VALIDATION OPINION – CREDITING PERIOD RENEWAL

N2O EMISSION REDUCTION IN NITRIC ACID PLANT PAULÍNIA, SP, BRAZIL

(UNFCCC Registration Ref. No. 1011)

REPORT NO. 2013-9528

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VALIDATION OPINION – CREDITING PERIOD RENEWAL

Date of first issue: 2013-11-23	ConCert Project No.: PRJC-493343-2013-CCS-ITA
Approved by: Ole A. Flagstad	Organisational unit: Accredited Climate Change Services
Client: Rhodia Energy GHG SAS	Client ref.: Philippe Chevallier

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Summary:

Project Name: N_2O Emission Reduction in nitric acid plant Paulínia, SP, Brazil
Registration Ref. No.: 1011)
Country: Brazil
Methodology: ACM0019 **Version:** 02.0
GHG reducing Measure/Technology: N_2O catalytic decomposition
ER estimate: 71 364 tCO_2e per year (average)
Size
☒ Large Scale ☐ Small Scale
Validation Phases:
☒ Desk Review
☒ Follow up interviews
☒ Resolution of outstanding issues
Validation Status
☒ Corrective Actions Requested ☒ Clarifications Requested
☐ Full Approval and request for renewal ☐ Rejected

In summary, it is DNV's opinion that the project activity "N2O Emission Reduction in nitric acid plant Paulínia, SP, Brazil" in Brazil, as described in the PDD, version 08 of 13 January 2014, meets all relevant UNFCCC requirements for the renewal of the crediting period. Hence DNV requests the renewal of the crediting period of the project.

Report No.: 2013-9528	Subject Group: Environment
Report title: N_2O Emission Reduction in nitric acid plant Paulínia, SP, Brazil	
Work carried out by: Grant Little	
Work verified by: Ole A. Flagstad, Krishnan Namboodiri	

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Key words
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Abbreviations

CAR	Corrective Action Request
CDM	Clean Development Mechanism
CER	Certified Emission Reduction(s)
CETESB	São Paulo State Environmental Agency
CH_4	Methane
CL	Clarification request
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
DNV	Det Norske Veritas
DNA	Designated National Authority
FAR	Forward Action Request
GHG	Greenhouse gas(es)
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
LoA	Letter of approval
MP	Monitoring Plan
N_2O	Nitrous oxide
NOx	Gaseous oxides of Nitrogen
NGO	Non-governmental Organisation
NPV	Net Present Value
ODA	Official Development Assistance
PDD	Project Design Document
PIMS	Process Information Management System
PP	Project Participant
PS	Clean Development Mechanism Project Standard
SCR	Selective Catalytic Reduction
SNCR	Selective Non-Catalytic Reduction
tCO_2e	Tonnes of CO_2 equivalents
UNFCCC	United Nations Framework Convention on Climate Change
UNICAMP	Campinas University
VVS	Clean Development Mechanism Validation and Verification Standard

1 EXECUTIVE SUMMARY – VALIDATION OPINION

DNV Climate Change Services AS (DNV) has performed an assessment of the request by Rhodia Energy GHG SAS to renew the crediting period of CDM project activity 1011 "N2O Emission Reduction in nitric acid plant Paulínia, SP, Brazil". The assessment was performed in accordance with the Validation and Verification Standard (Version 04.0) and the CDM Project Standard (Version 05.0) and included an assessment of:

(a) An impact of new relevant national and/or sectoral policies and circumstances on the baseline taking into account relevant guidance from the Board with regard to renewal of the crediting period at the time of requesting renewal of crediting period;

(b) The correctness of the application of an approved baseline methodology for the determination of the continued validity of the baseline or its update, and the estimation of emission reductions for the applicable crediting period.

The review of the project design documentation and the subsequent follow-up discussions have provided DNV with sufficient evidence to determine the validity of the original baseline and/or its update through an assessment. The project correctly applies the baseline and monitoring methodology ACM0019, version 02.0 "*Large-scale Consolidated Methodology.- N_2O abatement from nitric acid production*".

The total emission reductions from the project are estimated to be on the average 71 364 tCO2e per year over the 2nd renewable crediting period. The emission reduction forecast has been checked, and it is deemed likely that the stated amount is achieved given that the underlying assumptions do not change.

The monitoring plan provides for the monitoring of the project's emission reductions. The monitoring arrangements described in the monitoring plan are feasible within the project design, and it is DNV's opinion that the project participants are able to effectively implement the monitoring plan.

In summary, it is DNV's opinion that the CDM project activity 1011 "N2O Emission Reduction in nitric acid plant Paulínia, SP, Brazil" in Brazil meets all relevant UNFCCC requirements for the renewal of the crediting period. Hence DNV requests the renewal of the crediting period of the project.

Durban and Oslo, 2014-02-16

Grant Little
Validator
DNV Durban, South Africa

Ole A. Flagstad
Approver
DNV Climate Change Services AS

2 INTRODUCTION

DNV Climate Change Services AS (DNV) was commissioned by Rhodia Energy GHG SAS to perform an assessment of the request by to renew the crediting period of CDM project activity 1011 "N2O Emission Reduction in nitric acid plant Paulínia, SP, Brazil" in Brazil.

The assessment was performed in accordance with the Validation and Verification Standard (Version 04.0) and the CDM Project Standard (Version 05.0) and included an assessment of:

(a) An impact of new relevant national and/or sectoral policies and circumstances on the baseline taking into account relevant guidance from the Board with regard to renewal of the crediting period at the time of requesting renewal of crediting period;

(b) The correctness of the application of an approved baseline methodology for the determination of the continued validity of the baseline or its update, and the estimation of emission reductions for the applicable crediting period.

3 METHODOLOGY

The validation consisted of the following three phases:

I document review

II follow-up actions (e.g. on-site visit and telephone or email interviews)

III the closing out of validation findings and the issuance of the final validation report and opinion.

The following sections outline each step in more detail.

3.1 Document Review

The following tables list the documentation that was reviewed during the validation.

3.1.1 Documentation provided by the project participants

/1/ Solvay Energy Services: *CDM-PDD for project activity "N2O Emission* Reduction in nitric acid plant Paulínia, SP, Brazil*" in Brazil*, Version 05 dated 31 October 2013 and version 08 dated 13 January 2014

/2/ Solvay Energy Services: *Emission Reduction calculations 2nd crediting period*, version 1, 7 October 2013 (version 2, 25 November 2013) and (version 4, 13 January 2014).

/3/ Solvay Energy Services: *NPV Paganini confidential.xls*, 8 October 2013 (version 2 – 28 November 2013)

/4/ Rhodia Energy Services: *Extract of Catalyst Supply Agreement*1, 19 July 2007

/5/ Ministero Publico do Estado de São Paulo: Terms of adjustment between the São Paulo State Ministry and Rhodia on the NOx limits for Paulìnia plant (*Termo de Ajustamento IC. No 01/96*), 1996

/6/ CETESB, *Licença de Operação (Operating License)*, São Paulo, 2 April 2012

/7/ Rhodia Poliamida e Especialidades Ltda: *Calibration and maintenance protocol, version (MALHAS, EQUIPAMENTOS E VARIÁVEIS ANALÍTICAS CRÍTICAS E DETERMINANTES DA UNIDADE HNO3) version 18*, July 2012

/8/ Rhodia Poliamida e Especialidades Ltda: *Data handling protocol , version 11,* 30 January 2013

/9/ Rhodia Poliamida e Especialidades Ltda: *Data Flow Summary for Project CDM 1011, revision 3,* 9 August 2009

/10/ Rhodia Poliamida e Especialidades Ltda: *Extracts from SAP / Paganini project*, 16 October 2013

3.1.2 Methodologies, tools and other guidance by the CDM Executive Board

/11/ CDM Executive Board: *Clean Development Mechanism Validation and Verification Standard,* version 05.0

/12/ CDM Executive Board: *Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period*. Version 03.0.1

/13/ CDM Executive Board: *Clean Development Mechanism Project Standard,* version 05.0

/14/ CDM Executive Board: *Clean Development Mechanism Project Cycle Procedure,* version 05.0

/15/ CDM Executive Board*AM0028 - Catalytic N_2O destruction in the tail gas of Nitric Acid or Caprolactam Production Plants* , version 4

/16/ CDM Executive Board: *AM0034 - Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants* , version 2

/17/ CDM Executive Board: *Large-scale consolidated methodology: N_2O abatement from nitric acid production ACM0019,* version 02.0

/18/ CDM Executive Board: *Tool to determine the mass flow of a greenhouse gas in a gaseous stream,* Version 02.0.0

/19/ CDM Executive Board: *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion,* Version 02

/20/ CDM Executive Board: *Communication regarding the intent to renew crediting period*, 28 October 2013

/21/ CDM Executive Board: *Standard for application of the global warming potentials to CDM project activities and PoAs for the second commitment period of the Kyoto Protocol,* version 01.0

3.1.3 Documents used by DNV to validate / cross-check the information provided by the project participants

/22/ DNV: *Validation Report - N2O EMISSION REDUCTION IN NITRIC ACID PLANT PAULÍNIA, SP, BRAZIL,* Report No. 2006-1674, Version 3a, 19 March 2007

/23/ SRI consulting (*Glausner, J*): N_2O (nitrous oxide) Market research report, May 2011

/24/ SRI consulting (*Glausner, J*): HNO_3 (nitric acid) Market research report, May 2011

/25/ IPCC, G*ood practice guidance and uncertainty management in national GHG inventories*, 15 June 2001

/26/ ERM: *CDM Verification and Certification Report #7 of the registered CDM project "N_2O Emission Reduction in nitric acid plant Paulínia, SP, Brazil", version 2*, 2 May 2012

/27/ ERM: *CDM Verification and Certification Report #8 of the registered CDM project "N_2O Emission Reduction in nitric acid plant Paulínia, SP, Brazil", version 2*, 22 February 2013

/28/ Solvay Energy Services: *Monitoring report # 7 (03/07/2011 to 03/03/2012)*, 11 April 2012

/29/ Solvay Energy Services: *Monitoring report # 8 (04/03/2012 to 25/11/2012)*, 30 January 2013

/30/ Solvay Energy Services: *Workbook for Monitoring Campaign # 7 (03/07/2011 to 03/03/2012)*, 11 April 2012

/31/ Solvay Energy Services: *Workbook for Monitoring Campaign # 8 (04/03/2012 to 25/11/2012)*, 30 January 2013

/32/ IPEA (Brazilian governamental institute) *Mudança do Clima no Brasil: aspectos econômicos, sociais e regulatórios (Climate change in Brazil: Regulatory, Economical and Social aspects)*, 2011

/33/ Leiroz, Andrea Teixeira: *Email correspondence on sectoral and legal requirements in Brazil*, 14 November 2013

/34/ AmBio: *Relatório de auditoria de conformidade sobre os aspectos ambientais e sociais, Projeto Redução de Emissão de N2O em Paulínia, Projeto "ANGELA" Rhodia Energy, São Paulo, Brasil (Compliance audit report on the environmental and social aspects, N_2O reduction Project in Paulínia, Project "ANGELA" Rhodia Energy, Sao Paulo, Brazil)*, 28/01/2011

/35/ UNFCCC, CDM Project Cycle Search for "*Project 1011 : N2O Emission Reduction in nitric acid plant Paulínia, SP, Brazil'*, http://cdm.unfccc.int/Projects/DB/DNV-CUK1174479298.53/ accessed 21 November 2013

/36/ Rhodia Poliamida e Especialidades Ltda: Plant online gas stack monitoring from online plant PIMS, Extracted from live control system for period 1 July 2013 to 2 December 2013 and 16 September 2013 to 17 September 2013

/37/ Rhodia Poliamida e Especialidades Ltda: Excel transposition for gas stack monitoring from online plant PIMS, Extracted for period 3 December 2013

/38/ Norma Ambiental: *Extract of cumulative data set of potential new relevant regulations in Brazil*, 23 May 2013

/39/ Solvay Energy Services: *CDM-PDD for project activity "N2O Emission* Reduction in nitric acid plant Paulínia, SP, Brazil*" in Brazil*, Version 04 dated 23 January 2007

/40/ Banco Central Do Brasil: *Taxas de Câmbio (Exchange Rates), accessed from* http://www4.bcb.gov.br/pec/taxas/port/ptaxnpesq.asp?id=txcotacao

3.2 Follow-up actions

During November and December 2013 DNV discussed the project with project stakeholders. As only no changes to the baseline were proposed in the renewal of the crediting period, and only an update of the baseline presented in the first crediting period, in addition to changes in

the methodology that have come about due to amendments in the ensuing period, a site visit was not conducted in line with DNV procedures and the Project Standard /13/ and VVS /11/.

	Date / Type of interview	Name / Organization	Topic
/41/	November & December 2013 ☐ On-site ☐ Face-to-face at office ☒ Telephone ☒ E-mail	Philippe Chevallier (CO_2 Operations Team Leader) / Solvay Energy Services	• All aspects of the Renewal of Crediting period as PP liaison. This included all interfaces regarding the technical, carbon and administrative aspects of the project activity.

3.3 Closing out of validation findings

The objective of this phase of the assessment was to resolve any issues which needed to be clarified prior to DNV's positive conclusion on the project's compliance with applicable CDM requirements.

In order to ensure transparency a validation protocol was customised for the project. The protocol shows in a transparent manner the criteria (requirements), means of verification and the results from validating the identified criteria. The validation protocol serves the following purposes:

- It organises, details and clarifies the requirements a CDM project is expected to meet;
- It ensures a transparent validation process where the validator will document how a particular requirement has been validated and the result of the validation.

The validation protocol consists of four tables. The different columns in these tables are described in the figure below. The completed validation protocol for the project activity "N2O Emission Reduction in nitric acid plant Paulínia, SP, Brazil" in Brazil is enclosed in Appendix A to this report.

Table 1 of the validation protocol documents the findings of the desk review of the project design documentation and follow-up interviews with project stakeholders. Any findings raised in Table 1 are listed in Table 2 of the protocol, and changes to the description of the project design as a result of these findings will be addressed in Table 2. Table 1 thus may not reflect all aspects of the project as described in the final PDD submitted for registration.

A corrective action request (CAR) is raised if one of the following occurs:

(a) The project participants have made mistakes that will influence the ability of the project activity to achieve real, measurable additional emission reductions;

(b) The applicable CDM requirements have not been met;

(c) There is a risk that emission reductions cannot be monitored or calculated.

A clarification request (CL) is raised if information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met.

A forward action request (FAR) is raised during validation to highlight issues related to project implementation that require review during the first verification of the project activity. FARs shall not relate to the CDM requirements for registration.

The validation identified two CARs, nine CLs and no FARs. The CARs and CLs were satisfactorily addressed by the project participants by among other revising the PDD (please refer to Table 3 in Appendix A for further details). In addition to the changes made to the PDD as a result of the validation findings, following changes to the PDD (version 08 dated 13 January 2014) were made compared to the version of the PDD submitted for crediting period renewal (version 05 dated 31 October 2013):

- For the sake of clarity and transparency the summary of gases and sources included in the project boundary was updated to align with the consolidated methodology.
- Clarity was brought to the references used to demonstrate Changes in market characteristic and validity of the conditions used to determine the baseline in previous crediting period.
- The determination of $F_{N2O,tail\ gas,h}$ was clarified with respect to the use of NCSG and VSG in the determination.
- Archival timeframes for monitoring data was aligned with the requirements of the VVS.
- Parameter $h_{r,y}$ was added to the PDD in order to be consistent with the requirements of the consolidated methodology and the requirements of the monitoring thereof.
- Responsibilities of the personnel involved in the monitoring were clarified.
- The expected ERs indicated in the environmental impacts section was aligned with the expected ER for the project activity.
- Emission reductions were recalculated (and adjusted downward) based on the outcomes of CAR and CL closure
- Nitric acid production data ($P_{production,y}$) was adjusted to conform with data from the first crediting period
- Calibration QA/QC procedures were updated for relevant monitoring equipment

In a general way all the modifications introduced by the PP increase completeness, clarity and transparency of the PDD, so are deemed acceptable and correct by DNV.

Validation Protocol Table 1: Requirement Checklist				
Checklist question	***Reference***	***Means of verification (MoV)***	***Assessment by DNV***	***Draft and/or Final Conclusion***
The various requirements in Table 1 are linked to checklist questions the project should meet. The checklist is organised in different sections, following the logic of the CDM-PDD	*Gives reference to documents where the answer to the checklist question or item is found.*	*Means of verification (MoV) are **document review (DR)**, **interview (I)** or any other follow-up actions (e.g., on site visit and telephone or email interviews) and **cross-checking (CC)** with available information relating to projects or technologies similar to the proposed CDM project activity under validation.*	*The discussion on how the conclusion is arrived at and the conclusion on the compliance with the checklist question so far.*	*OK is used if the information and evidence provided is adequate to demonstrate compliance with CDM requirements. A c**orrective action request (CAR)** is raised when project participants have made mistakes, the CDM requirements have not been met or there is a risk that emission reductions cannot be monitored or calculated. A **clarification request (CL)** is raised if information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met. A **forward action request (FAR)** during validation is raised to highlight issues related to project implementation that require review during the first verification of the project activity.*

Validation Protocol Table 2: Resolution of Corrective Action and Clarification Requests			
Corrective action and/ or clarification requests	***Ref. to checklist question in table 2***	***Response by project participants***	***Validation conclusion***
*The **CARs** and/ or **CLs** raised in Table 2 are repeated here.*	*Reference to the checklist question number in Table 2 where the CAR or CL is explained.*	*The responses given by the project participants to address the CARs and/or CLs.*	*The validation team's assessment and final conclusions of the CARs and/or CLs.*

Validation Protocol Table 3: Forward Action Requests		
Forward action request	***Ref. to checklist question in table 2***	***Response by project participants***
The FARs raised in Table 2 are repeated here.	*Reference to the checklist question number in Table 2 where the FAR is explained.*	*Response by project participants on how forward action request will be addressed prior to first verification.*

Figure 1 Validation protocol tables

Internal quality control

This validation opinion underwent a technical review performed by a technical reviewer qualified in accordance with DNV's qualification scheme for CDM validation and verification.

3.4 Validation team

				Type of involvement						
Role	***Last Name***	***First Name***	***Country***	Desk review	Site visit / Interviews	Reporting	Supervision of work	Technical review	TA 5.1/11/12.1 competence	Financial expertise
Team leader (Validator)	Little	Grant	South Africa	✓		✓	✓		✓	✓
Technical reviewer	Flagstad	Ole A.	Norway					✓		
TA to TR	Namboodiri	Krishnan	India						✓	

The qualification of each individual validation team member is detailed in Appendix B to this report.

4 VALIDATION FINDINGS

The findings of the validation are stated in the following sections. The final validation findings relate to the project design as documented and described in the PDD, version 08 dated 13 January 2014.

DNV also checked that the names of the project participants included in the request for renewal of crediting period are consistent with the names of the registered project participants for the project activity and that the project participants updated the PDD in accordance with section 12.9 of the Project standard version 05.0: in both cases assessment of DNV is positive, so the PDD respect par. 303 and 305 of the VVS version 05.0.

4.1 Validity of selected baseline and monitoring methodology

The project activity was registered as a CDM project applying the methodology AM0028, version 4 /15/ and methodology AM0034 version 2 on 2 June 2007 /35/. For the renewal of crediting period, the project applies version 02.0 of ACM0019, which is the latest version currently available /17/

4.2 Application of selected baseline and monitoring methodology

The assessment of the project's compliance with the applicability criteria of ACM0019 (version 02.0) are documented in detail in section B.2 of Table 2 in the validation protocol in Appendix A to this report.

The project applies the baseline methodology ACM0019 version 02.0 titled "*N2O abatement from nitric acid production*" /17/.

The project meets the methodology's applicability criteria as applying to project activities that introduce N_2O abatement measures in nitric acid plants, as confirmed by the baseline in the first crediting period have not changed /22/ and:

In the case that the nitric acid plant started commercial operation before the implementation of the CDM project activity, the project participants shall demonstrate that there was no secondary or tertiary N_2O abatement technology installed in the respective nitric acid plant, as confirmed by the original baseline and this not changing in the renewal of the crediting period /22/.

The applicability requirement for continuous real-time measurements of the N_2O concentration and the total gas volume flow is complied to as such measurements can be carried out in the tail gas stream after the abatement of N_2O emissions. It has been demonstrated through the online measurement and process information management system (PIMS) /**36**/ that provides continuous measurement and recording.

All the applicability criteria indicated in the methodology ACM0019 version 02.0 are met, thus it is in DNV's opinion that the methodology is applicable to the project, moreover, DNV has concluded that the application of the baseline methodology is transparent and conservative.

4.3 Validity of the original baseline or its update

The assessment of the baseline validity has been performed in two steps, in the respect of the methodological tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" /12/.

The first step provides an approach to evaluate whether the current baseline is still valid for the next crediting period and the second step provides an approach to update the baseline in case that the current baseline is not valid anymore for the next crediting period.

It has to be noted that the demonstration of the validity of the original baseline or its update does not require a reassessment of the baseline scenario, but rather an assessment of the emissions which would have resulted from that scenario.

Step 1: Assess the validity of the current baseline for the next crediting period

The "CDM Project Standard" /13/ requires assessing and incorporating the impact of new relevant national and/or sectorial policies and circumstances on the baseline. The validity of the current baseline is assessed using the following Sub-steps:

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

In the respect of the methodology ACM0019 version 02.0 /17/ baseline emissions consist of the N_2O emissions that would be released without the implementation of the project activity. The algorithms and emission factors mentioned in the approved methodology have been used for determining these baselines.

As confirmed by IPEA /32/, a Brazilian governmental institute, Brazil has confirmed the Copenhagen Accord, and the Conference of Parties (COP 16) in Cancun, its voluntary national targets for reducing emissions greenhouse gas (GHG) reductions between 36.1% and 38.9% of emissions projected by 2020 /**32**/. These targets have been defined in the National Policy on Climate Change (NPCC), voted by Congress (Law 12,187, of 29 December 2009). The NPCC is actually a legal framework for the regulation of mitigation and adaptation in the country: the related Executive Decrees establish in line with the National Policy on Climate Change, sectorial plans mitigation and adaptation to climate change in order to consolidate an economy of low carbon. In December 2010 was thus edited Decree No. 7.390 (9 December 2010).

The decree allowed clarifying and defining various regulatory aspects the legal text regarding the measurement of goals, formulation of sectorial plans and structure governance.

To achieve the objectives of NPCC, the country will adopt as national commitment voluntary actions to mitigate emissions of greenhouse gases, in order to reduce its projected emissions by 2020. The Decree 7.390/2010, which regulates the NPCC, projected to achieve this tCO_{2eq} national by voluntary commitment: in the decree, article 11 says that the NPCC Executive Decree shall, in accordance with the National Policy on Climate Change, plans sectorial mitigation and adaptation in the generation and distribution of electricity, public transport modal systems in urban and interstate transportation of cargo and passengers, in the manufacturing industry and the consumer durables.

So it is clear by the analysis of the national regulatory environment, that there are no mandatory national and/or sectorial policies affecting the baseline scenario. This is further confirmed by a firm specialized in environmental auditing, that provided the World Bank /34/ with a "*Compliance audit report on the environmental and social aspects"* in which it is clearly stated that among the main legal requirements and specific requirements on environment, safety and health (49 Federal, 17 National and 6 Municipal laws) /38/ no requirements are related to GHG emissions reduction so to affect the baseline scenario. Communication with the State environmental authorities in 1996 /5/ with confirmed that the plant was in compliance with a requested limit of 200ppm for NO_x gaseous emissions and not requirement for any additional $DeNO_x$ or catalytic system for abatement, so as soon as this value is respected with the actual project system this is considered in compliance with the required legislation and requirements of the VVS. The project activity was further issued with an updated Operating License by CETESB on 2 April 2012 /6/ which confirms that no limits or requirements for N_2O abatement or control are required.

Further to this, the information was cross checked with DNV's Brazil office who are experienced in Brazilian legislation and policy updates and it was confirmed that the information presented above is correct /33/.

Finally, following the previous explanation, it is in DNV's opinion that the current baseline complies with all relevant mandatory national and/or sectorial policies which have come into effect after the submission of the project activity for validation or the submission of the previous request for renewal of the crediting period and are applicable at the time of requesting renewal of the crediting period.

Step 1.2: Assess the impact of circumstances

DNV's assessment did not identify any circumstances existing at the time of requesting renewal of the crediting period which would impact the current baseline.

Because the baseline scenario identified at the validation of the project activity /22/ was the continuation of the current practice without any investment, an assessment of:

a. the changes in market characteristics and validity of the conditions used to determine the baseline emissions in the previous crediting period
b. availability of new fuels or raw materials and the impact of electricity or fuel prices in the identification of the current practice for the baseline emissions

has been done for the renewal of the crediting period.

a. Changes in market characteristics and validity of the conditions used to determine the baseline emissions in the previous crediting period

Common industry practice: According to a global nitric acid market study 2011 /24/ and an associated study on nitrous oxide /23/ there has only been about an 8% increase in production units worldwide, with a higher value in Latin America attributed to the commissioning of an integrated production facility in Trinidad and Tobago in 2010. This plant did not however impact the Brazilian market where production and consumption remain stable in the period 2007 and 2010.
In October 2013, around 50% of the plants which started before 31 December 2005 (applicability constraint of the N_2O/nitric acid methodologies AM0028, AM0034 and AM0051) have implemented CDM projects. In Latin America, this percentage increases to 80% and 100% in Brazil. Due to the limiting fact that the methodology ACM0034 is not applicable for commercial production starting after 2005 these newer plants don't have any option to become registered under CDM nor do they have an economic incentive for destruction of the N_2O /38/.
This shows that market characteristics with respect to common industry practice have not changed.

Economic incentive for destruction of N_2O: The project activity would not be commercially viable as there is no commercial possibility for any by-products of the decomposition plant.
A net present value (NPV) had been chosen during first validation to be the relevant financial indicator for the project activity. This financial indicator is used by most companies including Rhodia group, to assess the economical value of a project, then, projects are ranked and those with the highest NPVs are selected.
The project activity involved the purchase and installation of a catalyst with no change in production volumes or additional products within the project boundary, along with all associated costs. The only financial (economic) benefit within the project activity, is derived from the potential sale of emission reductions.
To further support the demonstration that there is no economic incentive for destruction of N_2O, the PP decided to redo a hypothetical NPV analysis (the original NPV was conducted in 2007 for the first crediting period using actual figures for the NPV) in 2013 with updated figures. Installation costs have been taken from actual figures for the latest catalyst regime extracted from the SAP Enterprise Resource Management System /10/. Confidential costs for the leasing of the catalyst and associated contractual obligations were presented to DNV /4/ and these were checked and confirmed as being accurately applied in the investment analysis.
As there is no alternative investment to the project activity that would generate similar services /25/, the NPV is calculated only for the project activity. If the NPV is less than or equals zero the proposed project activity is considered additional. The net present value (NPV) of the investment in the decomposition facility considers discount rates of 0%, 5%, 10% and 15%. For the analysis installation costs as well as estimated annual fixed costs mainly for maintenance have been taken into account, in the respect of the hypothesis in the previous paragraph. Financing costs have not been taken into account.

As the by-products from the decomposition facility are not plausibly marketable, the only revenue results from the sale of emission reductions. It has been assumed that the facility

operates 30 years. The investment analysis using estimated figures in 2007 has clearly resulted in negative NPV for all chosen scenarios /3/. As already introduced the investment analysis was repeated for 2013 with real figures and had the same result as shown hereunder.

Investment analysis 2013				
Discount rate	0%	5%	10%	15%
NPV (EUR)	-2 820 033	-1 667 727	-1 199 359	-973 985

The choice to do the analysis with real data from 2013 (and Capex from 2007) has been done as at the time of starting validation the relevant data for 2013 update (for operational costs) had been extrapolated from contractual obligations that remain valid during the crediting period /4/. All input data used for the NPV analysis have been checked on site; the currency exchange rate has been checked with a third party source /40/ and has been estimated consistent with the one used by the PP.
This shows that market characteristics with respect to economic incentive for destruction of N_2O has not changed.

Therefore, DNV is able to confirm that based on the analysis of the market characteristics, the conditions used to determine the baseline emissions in the previous crediting period are still valid, so the current baseline is still applicable at the time of requesting renewal of the crediting period.

Step 1.3: Assess whether the continuation of the use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested

In respect of the methodological tool "*Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period*" /12/ this sub-step should only be applied if the baseline scenario identified at the validation of the project activity was the continuation of use of the current equipment(s) without any investment and, the projects proponents or third party (or parties) would undertake an investment later due, for example, to the end of the technical lifetime of the equipment(s) before the end of the crediting period or the availability of a new technology.

This step is not applicable to the project activity since even if the baseline is the continuation of the existing practice, no investment would have been undertaken in the absence of the project.

Step 1.4: Assessment of the validity of the data and parameters

Following the provisions of the '*Assessment of the validity of the original/current baseline and to update the baseline at the renewal of a crediting period*' (version 03.0.1) /12/, if "any of the data and parameters that were only determined at the start of the crediting period and

not monitored during the crediting period are not valid anymore, the current baseline needs to be updated for the subsequent crediting period".

As evidenced by the comparison between the registered PDD /39/, and the new PDD /1/, hereunder a summary table of the parameters that were determined at the start of the first crediting period and their relation with the new parameters in the updated methodology ACM0019 version 02.0.

Old Name	New Name	Old value	New Value	Comments
NAP	$P_{production,y}$	32 444	45 982.1	1
	$P_{product, max}$		55 900	2
GWP_N_2O - Global warming potential of the N_2O during the crediting period	GWP_{N2O}	310	298	3
EF_{BL}	$EF_{historical}$	0.00593666	5.7603	4
	$EF_{default,y}$	8.0	As per table "*data/parameter table 3*" in PDD ranging from 8.2 to 5.0	5
	EF_{new}		As per table "*data/parameter table 4*" in PDD ranging from 5.10 to 2.50	6
OH	h_y	5 092	6 068.8	7
	$h_{r,y}$		0	8

1. Parameter name changed only. The parameter value changed from 32 444 to 45 982.1 based on historical production figures from the first crediting period . This parameter, as shown in section 4.3, is still valid.
2. New parameter as required by new consolidated methodology ACM0019.
3. Value following the "Standard for application of the global warming potentials to CDM project activities and PoAs for the second commitment period of the Kyoto Protocol (version 01.0)", introduced after registration of the project activity. As this brings to a modification of the estimation of the baseline emissions, this will need to be updated
4. The units changed from t N_2O / t HNO_3 to kg N_2O / t HNO_3. Parameter name changed only. Value changed from 5.9367 to 5.7603 as per the data presented in the issuance

reports in the first crediting period. This parameter, as shown in section 4.3, is still valid.

5. New parameter as required by new consolidated methodology ACM0019.
6. New parameter as required by new consolidated methodology ACM0019.
7. Parameter name changed only. The old value of 5 092 was changed to 6 068.8, which was based on historical data from the first crediting period. This parameter, as shown in section 4.3, is still valid.
8. New parameter as required by new consolidated methodology ACM0019..

Moreover, some new formulas and parameters have been introduced with the consolidation and updates of the methodology, so following the provisions of the '*Assessment of the validity of the original/current baseline and to update the baseline at the renewal of a crediting period*'/12/ (version 03.0.1), the current baseline needs to be updated for the subsequent crediting period.

Conclusion on step 1

Following the assessment performed in Step 1.1, 1.2 and 1.3 above, DNV confirms that the baseline would be in compliance with relevant mandatory national and/or sectorial policies (c.f. Step 1.1) and that the changes in the market characteristics would not have an impact in the current baseline emissions (c.f. Step 1.2); hence, the current baseline is valid.

Following the assessment performed in Step 1.4 above, all the data and parameters that were determined only once at the start of the crediting period and are not valid anymore and new formulas and parameters have been introduced with the new version of the methodology. Therefore, these data and parameters cannot be used for the renewed crediting period and will have to be updated as part of Step 2 below.

Step 2: Update the current baseline and the data and parameters

Step 1.4 demonstrated that the current baseline emissions needs to be updated: in accordance with the methodological tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" /12/ step 2 is applicable and will be discussed in the following paragraph.

Step 2.1: Update the current baseline

The methodological tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" /12/ request for an update the current baseline emissions for the subsequent crediting period, without reassessing the baseline scenario, based on the latest approved version of the methodology applicable to the project activity.

Furthermore, as confirmed by DNV as outcome of step 1, the baseline would be in compliance with relevant mandatory national and/or sectorial policies (c.f. Step 1.1) and the changes in the market characteristics would not have an impact in the current baseline emissions (c.f. Step 1.2).

The approved baseline methodology has been correctly applied to calculate GHG emissions as per the par 4.5 of this report.

All the assumption and data used by the project participants are listed in the PDD and/or supporting documents. All documentation relevant for establishing the baseline scenario are correctly quoted and interpreted in the PDD. Assumptions and data used in the identification of the baseline emissions are justified appropriately, supported by evidence and can be deemed reasonable. Relevant national and/or sectorial policies and circumstances are considered and listed in the PDD.

Step 2.2: Update the data and parameters

As the application of Step 1.4 showed that part of the data and/or parameter(s) that were only determined at the start of the crediting period and not monitored during the crediting period are not valid anymore and the methodology calculations and formulas changed, project participant updated all applicable data, parameters, and formulas.

In section B.4 of the PDD a complete and clear comparative table between the original methodologies used (AM0034 – Version 2) and the new consolidated methodology ACM0019 version 02.0 is available. In particular data updated that were only determined at the start of the crediting period and not monitored (see step 1.4 comments) are the following:

Old Name	New Name	Old value	New Value	Comments
GWP_N_2O - Global warming potential of the N_2O during the crediting period	GWP_{N2O}	310	298	a

a – The new value is in compliance with the "*Standard for application of the global warming potentials to CDM project activities and PoAs for the second commitment period of the Kyoto Protocol* (version 01.0)", /21/ introduced after registration of the project activity, so the PP correctly updated the value in the emissions calculations.

Use of the formulas and validation of the different parameters is present in section 4.4-4.5 of this report.

4.4 Validity of monitoring plan

The project monitoring plan is in compliance with the monitoring methodology ACM0019 (version 02.0) /17/. The monitoring plan will give opportunity for real measurements of achieved emission reductions.

Based on the previous monitoring and verification reports /26/ /29/ /28/ /29/ analysis and on DNV's assessment provided in section 4.4.2 and 4.4.3 below, DNV deems that the project participants are able to implement the monitoring plan.

4.4.1 Parameters determined ex-ante

With the application of the methodology ACM0019 version 02.0, a series of parameters are determined at the start of crediting period, as per the following table:

Parameter	Value	Assessment
GWP_{N2O} (tCO_2e/tN_2O)	298	This is the Global warming potential of the N_2O during the crediting period. The value considered previously by the PP was 310, but the "*Standard for application of the global warming potentials to CDM project activities and PoAs for the second commitment period of the Kyoto Protocol* (version 01.0)", /21/ introduced after registration of the project activity and after the methodology update, indicate a value of 298, as correctly defined by the PP
Operating Pressure (kPa)	Between 359 and 385	The operating pressure was obtained from the manufacturers design specifications for the plant and had been cross checked against operating conditions during the first crediting period.
$EF_{historical}$ (kg N_2O/t HNO_3)	5.7603	The historical baseline emission factor of the nitric acid plant. As per the methodology, project activities that applied AM0034 /16/ in the first crediting period need to use the baseline emission factor from the latest baseline campaign. This was cross checked and verified with the latest monitoring /29/ and verification /27/ reports for the most recent (8^{th}) campaign at the time of validation of the renewal of the crediting period.
$EF_{default,y}$ (kg N_2O/t HNO_3)	The values decrease at 0.2 kg N_2O / t HNO_3 per annum to a minimum value. Range for crediting period is 8.2 to 6.8	Default emission factor according to the operating pressure of the ammonia burner in year y (related to 100 per cent pure acid). This was extracted directly from the latest version of the consolidated methodology /17/.

EF_{new} (kg N_2O/t HNO_3)	The baseline N2O emission factor for nitric acid production will vary every year. In year 2005 the emission factor was 5.1 and then it will decrease every year until it reaches a final value of 2.5 in the year 2020. The value of 2.5 will remain constant after 2020. Range for crediting period is 3.4 to 2.5	Baseline N2O emission factor for nitric acid production in year y (related to 100 per cent pure acid). This was extracted directly from the latest version of the consolidated methodology /17/.
$P_{product,\ max}$ (t HNO_3)	55 900	This value was obtained from the design capacity of the production facility. This value was confirmed /**29**/ /**27**/ by DNV during the validation.

The use of the "*Tool to determine the mass flow of a greenhouse gas in a gaseous stream*, is explicitly requested in the methodology ACM0019 version 02.0.

DNV confirms that all the data used are acceptable and conservative.

4.4.2 Parameters monitored ex-post

The following parameters will be monitored, either as required from the methodology /17/ or the tools /18/ /19/:

- $P_{production,y}$: Nitric acid produced in year y
- h_y: Number of hours of operation in a year y
- NCSG: N_2O concentration in stack gas
- VSG: Volume flow rate in the stack gas

All these parameters included in the methodology, are applicable to the project and have been correctly described in the PDD, as it's possible to see in the following table, that summarize all the information needed.

Parameter	**Unit**	**Meas. Method**	**Monitoring Frequency**	**Accuracy**	**QA/QC** (in addition to the general procedures)
$P_{production,y}$	t HNO_3	The quantity of nitric acid is determined on a daily basis using the data provided by the flow meter measurement and the nitric acid concentration obtained through density measurement	Continuous	For flow meter: ± 1% For specific mass densimeter: ±0.05% For Thermometer : ±0.5%	The meters will be calibrated and maintained in accordance with industry standards. Calibration frequency: *Flow meter* - annually *Thermometer & Densimeter* – replaced at end of calibration validity
h_y	h	The number of hours of operation is daily calculated subtracting the hours when the ammonia feed on the reactor is below of 0.8t/h. This calculation is done by PIMS considering the value of ammonia feed provided by	Monthly	Flowmeter: ±2%	The meters will be calibrated and maintained in accordance with industry standards. Calibration frequency: annually

Parameter	**Unit**	**Meas. Method**	**Monitoring Frequency**	**Accuracy**	**QA/QC** (in addition to the general procedures)
		flowmeter.			
NCSG	mg/Nm^3	NCSG is used for hourly calculation of $F_{N2O,tailgas,h}$	Continuous	Analyser: ±0.5%	The meters will be calibrated and maintained in accordance with industry standards. Calibration frequency: twice annually
VSG	Nm^3/h	VSG is used for hourly calculation of $F_{N2O,tailgas,h}$	Continuous	Meter: ±2.0%	The meters will be calibrated and maintained in accordance with industry standards. Calibration frequency: annually
h_{ry}	h	The number of hours where, for secondary N_2O abatement, abatement system was not installed, underperforming or failed is determined by comparison of $F_{N2O,tail\ gas,h}$ and $EF_{existing,y} \times P_{NA,h}$	Monthly	Calculated	The meters will be calibrated and maintained in accordance with industry standards.

It has to be noticed that the following parameters, that are present in the methodology as parameters to be monitored, are in reality not monitored directly or monitored at all:

- $h_{r,y}$: Number of hours in year y where, for secondary N_2O abatement, abatement system was not installed, underperforming or failed, this is checked but in reality, the catalyst is either installed or not installed. This is recorded and determined. In reality – when the catalyst is not installed – there is no project activity.

Two parameters will be monitored, that are included above and not a direct requirement of the methodology (viz. VSG and NCSG). These are used in the determination of $F_{N2O,tailgas,h}$.

This is in alignment with "*Tool to determine the mass flow of a greenhouse gas in a gaseous stream*" /18/.

The data handling protocol/8/ has been provided to the validator and DNV can confirm and validate that the data handling protocol addresses the backup and archival for the instrumentation in a satisfactory way.

Calibration frequencies have been provided in the PDD and have been validated by DNV by confirming the previous verification reports which assessed the calibrations and found the process to be acceptable and in compliance with the requirements /26/ /27/, DNV can validate that the PDD in respect of paragraph 56 of the Project Standard /13/ as the monitoring plan has been implemented including:
(a) The operational and management structure
(b) Provisions to ensure that data monitored and required for verification and issuance to be kept and archived electronically for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later
(c) Definition of responsibilities and institutional arrangements for data collection and archiving;
(d) Quality assurance and quality control (QA/QC) procedures;
(e) Uncertainty levels, methods and the associated accuracy level of measuring instruments to be used for all parameters and variables to be measured;
(f) Specifications of the calibration frequency for the measuring equipment.

4.4.3 Management system and quality assurance

The management system, quality control and quality assurance procedures are based on the principle of a redundant metering and redundant daily storage supported by electronic files /8/.
A Data Control System creates electronic files where the information is stored /8/. A backup of all the data is made every day on the plant server. Both original document and the backup file are kept for at least 2 years after the crediting period.
With this information monitoring reports are generated /1/.
It is the Production Manager's responsibility to prepare a data review protocol that in case of failure of an instrument, or non-consistency of the data, enables staff to adjust the data according to the procedures outlined in this protocol.
It is the Plant Manager's responsibility to ensure that the per manufacturers specifications required calibration and maintenance procedures for all measurement instruments relevant for monitoring the parameters included in the CDM monitoring plan
For the monitoring plan, the management system and quality assurance includes procedures/9/:
For maintenance of the monitoring equipment and installations.
For identification of training for the monitoring personnel.
For review of reported results/data.
For corrective actions in order to provide more accurate future monitoring and reporting.

The monitoring plan is in accordance with the monitoring methodology. The monitoring plan will give opportunity for real measurements of achieved emission reductions. The application of the monitoring methodology is transparent and DNV considers the project participants able to implement the monitoring plan.
It is DNV's opinion, that the project participants are able to implement the monitoring plan.

4.5 Algorithms and/or formulae used to determine emission reductions

The project correctly applies the baseline and monitoring methodology ACM0019, version 02.0 /17/. The emission reduction ER_y by the proposed project activity during the crediting period is the difference between baseline emissions (BE_y) and project emissions (PE_y) as follows: $ER_y=BE_y-PE_y$

By the time of starting validation the latest data fully verified and issued was ending at 25/11/2012.The use of fully verified data is the most accurate way to estimate emissions, so historical data to estimate ex-ante values for parameters will be taken in this database.

The PP proposed to use data from 26th November 2011 to 25th November 2012 which is the year preceeding the last day of the verified data from the first crediting period. It is DNV's opinion that the use of this historical dataset is acceptable, as all parameters are adequately addressed and comprehensively covered.

It was decided by the PP and considered acceptable by DNV to use the 12 months period from 26th November 2011 to 25th November 2012 for the ex-ante calculations of the emission reductions.

Baseline emissions (BEy)

The approved methodology ACM0019, version 02.0 /17/ allows for two case options to be applied during the calculation of the baseline. As the project activity had been registered using the previous methodologies, AM0028 /15/ and AM0034 /16/, Case1 has been applied by the PP in compliance with the requirements of the methodology.

The following equation estimates the baseline emissions:

$$BE_y = \begin{pmatrix} min\{P_{production,y}; P_{product,max}\} \times EF_{existing,y} + \\ max\{P_{production,y} - P_{product,max}; 0\} \times EF_{new,y} \end{pmatrix} \times \frac{(h_y - h_{r,y})}{h_y} \times GWP_{N2O} \times 10^{-3} \quad \text{Equation (1)}$$

Where:

		Value	Notes
BE_y	Baseline emissions in year y (t CO_2e)		
$P_{product, max}$	Design capacity (t HNO_3)	55 900 t HNO_3	See chp. 4.4.1 of this report
$P_{production,y}$	Production of nitric acid in year y (t HNO_3)	45 982 t HNO_3	Historical data from latest crediting period. /**29**/
$EF_{existing,y}$	N_2O emission factor for nitric acid	5.7603 kg	Minimum value between

	plants that have used AM0028 or AM0034 in the first crediting period in year *y* (kg N_2O/t HNO_3)	N_2O / t HNO_3	$EF_{historical}$ and $EF_{default,y}$ as per equation 2 of the methodology /17/.
$EF_{new,y}$	Baseline N_2O emission factor for nitric acid production in year y (kg N_2O/t HNO_3)	3.4 kg N_2O / t HNO_3	Default value from approved methodology ACM0019 /24/ decreasing to 2.5 in accordance with methodology
GWP_{N2O}	Global warming potential of N_2O	298 tCO_2e/tN_2O	See chp. 4.4.1 of this report
h_y	Number of hours in year y during which the plant was in operation (h)	6 860.8 h	Cross checked against verified monitoring report /**29**/ and confirmed in the ER spread sheet /2/.
$h_{r,y}$	Number of hours (h) in year y where: (a) For secondary N_2O abatement: the abatement system was not installed, underperforming or failed;	0 h	Cross checked against verified monitoring report /**29**/ and confirmed in the ER spread sheet /2/.

To determine the quantity of N_2O emission factor for nitric acid plants that have used AM0028 and AM0034 in the first crediting period ($EF_{exisitng,y}$) will be calculated as follows:.

$$EF_{existing,y} = min\{EF_{historical}; EF_{default,y}\}$$ Equation (2)

Where:

		Value	Notes
$EF_{existing,y}$	N_2O emission factor for nitric acid plants that have used AM0028 or AM0034 in the first crediting period in year *y* (kg N_2O/t HNO_3)	5.7603 kg N_2O / t HNO_3	Minimum value between $EF_{historical}$ and $EF_{default,y}$ as per equation 2of the methodology /17/.
$EF_{historical}$	Historical baseline emission factor of the nitric acid plant (kg N_2O/t HNO_3)	5.7603 kg N_2O / t HNO_3	The historical baseline emission factor of the nitric acid plant. As per the methodology, project activities that applied AM0034 /16/ in the first crediting period need to use the baseline emission factor from the latest baseline campaign. This was cross checked and verified with the latest monitoring /29/ and verification /27/ reports for the most recent (8^{th}) campaign /**31**/ at the time of validation of the renewal of the crediting period.
$EF_{default,y}$	Default emission factor according to the operating pressure of the ammonia burner in year y (kg N_2O/t HNO_3)	8.0 kg N_2O / t HNO_3	Default emission factor according to the operating pressure of the ammonia burner in year y (related to 100 per cent pure acid). This was extracted directly from the latest version of the consolidated methodology /17/ decreasing to 6.8 in accordance with methodology.

Calculation of $h_{r,y}$ is also based on two cases,again in accordance with the methodology, Case 1 is applied.

An abatement system is deemed to be bypassed, not working, underperform or failed in the hour h in year y (i.e. $h_{r,y}$) if:

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

Where:

		Value	Notes
$P_{NA,h}$	Nitric acid produced in the hour *h* (t HNO_3)	0	It was confirmed that no production had occurred without a catalytic component. Thus a zero value was justified and $P_{NA,h}$ did not need to be determined as such.
$EF_{existing,y}$	N_2O emission factor for nitric acid plants that have used AM0028 or AM0034 in the first crediting period in year *y* (kg N_2O/t HNO_3)	5.7603 kg N_2O / t HNO_3	Minimum value between $EF_{historical}$ and $EF_{default,y}$ as per equation 2 of the methodology /17/.
$F_{N2O,tail\ gas,h}$	Mass flow of N_2O in the gaseous stream of the tail gas in the hour *h* (kg N_2O/h)	3.7271 kg N_2O/h	Determined as per "*Tool to determine the mass flow of a greenhouse gas in a gaseous stream*" /18/.

A zero value had been applied for this parameter.

The baseline emissions have been calculated as per the methodology ACM0019 version 02.0, by the formula introduced at the top of this paragraph:

$$BE_y = \begin{pmatrix} min\{P_{production,y};P_{product,max}\}\times EF_{existing,y} + \\ max\{P_{production,y}-P_{product,max};0\}\times EF_{new,y} \end{pmatrix} \times \frac{(h_y - h_{r,y})}{h_y} \times GWP_{N2O} \times 10^{-3} \qquad \text{Equation (1)}$$

That gives a value of 78 931 tCO_2/year.

Project emissions (PEy)

According to the applicable methodology ACM0019 version 02.0, emissions from the project activity shall be calculated with the following formula:

$$PE_y = PE_{N2O,y} + PE_{CO2,tertiary,y} \qquad \text{Equation (6)}$$

Where:

		Value	Notes
$PE_{N2O,y}$	Project N_2O emissions in year *y*	7 567 tonnes	Calculated as per the below formula

$PE_{CO2,tertiary,y}$	Project emissions of CO_2 from the operation of the tertiary N_2O abatement facility in year *y* (t CO_2)	CO_{2eq} n/a	This is not applicable as the project activity only applies secondary abatement and not tertiary abatement.

In particular the calculation of the N_2O project emissions in year y is done as per the following:

$$PE_{N2O,y} = \sum_{1}^{h_y - h_{r,y}} F_{N2O,tail\ gas,h} \times GWP_{N2O} \times 10^{-3}$$ Equation (7)

Where:

		Value	Notes
$PE_{N2O,y}$	Project emissions of N_2O from the project plant in year *y* (t CO_2e)		
GWP_{N2O}	Global warming potential of N_2O	298 tCO_2e/tN_2O	See chp. 4.4.1 of this report
$\Sigma F_{N2O,tail\ gas,h}$	Mass flow of N_2O in the gaseous stream of the tail gas in the hour *h* (kg N_2O/h)	25 392.4 kg N_2O	Determined as per "*Tool to determine the mass flow of a greenhouse gas in a gaseous stream*" /18/.

For the determination of $F_{N2O,tail\ gas,h}$, the requirements of the "*Tool to determine the mass flow of a greenhouse gas in a gaseous stream*" /18/ are applied as follows.

Option B (volume flow on a wet basis) is selected as the measurement option from the tool, as the automated measuring calculates flow from instrumentation on a wet basis. Using the guidance from the tool, "simplified calculation without measurement of the moisture content", absolute humidity ($m_{H2O,t,db,Sat}$) is taken as zero in order to demonstrate a conservative approach.

As the N_2O fraction is measured directly in mg N_2O / Nm^3 and not in m^3 N_2O / Nm^3, there is no need to use the density of the greenhouse gas and the formula proposed by the tool can be simplified in:

$F_{N2O,tail\ gas,h} = NCSG_h \times VSG_h/1000000$

Where:	=	
$F_{N2O,tail\ gas,h}$		Mass flow of N_2O in the gaseous stream of the tail gas in the hour *h* (kg N_2O/h)
$NCSG_h$	=	N_2O concentration in the stack gas (mg/Nm^3)
VSG_h	=	Volume flow rate of the stack gas (Nm^3/h)

Hence, applying formula

$$PE_y = PE_{N2O,y} + PE_{CO2,tertiary,y}$$ Equation (6)

It is found that PE_y = 7 567 tCO_2 per year.

Leakage emissions (Ly)

According to the applicable methodology ACM0019 version 02.0, leakage emissions are considered negligible and are considered zero for the Emission Reduction (ER_y) calculations.

Emission reductions (ERy)

As defined at the start of this section,

$ER_y = BE_y - PE_y$

Which result is presented in section 4.6 of this report.

All assumptions and data used by the project participants are listed in the PDD and/or supporting documents, including their references and sources. All documentation used by the project participants as the basis for assumptions and source of data is correctly quoted and interpreted in the PDD. All values used in the PDD are considered reasonable in the context of the proposed CDM project activity. The methodology has been applied correctly to calculate project emissions, baseline emissions, leakage and emission reductions. All estimates of the baseline, project and leakage emissions can be replicated using the data and parameter values provided in the PDD.

The methodologies for calculating emission reductions are transparently documented and the accuracy of the calculations has been verified.

4.6 Estimation of GHG emissions

As defined at the previous section,

$ER_y = BE_y - PE_y$

That applied for the next crediting period (7 years) gives:

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage emissions (t CO_2e)	Emission reductions (t CO_2e)
28/07/2014 - 31/12/2014	33 951	3 255	0	30 696
01/01/2015 - 31/12/2015	78 931	7 567	0	71 364
01/01/2016 - 31/12/2016	78 931	7 567	0	71 364
01/01/2017 - 31/12/2017	78 931	7 567	0	71 364
01/01/2018 - 31/12/2018	78 931	7 567	0	71 364
01/01/2019 - 31/12/2019	78 931	7 567	0	71 364
01/01/2020 - 31/12/2020	78 931	7 567	0	71 364
01/01/2021 - 27/07/2021	44 980	4 312	0	40 668
Total	**552 517**	**52 969**	**0**	**499 548**
Annual average over crediting period	**78 931**	**7 567**	**0**	**71 364**

Based on the calculations and results presented in the sections above the implementation of the project activity will result in an average ex-ante estimation of emission reduction correctly calculated to 71 364 tCO_2e per year for the selected crediting period.

All assumptions and data used by the project participants are listed in the PDD, including their references and sources and have been validated by DNV; all documentation used by project participants as the basis for assumptions and source of data is correctly quoted and interpreted in the PDD; all values used in the PDD are considered by DNV reasonable in the context of the project activity and have been cross-checked in the previous section.

The baseline methodology and corresponding tools have been applied correctly to calculate project emissions, baseline emissions, leakage and emission reductions, as demonstrated in the previous section, resulting in a complete, accurate, transparent and conservative calculation of the emissions reduction.

All estimates of the baseline emissions can be replicated using the data and parameter values provided in the PDD.

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APPENDIX A

CDM VALIDATION PROTOCOL

Table 1 Requirements checklist

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
A General description of project activity						
A.1	**Title of the project activity (PS § 31, VVS § 62-63)**					
A.1.1	Does section A.1 of the PDD include a clearly identifiable project title, version number of the PDD and date of the PDD?	/1/	DR	☒ Clearly identifiable title of the project activity ☒ Version number of the PDD is included ☒ Date of the PDD is included.		OK
A.1.2	Is the PDD is in accordance with the applicable requirements for completing PDDs?	/1/	DR	☒ Yes PDD had been updated for all relevant sections. PDD was in the newest available format (version 4.1) for the VVS.		OK
B Application of a baseline and monitoring methodology						
B.1	**Methodology applied (VVS para 70-133 and VVS § 150-153 for small-scale project activities, as applicable)**					
B.1.1	Does the project apply an approved methodology and the correct version thereof? *If during the course of validation the originally applied version of the methodology expires, a CAR shall be raised in Table 3 of the validation protocol. Any new requirements of the revised version of the methodology not yet validated in Table 2 of the validation protocol shall be validated in Table 3 as part of the assessment of the CAR raised.*	/1/	DR	The project activity was registered as a CDM project applying the methodologies AM0028 ver. 4 - Catalytic N_2O destruction in the tail gas of Nitric Acid or Caprolactam Production Plants /15/and AM0034 ver. 2 - Catalytic reduction of N2O inside the ammonia burner of nitric acid plants /16/.For the renewal of crediting period, the project applies the consolidated methodology which was based on the previous methodologies. Version 02.0 of ACM0019, which is the latest version currently available was applied/17/		OK

MoV = Means of Verification, DR= Document Review, I= Interview, CC= Cross-Checking

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
B.2	**Applicability of methodology (and tools) (VVS § 73-77)** *Insert a row for each applicability criteria of the applied methodology (and tools)*					
B.2.1	How was it validated that project complies with the following applicability criteria: *This methodology applies to project activities that introduce N_2O abatement measures in nitric acid plants*?	/1/	DR	The project activity consists of the installation of a new (not previously installed) catalyst below the oxidation gauzes with the sole purpose is the decomposition of N_2O at the existing nitric acid production plant. This was installed specifically for the project activity, as described in section A.1 of the PDD /1/, that confirmed that the scope had not changed since the first crediting period		OK
B.2.2	How was it validated that project complies with the following applicability criteria: *In the case that the nitric acid plant started commercial operation before the implementation of the CDM project activity, the project participants shall demonstrate that there was no secondary or tertiary N_2O abatement technology installed in the respective nitric acid plant;*?	/1/	DR	The project activity consist of the installation of a new (not previously installed) catalyst below the oxidation gauzes with the sole purpose is the decomposition of N_2O at the existing nitric acid production plant as described in section A.1 of the PDD /1/.		OK
B.2.3	How was it validated that project complies with the following applicability criteria: *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*?	/1/	DR	This was not clear in the evidence provided by the PP and a CL will be raised for clarification.	~~CL 1~~	OK
B.2.4	How was it validated that project complies with the following applicability criteria: *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 CDM project activity is implemented?*	/1/	DR	As confirmed by IPEA /32/, a Brazilian governmental institute, Brazil has confirmed the Copenhagen Accord, and the Conference of Parties (COP 16) in Cancun, its voluntary national targets for reducing emissions greenhouse gas (GHG) reductions between 36.1% and 38.9% of emissions projected by		OK

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Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
			2020. These targets have been defined in the National Policy on Climate Change (NPCC), voted by Congress (Law 12,187, of 29 December 2009). The NPCC is actually a legal framework for the regulation of mitigation and adaptation in the country: the related Executive Decrees establish in line with the National Policy on Climate Change, sectorial plans mitigation and adaptation to climate change in order to consolidate an economy of low carbon. In December 2010 was thus edited Decree No. 7.390 (9 December 2010). The decree allowed clarifying and defining various regulatory aspects the legal text regarding the measurement of goals, formulation of sectorial plans and structure governance. To achieve the objectives of NPCC, the country will adopt as national commitment voluntary actions to mitigate emissions of greenhouse gases, in order to reduce its projected emissions by 2020. The Decree 7.390/2010, which regulates the NPCC, projected to achieve this tCO_{2eq} national by voluntary commitment: in the decree, article 11 says that the NPCC Executive Decree shall, in accordance with the National Policy on Climate Change, plans sectorial mitigation and adaptation in the generation and distribution of electricity, public transport modal systems in urban and interstate transportation of cargo and passengers, in the manufacturing industry and the consumer durables. So it is clear by the analysis of the national		

Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
			regulatory environment, that there are no mandatory national and/or sectorial policies affecting the baseline scenario. This is further confirmed by a firm specialized in environmental auditing, that provided the World Bank /34/ with a "*Compliance audit report on the environmental and social aspects"* in which it is clearly stated that among the main legal requirements and specific requirements on environment, safety and health (49 Federal, 17 National and 6 Municipal laws) /38/ no requirements are related to GHG emissions reduction so to affect the baseline scenario. Communication with the State environmental authorities in 1996 /5/ with confirmed that the plant was in compliance with a requested limit of 200ppm for NO_x gaseous emissions and not requirement for any additional $DeNO_x$ or catalytic system for abatement, so as soon as this value is respected with the actual project system this is considered in compliance with the required legislation and requirements of the VVS. The project activity was further issued with an updated Operating License by CETESB on 2 April 2012 /6/ which confirms that no limits or requirements for N_2O abatement or control are required. Further to this, the information was cross checked with DNV's Brazil office who are experienced in Brazilian legislation and policy updateds and it was confirmed that the information presented above is correct /33/.		

	Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
B.3	**Project boundary (VVS § 82-87)**					
B.3.1	What are the project's system boundaries (components and facilities used to mitigate GHGs)? Are they clearly defined and in accordance with the methodology?	/1/	DR	In the respect of methodology ACM0019 version 02.0 /17/ 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. A schematic illustration of the project boundary is given in the PDD, section B.3, that coincide with the scheme contained in the methodology./1/		OK
B.3.2	Which GHG sources are identified for the project? Does the identified boundary cover all possible sources linked to the project activity? Give reference to documents considered to arrive at this conclusion.	/1/	DR	Not all emission sources considered in the PDD. Emissions and sources included in the project boundary are: - Baseline emissions: N_2O emissions from NH_3 oxidation at the primary catalyst gauze which is a main emission source for the project activity. - Project emissions: According to the applicable methodology ACM0019 version 02.0, for this kind of project activity, emissions are related to: • N_2O emissions from process that are directly released in the atmosphere during project activity from the oxidation of NH_3 at the primary catalyst gauze: the PP calculated these emission in the PDD in respect of the methodology /17/ formulas • CO_2 and N_2O emissions from the operation of a tertiary N_2O abatement facility: the PP omitted these emissions in the PDD in respect of the methodology /17/ formulas	~~CL 2~~	OK

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				as no tertiary N_2O abetment facility was installed in the project activity, as confirmed in the previous validation and in the documentary analysis of the project activity. DNV checked the validation report of the registered PDD in the first crediting period /22/ and the verification reports and confirmed that the emissions have always been accounted for during the first crediting period – so no change was made and the GHG sources remain unchanged and valid.. - Leakage: According to the applicable methodology ACM0019 version 02.0, leakage emissions are deemed to be negligible for this project activity and were considered as zero by the project participant.		
B.3.3	Do the system boundaries for the project as described in the PDD fully comply with the system boundaries stipulated by the applied baseline methodology?	/1/	DR	A schematic illustration of the project boundary is given in the PDD, section B.3, /1/ that coincides with the scheme contained in the methodology/17/. The project activity implemented on site in respect of the project boundary indicated in the PDD was confirmed as not having changed from the first validation period and checked the validation report of the registered PDD in the first crediting period /22/ and the verification reports. The system boundaries therefore remain unchanged and valid.		OK

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
B.3.4	Does the project involve other emissions sources not foreseen by the methodologies that may question the applicability of the methodology? Do these sources contribute with more than 1% of the estimated emission reductions of the project?	/1/	DR	The validation of the renewal of the crediting period of the project activity did not reveal other greenhouse gas emissions occurring within the proposed CDM project activity boundary as a result of the implementation of the proposed project activity which are expected to contribute more than 1% of the overall expected average annual emission reduction, which are not addressed by ACM0019 version 02.0 /17/.		OK
B.4	**Baseline scenario determination and description (VVS § 88-95 / Identification of alternatives to the project activity (VVS § 113-116)** *Ensure that the evaluation of all alternatives provided in the PDD and required by the methodology and also possible alternatives/offshoots of alternatives are discussed. Check that all alternatives required to be considered by the methodology are included in the final PDD. If baseline alternatives required to be considered by the methodology are considered not applicable, please assess the justification for this.*					
B.4.1	Which baseline scenarios have been identified? Is the list of baseline scenarios complete? Does the list include as one of the options that the project activity is undertaken without being registered as a proposed project activity? Does the list contains all plausible alternatives which are viable means of supplying the comparable outputs or services that are to be supplied by the proposed project activity?	/1/	DR	Baseline information from PDD registered for first crediting period remains unchanged and remains valid for the second crediting period.		OK
B.4.2	Could the project activity in absence of the CDM or other baseline alternatives also be implemented by other entities than the CDM project participants? If so, has this also been included in the list of baseline scenarios?	/1/	DR	Baseline information from PDD registered for first crediting period remains unchanged and remains valid for the second crediting period.		OK

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Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
B.4.3	How have the other baseline scenarios been eliminated in order to determine the baseline?	/1/	DR	Baseline information from PDD registered for first crediting period remains unchanged and remains valid for the second crediting period		OK
B.4.4	What is the baseline scenario?	/1/	DR	The baseline was the scenario that existed prior to the implementation of the project activity (i.e. production of nitric acid with no N_2O abatement). Baseline information from PDD registered for first crediting period remains unchanged and remains valid for the second crediting period.		OK
B.4.5	Is the determination of the baseline scenario in accordance with the guidance in the methodology?	/1/	DR	Baseline information from PDD registered for first crediting period remains unchanged and remains valid for the second crediting period.		OK
B.4.6	Has the baseline scenario been determined using conservative assumptions where possible?	/1/	DR	Baseline information from PDD registered for first crediting period remains unchanged and remains valid for the second crediting period, including the assumptions made.		OK
B.4.7	Does the baseline scenario sufficiently take into account relevant national and/or sectoral policies? Does the baseline scenario comply with all applicable and enforced legislation?	/1/	DR	As confirmed by IPEA /32/, a Brazilian governmental institute, Brazil has confirmed the Copenhagen Accord, and the Conference of Parties (COP 16) in Cancun, its voluntary national targets for reducing emissions greenhouse gas (GHG) reductions between 36.1% and 38.9% of emissions projected by 2020. These targets have been defined in the National Policy on Climate Change (NPCC), voted by Congress (Law 12,187, of 29 December 2009). The NPCC is actually a legal framework for the regulation of mitigation and adaptation in the country: the related Executive Decrees establish in line with the National Policy on Climate Change, sectorial plans mitigation and adaptation to climate change in order to consolidate an economy of low		OK

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Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
			carbon. In December 2010 was thus edited Decree No. 7.390 (9 December 2010). The decree allowed clarifying and defining various regulatory aspects the legal text regarding the measurement of goals, formulation of sectorial plans and structure governance. To achieve the objectives of NPCC, the country will adopt as national commitment voluntary actions to mitigate emissions of greenhouse gases, in order to reduce its projected emissions by 2020. The Decree 7.390/2010, which regulates the NPCC, projected to achieve this tCO_{2eq} national by voluntary commitment: in the decree, article 11 says that the NPCC Executive Decree shall, in accordance with the National Policy on Climate Change, plans sectorial mitigation and adaptation in the generation and distribution of electricity, public transport modal systems in urban and interstate transportation of cargo and passengers, in the manufacturing industry and the consumer durables. So it is clear by the analysis of the national regulatory environment, that there are no mandatory national and/or sectorial policies affecting the baseline scenario. This is further confirmed by a firm specialized in environmental auditing, that provided the World Bank /34/ with a "*Compliance audit report on the environmental and social aspects"* in which it is clearly stated that among the main legal requirements and specific requirements on environment, safety and health (49 Federal, 17 National and 6 Municipal		

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				laws) /38/ no requirements are related to GHG emissions reduction so to affect the baseline scenario. Communication with the State environmental authorities in 1996 /5/ with confirmed that the plant was in compliance with a requested limit of 200ppm for NO_x gaseous emissions and not requirement for any additional $DeNO_x$ or catalytic system for abatement, so as soon as this value is respected with the actual project system this is considered in compliance with the required legislation and requirements of the VVS. The project activity was further issued with an updated Operating License by CETESB on 2 April 2012 /6/ which confirms that no limits or requirements for N_2O abatement or control are required. Further to this, the information was cross checked with DNV's Brazil office who are experienced in Brazilian legislation and policy updateds and it was confirmed that the information presented above is correct /33/.		
B.4.8	Is the baseline scenario determination compatible with the available data and are all literature and sources clearly referenced?	/1/	DR	Baseline information from PDD registered for first crediting period has been amended.		OK
B.4.9	Is the baseline determination adequately documented in the PDD? • All assumptions and data used by the project participants are listed in the PDD and related document to be submitted for registration. The data are properly referenced. • All documentation is relevant as well as correctly quoted and interpreted.	/1/	DR	*It is required that all source data is provided transparently and completely.*	~~CAR 1~~	OK

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Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
	• Assumptions and data can be deemed reasonable • Relevant national and/or sectoral policies and circumstances are considered and listed in the PDD. • The methodology has been correctly applied to identify what would occurred in the absence of the proposed CDM project activity					
B.5	**Calculations of GHG emission reductions**					
	Data and parameters that are available at validation and that are not monitored (VVS § 96-100)					
B.5.1	How was the Operating Pressure parameter available at validation verified?	/1/	DR	The Operating Pressure is defined by manufacturer specifications.	~~CL 3~~	OK
B.5.2	How was the $EF_{historical}$ parameter available at validation verified?	/1/	DR	The parameter $EF_{historical}$ is applied (previously refered to as EF_{BL} in previous versions of methodology) as per the methodology ACM0019, /17/ and applies the same value used in the previous methodology AM0034 /16/.	~~CL 3~~	OK
B.5.3	How was the $EF_{default,y}$ parameter available at validation verified?	/1/	DR	The volume of emission reductions does not show an accurate reflection of the values of parameters the EFnew and EFdefault,y that show a decrease over the crediting period as per the approved methodology. Clarity is requesting in the application of the methodology values in the calculation of the ER estimates..	~~CL10~~	OK
B.5.4	How was the $EF_{new,y}$ parameter available at validation verified?	/1/	DR	The volume of emission reductions does not show an accurate reflection of the values of parameters the EF_{new} and $EF_{default,y}$ that show a decrease over the crediting period as per the approved methodology. Clarity is requesting in the application of the methodology values in the calculation of the ER estimates.	~~CL10~~	OK
B.5.5	How was the $P_{product,\ max}$ parameter available at validation	/1/	DR	This parameter has been renamed in the	~~CL3~~	OK

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	Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
	verified?			consolidated methodology ACM0019 from NAP to $P_{product, max}$. The value remains unchanged from the first crediting period.		
B.5.6	How was the GWP_{N2O} parameter available at validation verified?	/1/	DR	Global warming potential of the N_2O during the crediting period (298 tCO_2e/tN_2O) respect the 4/CMP.7		OK
	Baseline emissions (VVS § 96-100)					
B.5.7	Are the calculations documented according to the approved methodology and in a complete and transparent manner?	/1/	DR	The baseline emissions need to be calculated in accordance with the baseline methodology ACM0019 version 02.0 /17/ ➢ The source data for selected parameters had not been provided in order to validate their authenticity. ➢ $P_{production,y}$source of data required from annual production records ➢ h_y data from the first crediting period to support the value is outstanding ➢ $h_{r,y}$ is absent from section B.7.1 of the PDD although included in table in step 1.4 of section B.4 of the PDD. ➢ NCSG is included in section B.7.1 of the PDD but not adequately explained as the methodology ACM0019 does not require the monitoring thereof, ➢ VSG is included in section B.7.1 of the PDD but not adequately explained as the methodology ACM0019 does not require the monitoring thereof.	~~CAR 2 CL10~~	OK
B.5.8	Have conservative assumptions been used when calculating the baseline emissions?	/1/	DR	*To be assessed after closure of all CAR/CL related.*	~~CAR 2~~	OK

	Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
B.5.9	Are uncertainties in the baseline emission estimates properly addressed?	/1/	DR	*To be assessed after closure of all CAR/CL related.*	~~CAR 2~~	OK
	Project emissions (VVS § 96-100)					
B.5.10	Are the calculations documented according to the approved methodology and in a complete and transparent manner?	/1/	DR	*The project emissions need to be calculated in accordance with the baseline methodology ACM0019 version 02.0, the 'Tool to calculate the emission factor for an electricity system' (version 2.2.1) and the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" /19/. A clarification on the data source is needed. It was confirmed during the on site validation that there was no captive power plants on the site.*	~~CL 4~~	OK
B.5.11	Have conservative assumptions been used when calculating the project emissions?	/1/	DR	*To be assessed after closure of all CAR/CL related.*	~~CL 4~~	OK
B.5.12	Are uncertainties in the project emission estimates properly addressed?	/1/	DR	*To be assessed after closure of all CAR/CL related.*	~~CL 4~~	OK
	Leakage (VVS § 96-100)					
B.5.13	Are the leakage calculations documented according to the approved methodology and in a complete and transparent manner?	/1/	DR	*In accordance with the baseline methodology ACM0019 version 02.0* - *Any leakage emissions sources are deemed to be negligible*		OK
B.5.14	Have conservative assumptions been used when calculating the leakage emissions?	/1/	DR	*In accordance with the baseline methodology ACM0019 version 02.0* *Any leakage emissions sources are deemed to be negligible*		OK
B.5.15	Are uncertainties in the leakage emission estimates properly addressed?	/1/	DR	*In accordance with the baseline methodology ACM0019 version 02.0* *Any leakage emissions sources are deemed to be*		OK

Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
			negligible		
Emission Reductions (VVS § 96-100)					
B.5.16 Algorithms and/or formulae used to determine emission reductions: • All assumptions and data used by the project participants are listed in the PDD and related document submitted for registration. The data are properly referenced • All documentation is correctly quoted and interpreted. • All values used can be deemed reasonable in the context of the project activity • The methodology has been correctly applied to calculate the emission reductions and this can be replicated by the data provided in the PDD and supporting files to be submitted for registration.	/1/	DR	According to the applicable methodology ACM0019 version 02.0, Emissions reductions in year is equal to : ERy = BEy - PEy As indicated in the PDD, the formula is correctly applied. *Section 7.12.7 of the VVS regarding Algorithms and/or formulae used to determine emission reductions are required to be transparent and complete. The Emission reduction calculations presented were not complete with transparency to source raw data.*	~~CL 5~~ ~~CL 9~~	OK
B.6 Monitoring plan (VVS § 131-133)					
Data and parameters monitored					
B.6.1 Do the means of monitoring described in the plan comply with the requirements of the methodology?	/1/	DR	The archival of monitoring information requires clarification to confirm it complies with paragraph 6.1 of the applied methodology, as the requirement is for "*at least two years after the end of the last crediting period*." The PDD lists ten years which is potentially a shorter period.	~~CL 6~~	OK
B.6.2 Does the monitoring plan contains all necessary parameters, and are they clearly described?	/1/	DR	The monitoring plan described in the PDD complies with the requirements of the methodology and all the required parameters are described. • $P_{production,y}$ *: Nitric acid produced in year y* • h_y*: Number of hours of operation in a year y*	~~CAR2~~	OK

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Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				• $h_{r,y}$ – *this is not included in the PDD*		
B.6.3	In case parameters are measured, is the measurement equipment described? Describe each relevant parameter.	/1/	DR	*To be assessed after closing relevant CAR/CLs*		OK
B.6.4	In case parameters are measured, is the measurement accuracy addressed and deemed appropriate? Describe each relevant parameter.	/1/	DR	*To be assessed after closing relevant CAR/CLs*		OK
B.6.5	In case parameters are measured, are the requirements for maintenance and calibration of measurement equipment described and deemed appropriate? Describe each relevant parameter.	/1/	DR	*To be assessed after closing relevant CAR/CLs*		OK
B.6.6	Is the monitoring frequency adequate for all monitoring parameters? Describe each parameter.	/1/	DR	*To be assessed after closing relevant CAR/CLs*		OK
B.6.7	Is the recording frequency adequate for all monitoring parameters? Describe each parameter.	/1/	DR	*To be assessed after closing relevant CAR/CLs*		OK
	Ability of project participants to implement monitoring plan					
B.6.8	How has it been assessed that the monitoring arrangements described in the monitoring plan are feasible within the project design?	/1/	DR	*It could not be validated that "*the monitoring arrangements described in the monitoring plan are feasible within the project design*" as the following documents as listed in the PDD were still required for validation; Data Handling Protocol, Information about the management and operational system implemented for the monitoring system, Workbook for emission reduction calculation, Data review protocol and Calibration and maintenance protocol*	~~CL 7~~	OK
B.6.9	Are procedures identified for day-to-day records handling (including what records to keep, storage area of records and how to process performance documentation)?	/1/	DR	The roles and responsibilities for the implementation of the Monitoring plan need to be clarified in order to ensure adequate implementation in terms of paragraph 132 of the VVS. There are multiple roles assigned	~~CL 8~~	OK

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				responsibility for an element of the monitoring plan (e.g. Production Manager, Production Engineer and CO2 Operations Director).		
B.6.10	Are the data management and quality assurance and quality control procedures sufficient to ensure that the emission reductions achieved by/resulting from the project can be reported ex post and verified?	/1/	DR	To be assessed after closing relevant CAR/CLs	~~CL 7~~	OK
B.6.11	Will all monitored data required for verification and issuance be kept for two years after the end of the crediting period or the last issuance of CERs, for this project activity, whichever occurs later?	/1/	DR	To be assessed after closing relevant CAR/CLs		OK

Table 2 Resolution of corrective action requests and clarification requests

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
CAR 1**:** It is required that all source data for assessing the impact of circumstances (Step 1.2) is provided transparently and completely. Specifically the source document for the Investment analysis, and the "*N_2O marketing research report*" (footnote 10 of PDD)	B.4.9	NPV calculation file was revised to include the sources of the investment costs and of the operational costs Extracts of the contract with the catalyst supplier were sent to the DOE to justify the operating costs of the project The footnotes page 11 of the PDD were revised and the documents listed in these footnotes sent to the DOE	The PP provided an updated version of the NPV calculation spreadsheet /3/ (version 2) and copies of the marketing reports for both nitric acid (HNO_3) /24/ and nitrous oxide (N_2O) /23/. Additional documentation such as the catalyst supply agreement /4/ were also supplied. The parameters used in the NPV determination were checked against the source documentation and found to be acceptable. **CAR1 is Closed**
CAR 2**:** Paragraph 97 of the VVS requires that all algorithms and equations, and the component parameters need to be presented in order to demonstrate compliance with the relevant methodologies and tools. A number of data and parameters presented in the PDD did not provide explanation or justification. The source data for selected parameters had not been provided in order to validate their authenticity. ➢ $P_{production,y}$source of data required from annual production records ➢ h_y data from the first crediting period to support the value is outstanding ➢ $h_{r,y}$ is absent from section B.7.1 of the PDD although included in table in step 1.4 of section B.4 of the PDD.	B.5.7 B.5.8 B.5.9 B.6.2	• $P_{production,y}$ source of data are the production recorded in the Monitoring Report and Emission Reductions calculation files of the verification periods #7 (from 03/07/11 to 03/03/12) and #8 (from 04/03/12 to 25/11/12). These periods were verified by the verification DOE and the corresponding credits issued by UNFCCC (see http://cdm.unfccc.int/Projects/DB/DNV-CUK1174479298.53/view). The Emission Reductions calculation files of these 2 periods were submitted to the DOE • h_y source of data are the production	The PP has supplied evidence and supporting documentation to demonstrate the compliance of the algorithms and equations, and the component parameters to the requirements of the VVS. • $P_{production,y}$ was cross checked against the latest 2 monitoring reports for the project /28/, /29/ which were both verified and reported by the verifying DOE /26/, /27/ for the 7th and 8th Monitoring periods. These were confirmed and determined to be acceptable by DNV. • h_y was cross checked against the latest 2 monitoring reports for the

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
➢ NCSG is included in section B.7.1 of the PDD but not adequately explained as the methodology ACM0019 does not require the monitoring thereof, ➢ VSG is included in section B.7.1 of the PDD but not adequately explained as the methodology ACM0019 does not require the monitoring thereof		recorded in the Monitoring Report and Emission Reductions calculation files of the verification periods #7 (from 03/07/11 to 03/03/12) and #8 (from 04/03/12 to 25/11/12). These periods were verified by the verification DOE and the corresponding credits issued by UNFCCC (see http://cdm.unfccc.int/Projects/DB/DNV-CUK1174479298.53/view). The Emission Reductions calculation files of these 2 periods were submitted to the DOE • The table for the parameter $h_{r,y}$ is included in section B.7.1 • NCSG is the N_2O concentration in the stack gas. It is used for calculation of $F_{N2O,tailgas,h}$. Explanations were included in section B.6.1 and in the table NCSG of section B.7.1 • VSG is the volume flow rate in the stack gas. It is used for calculation of $F_{N2O,tailgas,h}$. Explanations were included in section B.6.1 and in the table VSG of section B.7.1	project /28/, /29/ which were both verified and reported by the verifying DOE /26/, /27/ for the 7th and 8th Monitoring periods. These were confirmed and determined to be acceptable by DNV. • $h_{r,y}$ was added to the PDD. This was confirmed and determined to be acceptable by DNV. • NCSG is the N_2O concentration in the stack gas. It is used for calculation of $F_{N2O,tailgas,h}$. Explanations were included in section B.6.1 and in the table NCSG of section B.7.1. This was confirmed and determined to be acceptable by DNV. • VSG is the volume flow rate in the stack gas. It is used for calculation of $F_{N2O,tailgas,h}$. Explanations were included in section B.6.1 and in the table VSG of section B.7.1. This was confirmed and determined to be acceptable by DNV The changes made and substantiation of the data parameters were acceptable for DNV and the algorithms and equations, and the component parameters presented were deemed to demonstrate compliance with the relevant methodologies and tools. **CAR2 is Closed**

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
CL 1: The methodology lists conditions that need to be met in order for the methodology to be applicable. Evidence of "*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"* was not seen during the validation.	B.2.3	The N_2O concentration and the total gas flow are continuously measured and registered in the PIMS system. An extraction of the PIMS system, showing the graphs of the two parameters and the registration of the values each 2 seconds, was provided to the DOE.	The PP provided evidence from the Process Information Management System (PIMS) which provides continuous measurement of both the total gas flow and gas concentration on a 2 second interval /36/ and then transposed into an Excel spreadsheet for data analysis and reporting /37/. **CL1 is Closed**
CL 2: The consolidated methodology**,** ACM0019 summarises gases and sources in section 5.2, Table 2. Not all gases and sources had been justified as to their inclusion or exclusion.	B.3.2	In the table 2 of section 5.2 of the consolidated methodology the last part of the table is dealing with the emissions linked to the Operation of a **tertiary** N_2O Abatement facility. As the project activity is the installation of a **secondary** N_2O Abatement facility and as there is no fossil fuel used in the project activity, this part was omitted of the first version of the PDD. The table 2 was revised to include this part with an explanation about the type of project activity	The PP has updated the table of gas and sources in the PDD. This includes now all gases mentioned in the methodology. This now is aligned with the methodology. **CL2 is closed**
CL 3: VVS requires that data and parameters are adequately supported. A number of monitoring data and parameters have not been adequately supported with adequate documentary evidence. Evidence is required for: ➢ Operating Pressure ➢ $EF_{historical}$ – not justified in terms of section 5.7 of the methodology ➢ $P_{product, max}$	B.5.1 B.5.2 B.5.5	For the registration of its first crediting period, the project had to realize a baseline campaign previous to the installation of the catalyst. • During this baseline campaign, the range for operating pressure was confirmed to be between 359 and 385 kPa (data available in all the ER calculation files of the verified periods	The PP had clarified the parameters and supplied supporting evidence to support the values in the PDD. ➢ Operating Pressure was clarified to be in the range 359 to 385 kPa as included in the verification reports from the first crediting period and the PDD (version 4 of 23 January 2007) which was used in the initial

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
		of the first crediting period) • $EF_{historical}$ was determined using the data provided during this last baseline campaign (data available in all the ER calculation files of the verified periods of the first crediting period) in conformity with the requirement of the consolidated methodology ACM0019 section 5.7, table $EF_{historical}$ option b (for plants that used AM0034 in the first crediting period) • $P_{product, max}$ was also defined to follow the requirements of the methodology AM0034 (used for the first crediting period). This parameter was used during the first crediting period to cap the yearly HNO_3 production PDD and ER calculation files of issued periods were provided to the DOE. To be noted that the methodology AM0028 is mentioned in the PDD of the first crediting period only because the methodology AM0034 used was referring to AM0028 for definition of the baseline scenario and for the definition of EF_{reg} (Emissions level set by newly introduced policies or regulations)	registration of the project activity during the first crediting period, this was confirmed by cross checking against monitoring reports for the first crediting period including the most recent /29/. ➢ $EF_{historical}$ – as required by part (b) of the parameter procedures in the methodology /17/, the "*the baseline emission factor determined through the latest baseline campaign conducted in accordance with the methodology AM0034*." In the project case, this was checked for monitoring campaign #8 ending on 25 November 2012 /29/. The same value of 5.7603 kg N_2O / t HNO_3 was used consistently used in all the verification periods of the first crediting period. ➢ $P_{product, max}$ – the unit nameplate value of 55,900 t HNO_3 has been used consistently throughout the first crediting period. This was cross checked in the registered PDD (version 05) for the first crediting period /1/ and the latest Monitoring Report /29/. **CL3 is Closed**

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
CL 4: The project emissions need to be calculated in accordance with the baseline methodology ACM0019 version 02.0, the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" and "Tool to determine the mass flow of a greenhouse gas in a gaseous stream". A clarification on the data source is needed. It was confirmed that there was no captive power plants on the site.	B.5.10 B.5.11 B.5.12	The "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 2.0.0) is used in the following way: Due to the characteristics of the AMS, the measurement option chosen for the project is the option B (volume flow on a wet basis and volumetric fraction on a dry basis). The option 2 "simplified calculation without measurement of the moisture content" is also applied and, to be conservative, the absolute humidity of the gaseous stream is assumed to equal 0. As the N_2O fraction is measured directly in mg N_2O / Nm^3 and not in m^3 N_2O / Nm^3, there is no need to use the density of the greenhouse gas and the formula proposed by the tool can be simplified in: $F_{N2O,tail\ gas,h} = NCSG_h \times VSG_h \quad /1000000$ Where: • $F_{N2O,tail\ gas,h}$ = Mass flow of N_2O in the gaseous stream of the tail gas in the hour h (kg N_2O/h) • $NCSG_h$ = N_2O concentration in the stack gas (mg N_2O/Nm^3) • VSG_h = Volume flow rate of the stack gas (Nm^3/h) The "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" is only to be used in the case of tertiary abatement where fossil fuel can be used in the project activity. As the project activity is the installation of a secondary N_2O	The PP demonstrated correctly that the tools had been correctly applied in the PDD and clarified that no tertiary abatement technology had been applied. **CL4 is Closed**

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
		Abatement facility and as there is no fossil fuel used in the project activity, there is no need to use the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion".	
CL 5: Section 7.12.7 of the VVS regarding Algorithms and/or formulae used to determine emission reductions are required to be transparent and complete. The Emission reduction calculations presented were not complete with transparency to source raw data.	B.5.16	A color code was included in the cover sheet of the ER calculation file to differentiate the raw data from the calculated data. The main equation from the methodology were also included in the ER calculation file	The PP had amended the ER calculation spreadsheet /2/ which was aligned with baseline methodology ACM0019 /17/. This included colour coding of the parameters and explainations and links to source data. **CL5 is Closed**
CL 6: The archival of monitoring information requires clarification to confirm it complies with paragraph 6.1 of the applied methodology and paragraph 56 of the Project Standard, as the requirement is for "*at least two years after the end of the last crediting period*." The PDD lists ten years which is potentially a shorter period.	B.6.1	The archival of monitoring information will be done in conformity with paragraph 6.1 of the applied methodology and paragraph 56 of the Project Standard. The "additional comments" part of the monitoring parameters tables and the paragraph "Data archiving" of the section B.7.3 were modified to indicate that the monitoring information will be kept for at least for two years after the end of the last crediting period	The PP has amended the PDD to ensure that the archival period meets the requirements of the Project Standard. **CL6 is Closed**
CL 7: It could not be validated that "*the monitoring arrangements described in the monitoring plan are feasible within the project design*" as the following documents as listed in the PDD were still required for validation; Data Handling Protocol, Information about the	B.6.8	The following documents: • Data Handling Protocol, • Data flow summary • Calibration and maintenance protocol were sent to the DOE In addition, the wording of the Monitoring	DNV applied a two-step process to determine whether the description of the monitoring plan included in the PDD is based on the approved monitoring methodology including applicable tool(s): (a) DNV assessed compliance of the

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
management and operational system implemented for the monitoring system, Workbook for emission reduction calculation, Data review protocol and Calibration and maintenance protocol.		plan was slightly changed as the data review is included in the Data Handling Protocol of the project	monitoring plan with the approved methodology and the applicable tool(s), by: (i) Identifying the list of parameters required by the selected approved methodology including applicable tool(s) by document review; DNV found that all parameters applicable to the project are present and described; (ii) Confirming that the description of the monitoring plan contains all necessary parameters, that they are described and that the means of monitoring described in the plan complies with the requirements of the methodology including applicable tool(s). (b) DNV assessed the implementation of the plan by means of review of the documented procedures, by: (i) Analysis of the monitoring arrangements described in the monitoring plan, and in particular it can be concluded that they are feasible within the project design; (ii) The means of implementation of the monitoring plan, including the data management and quality assurance and quality control procedures, are considered by DNV sufficient to ensure that the emission reductions achieved by/resulting from the proposed project activity can be reported ex post and verified. So it is DNV's opinion that the described monitoring plan is in compliance with the requirements of the methodology including

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
			applicable tool(s) and is feasible within the project design; Moreover, checking of internal project documentation (including the Data Handling Protocol /8/, Data Flow Summary /9/ and the Calibration and Maintenance manual /7/) and monitoring reports prepared during the previous crediting period, DNV's opinion is that the project participants' are able to implement the described monitoring plan. **CL7 is closed**
CL 8: The roles and responsibilities for the implementation of the Monitoring plan need to be clarified in order to ensure adequate implementation in terms of paragraph 132 of the VVS. There are up to four roles assigned for an element of the monitoring plan.	B.6.9	The description in PDD section B.7.2 has been improved. Roles and responsibilities for the implementation of the monitoring plan have been clarified in the updated PDD.	The roles and responsibilities for the implementation of the Monitoring plan have been clarified within the PDD in order to ensure adequate implementation in terms of paragraph 132 of the VVS So it is in DNV's opinion that the described monitoring plan is in compliance with the requirements of the methodology including applicable tool(s) and are feasible within the project design; **CL8 is closed**
CL 9: The volume of emission reductions mentioned in summary table in section D.1 is inconsistent with those presented in section B.6.4	B.5.16	The volume of emission reductions was modified in section D.1 to be consistent with the volumes indicated in the other parts of the PDD and in the ER calculation file	The PP corrected the PDD in order to show consistency in the ER volumes throughout the PDD. **CL9 is Closed**
CL 10: The volume of emission reductions does not show an accurate reflection of the values of	B.5.3 B.5.4	The values used for the determination of the ERs were historical values (from	The corrected values were updated in the new version (version 6) of the PDD /1/ and

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
parameters the EF_{new} and $EF_{default,y}$ that show a decrease over the crediting period as per the approved methodology. Clarity is requesting in the application of the methodology values in the calculation of the ER estimates.	B.5.7	26/11/2011 until 25/11/2012). This causes the discrepancy in the values of EF_{new} and $EF_{default,y}$. To be consistent with the beginning of the second crediting period the dates were changed to [28/07/2014 ; 27/07/2015] in the revised version of the ER calculation. The values of EF_{new} and $EF_{default,y}$ are now the values of 2015 (end date of the period considered for ERs calculations. Nevertheless this change didn't impact	the ER calculation spreadsheet /2/ and resulted in a reduced ER estimate per year. **CL10 is closed**

Table 3 Forward action requests

Forward action request	Reference to Table 1	Response by project participants
No FARs raised	-	-

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APPENDIX B

CURRICULA VITAE OF THE VALIDATION TEAM MEMBERS

Grant Little

Holds a Bachelor Degree in Pure and Applied Chemistry; with a Secondary Degree in Forest Products Manufacture and a Master's Degree in Business Administration. He has over 20 years of industrial experience. Prior to joining DNV having 16 years' experience in the forest products industry covering Process Engineering, energy projects, Sustainable Development, Forest eco-labelling and Environmental Management Systems. He also has over 5 years' experience in the carbon project development and carbon markets in Africa and the Middle East where he worked for a carbon aggregator and a government owned carbon management and environmental company. He is passionate about Africa and sees his work as a contribution to the development of the continent.

Ole Andreas Flagstad

Holds a Master Degree in thermodynamics/energy efficiency and has an overall working experience of around 20 years. He has worked both in public and private sector, including 5 years with a research institute (IFE) where specific responsibilities included running an energy efficiency network in the food industry and direct intervention with the industry. Other work experience includes working in European research programmes, administering national research programmes and International Energy Agency annexes.

Ole Andreas Flagstad has more than 6 years experience in validation and verification of projects within CDM, JI and other carbon credit schemes. His qualifications and experience in carbon credit schemes (primarily CDM and JI), qualifies him for different roles in a broad group of technical areas

Krishnan Namboodiri, Senior CDM Specialist, DNV Kochi, India. Holds graduate degree in chemical engineering and has done a short term diploma course in Management. Prior to joining DNV in 2008, has had 24 years of direct work experience in the fertilizer and chemicals industry. Work experience covers 5 years in process design & engineering for chemical industry 7 years in technical services including environment management activities, 7 years in project management and 5 years in training & corporate planning in fertilizer & petrochemical manufacturing units. Has been actively involved in Management System Audits as per ISO 14001 for more than 8 years.

The above work experience includes-(a) experience in steam system optimisation & trouble shooting , development of improvement schemes in large fertiliser & caprolactum complex (b) Design and engineering, efficiency studies and development of efficiency improvement schemes for fossil fuel fired steam & power generation plants (c) Implementation of energy saving measures in Ammonia plants , sulphuric acid plant etc (d) Monitoring, trouble shooting and development & implementation of of improvement schemes for of pollution control facilities (chemical, aerobic & anaerobic treatment systems) in Fertiliser and petrochemical complex. Development & implementation of landfill facilities for soild and hazardous wastes from fertiliser & caprolactam manufacturing complex.

He has received extensive training in the CDM validation and verification process. He is an appointed GHG auditor for the CDM validation and verification program of DNV and has performed validation & verification and Technical Review of several CDM, VCS and GS projects in India and other countries.

His qualification, industrial experience and experience in CDM demonstrate his sufficient sectoral competence in (1) Thermal energy generation from fossil fuels as well as thermal electricity from solar and (2) waste handling and disposal. (3) Energy demand (4) Chemical process industries (5) Household end use energy efficiency and (6) Energy generation from renewable energy sources