and CDM transaction costs) are estimated at 4–21% of the market value of the main product nitric acid.
– For the proposed project activity, CER revenues will likely fall in the lower end of this range.
– Nevertheless, the estimates show that gross CER can easily exceed 10% of the market value of the main product.

CER revenues in relation to market value of nitric acid: Scenarios d

		Low Case	High Case	Comment
N2O formation	kg N2O/t nitric acid	8	12	Up to 19 reported
N2O destruction rate	%	90%	100%	See PDD p.2
N2O destructed	kg N2O/t nitric acid	7.2	12	
GWP N2O	--	310	310	
CO2e destructed	t CO2e/t nitric acid	2.2	3.7	
CER market price	USD/t CO2e	5	10	Best estimate is 7-8
Gross CER revenue	USD/t nitric acid	11	37	
Nitric acid price	USD/t nitric acid	250	180	
Relative CER revenue	%	4%	21%	

II. Proposed new monitoring methodology *(specify title here):* >>Monitoring methodology for catalytic N2O destruction in the reactor gas of nitric acid plants.

In respect of the proposed new monitoring methodology, evaluate each section of CDM-NMM to the draft CDM-PDD. Please provide your comments section by section:

(1) Brief description of new methodology:

Describe new methodology:

>>The methodology quantifies N2O streams at the inlet and outlet of the N2O destruction facility through continuous analysis of the reactor gas and tail gas, respectively, as a basis for the determination of baseline and project emissions. The volume of the reactor gas is calculated from the monitored streams of ammonia and reactor air.

Other monitored parameters include:
– Emergence of regulations requiring N2O control, and operational parameters needed to adjust the baseline for this regulation (if applicable, for example nitric acid production for the calculation of a N2O formation rate per tonne of nitric acid, in case this formation rate would be capped by regulation).

(2) Key assumptions/parameters:

a) List the implicit and explicit key assumptions. Identify those, if any, which are problematic and explain:

>>Key assumptions are:

– Flows of ammonia, reactor air and tail gas, as well as N2O concentrations in these streams, can be monitored online with adequate accuracy.
– Flow of reactor gas can be calculated from ammonia and air flows with adequate accuracy.

b) State whether the key assumptions are arrived at in a transparent manner:

>>No.

c) Give your expert judgement on whether the assumptions/parameters are adequate:

>>
1) The uncertainty of N2O analysis in the reactor gas should be addressed in more detail:
– Is it possible to reliably sample and analyze reactor gas at the prevailing harsh conditions (high temperature, pressure, corrosiveness)?
– Specify minimum availability rate for the sampler and on-line analyzer;
– Location and minimum number of sampling points, since reactor gas will not necessarily be well-mixed immediately after the gauzes.
– Uncertainty of N2O analyses as well as gas flow measurements and calculations should be substantiated in Section B.7. How low (in % at given confidence interval) is "low" uncertainty?

2) The methodology calculates reactor gas flow by simply adding the flows of ammonia and reactor air. This does not seem adequate since the main chemical reaction in the ammonia burner (oxidation of ammonia to nitric oxide) involves an increase in molecules and hence gas flow (at norm conditions):

$4\ NH_3 + 5O_2 \rightarrow 4\ NO + 6\ H_2O$ (formula from S9)

Note that this error in the methodology, if not corrected, would lead to an underestimation of the reactor gas flow and hence baseline emissions.

(3) Data sources and data quality:

a) Indicate which data sources are used and how the data are obtained (e.g. official statistics, expert judgement):

>>Mostly on-site data.

b) Give your expert judgement on whether the data used are adequate, consistent, accurate and reliable:

>>Yes.

c) *State possible data gaps:*

>> None identified.

(4) Assessment of the description of the proposed methodology and its applicability:

a) State whether the proposed methodology has been described in an adequate manner:

>> Generally yes.

– Relics from NM0117 should be removed. E.g., DF_O_E_p should be deleted in Section B.2.2.
– Parameter B2 in Section B.2.3 should be re-named from N2O_co_RG_O to N2O_co_RG_I, to ensure consistency with formulas in Section B.2.4.

– The location of the tail gas sampling point should be described more precisely: immediately after the destruction facility, or further downstream? This will be relevant with regard to "spontaneous" decomposition of N2O on the way to the stack. If an SCR DeNOx unit is installed, sampling must occur downstream to account for possible increases in N2O.

b) State whether the proposed methodology is appropriate for the referred proposed project activity and the referred project context (described in Sections A - E of the draft CDM-PDD and submitted along with CDM-NMM):

>>Yes.

c) State whether this proposed monitoring methodology is compatible with the proposed baseline methodology described in CDM-NMB of the draft CDM-PDD:

>>Yes. May be revised in line with the NMB, e.g. with regard to baseline decomposition of N2O.

(5) Leakage *(please elaborate, if appropriate)***:**

>>No monitoring of leakage parameters is foreseen, which is appropriate.

The term (L_N2O_p * GWP_N2O) in Section B.5 should be deleted or explained.

(6) Quality assurance and control procedures *(please explain)***:**

>>Uncertainty level regarding reactor gas parameters (flow, N2O content) should be substantiated.

(7) Potential strengths and weaknesses of the proposed monitoring methodology *(please explain)***:**

>>No particular strengths or weaknesses identified.

(8) Applicability of the proposed methodology across project types and regions *(please indicate)***:**

>>Applicable to other projects for secondary destruction of N2O in <u>existing</u> nitric acid plants. Applicability to project activities in <u>new</u> nitric acid plants remains to be determined in the light of an improved NMB. Not applicable to primary and tertiary approaches for N2O abatement.

(9) Any other comments:

a) State whether any other source of information (i.e. other than documentation on this proposed methodology available on the UNFCCC CDM web site) has been used by you in evaluating this methodology. If so, please provide specific references:

>>--

b) Indicate any further comments:

>>--

Signature of desk reviewer …Urs Brodmann

Date: 07 July 2005

Information to be completed by the secretariat	
F-CDM-NMex doc id number	
Date when the form was received at UNFCCC secretariat	
Date of transmission to the Meth Panel and EB	
Date of posting in the UNFCCC CDM web site	