VERIFICATION / CERTIFICATION REPORT

N2O ABATEMENT PROJECT AT NITRIC ACID PLANT NO. 11 AT AFRICAN EXPLOSIVES LTD. (AEL), SOUTH AFRICA

(UNFCCC Registration Ref. No. 1364)

Monitoring Period:
24 May 2009 to 16 November 2010

REPORT NO. 2012-0548

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VERIFICATION / CERTIFICATION REPORT

Date of first issue: 27 August 2012	Project No.: PRJC-277995-2010-CCS-NOR.
Approved by Trine Kopperud	Organisational unit: DNV KEMA Energy & Sustainability, Accredited Climate ChangeService
Client: African Explosives Ltd.	Client ref.: Hendrik Burger

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Summary:

DNV Climate Change Services AS (DNV) has performed the verification of the emission reductions reported for the "N2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa" (UNFCCC Registration Ref. No. 1364) for the period 24 May 2009 to 16 November 2010.

In our opinion, the GHG emission reductions reported for the project from 24 May 2009 to 16 November 2010 in the monitoring report (Version 07) of 22 August 2012 are fairly stated.

The GHG emission reductions were calculated correctly on the basis of the approved monitoring methodology AM0034 (version 02) and the monitoring plan contained in the Project Design Document of 25 September 2007, version 1.c.

DNV Climate Change Services AS is able to certify that the emission reductions from the "N2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa" during the period 24 May 2009 to 16 November 2010 amount to 391 122 tonnes of CO_2 equivalent.

Report No.: 2012-0548	Subject Group: Environment
Report title: N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa	
Work carried out by: Zuzana Andrtová, Torkjell Berge, Fahad Saleem	
Work verified by: Lin Wu	

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Abbreviations

AEL	African Explosives Ltd.
AMS	Automated Measuring System
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CER	Certified Emission Reduction(s)
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
DNV	Det Norske Veritas
DOE	Designated Operational Entity
FAR	Forward Action Request
GHG	Greenhouse gas(es)
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
MP	Monitoring Plan
N_2O	Nitrous oxide
PDD	Project Design Document
QAL1	One of the Quality Assurance Levels defined by EN 14181:2004 “Stationary source emissions – quality assurance of automated measuring systems”
QAL2	One of the Quality Assurance Levels defined by EN 14181:2004 “Stationary source emissions – quality assurance of automated measuring systems”
QAL3	One of the Quality Assurance Levels defined by EN 14181:2004 “Stationary source emissions – quality assurance of automated measuring systems”
QMS	Quality Management System
SRM	Standard Reference Method
UNFCCC	United Nations Framework Convention for Climate Change

1 INTRODUCTION

African Explosive Ltd. has commissioned DNV Climate Change Services AS (DNV) to carry out the verification and certification of emission reductions reported for the "N2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa" (the project) in the period 24 May 2009 to 16 November 2010. This report contains the findings from the verification and a certification statement for the certified emission reductions.

1.1 Objective

Verification is the periodic independent review and *ex post* determination by a Designated Operational Entity (DOE) of the monitored reductions in GHG emissions that have occurred as a result of the registered CDM project activity during a defined monitoring period.

Certification is the written assurance by a DOE that, during a specific period in time, a project activity achieved the emission reductions as verified.

The objective of this verification was to verify and certify emission reductions reported for the "N2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa" for the period 24 May 2009 to 16 November 2010.

1.2 Scope

The scope of the verification is:

- To verify that actual monitoring systems and procedures are in compliance with the monitoring systems and procedures described in the monitoring plan.
- To evaluate the GHG emission reduction data and express a conclusion with a reasonable level of assurance about whether the reported GHG emission reduction data is free from material misstatement.
- To verify that reported GHG emission data is sufficiently supported by evidence.

The verification shall ensure that reported emission reductions are complete and accurate in order to be certified.

The verification team has based the verification on the recommendations in the Validation and Verification Manual version 0.1.2 /27/.

1.3 Description of the Project Activity

Project Parties:	*South Africa (host), United Kingdom of Great Britain and Northern Ireland and Switzerland*
Title of project activity:	*N2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa*
UNFCCC registration No:	*1364*
Baseline and monitoring methodology	*AM0034 (version 02)*

Project Participants:	*African Explosives Ltd ("AEL") authorised by South Africa, N.serve Environmental Services GmbH, Germany ("N.serve") and Electrabel NV/SA authorised by United Kingdom of Great Britain and Northern Ireland, and N.serve Environmental Services GmbH, authorised by Switzerland.*
Location of the project activity:	*20 km north-east of Johannesburg, Modderfontein 1645, Province of Gauteng, South Africa, GPS: 26°05'50" S and 28°10'26" E*
Project's crediting period:	8 February 2008 to 7 February 2018 (Fixed)
Period verified in this verification:	24 May 2009 to 16 November 2010

The project covers installation of secondary abatement technology and Automated Monitoring System (AMS) for continuous measurement of N_2O. The secondary catalyst supplier is Johnson Matthey plc. The secondary catalyst is installed inside the ammonia reactor below precious metal gauze produced by W.C Heraeus.

The N_2O catalyst is selective and promotes the decomposition of N_2O to nitrogen and oxygen. Secondary abatement technologies will normally reduce the emissions by 70-90%.
The emission reductions reported from the project for the period from 24 May 2009 to 16 November 2010 amount to 391 122 tonnes of CO_2 equivalent.

1.4 Methodology for Determining Emission Reductions

The emission reductions for the project activity over a specific campaign are determined by deducting the campaign-specific emission factor from the baseline emission factor and multiplying the result by the production output of 100% concentrated nitric acid over the campaign period and the GWP of N2O. The nitric acid production for the project campaign (tHNO3), NAP, shall not exceed the design capacity.

The baseline emission factor is determined ex-ante, and may necessarily be re-calculated when the length of a project campaign is shorter than the normal campaign length as defined by the historic campaigns. The flow-rate of stack gas, the concentration of N2O in the stack gas, the operating hours, and the production output of 100% concentrated nitric acid need to be monitored in order to calculate the campaign-specific emission factor and the emission reductions for a specific campaign. The emission reductions for a monitoring period are the sum of emission reductions for each campaign within the monitoring period.

In accordance to the applied methodology AM0034 version 02 /26/, the emission reductions for the project activity over a specific campaign are determined by deducting the campaign-specific emission factor from the baseline emission factor and multiplying the result by the production output of 100% concentrated nitric acid over the campaign period and the GWP of N_2O as follows:

$$ER = (EF_{BL} - EF_P) * NAP * GWP_{N2O} \quad (tCO_{2e})$$

Where:

ER	Emission reductions of the project for the specific campaign (tCO_2e)
NAP	Nitric acid production for the project campaign ($tHNO_3$). The maximum value of NAP shall not exceed the design capacity.
EF_{BL}	Baseline emissions factor ($tN_2O/tHNO_3$)

EF_P Emissions factor used to calculate the emissions from this particular campaign (i.e. the higher of $EF_{ma,n}$ and EF_n) – see below

GWP_{N2O} Global warming potential of N_2O = 310

The average mass of N_2O baseline emissions per hour is estimated as product of the NCSG and VSG after applying statistical process as per the methodology requirements. The N_2O emissions per campaign are estimates product of N_2O emission per hour and the total number of complete hours of operation of the campaign using the following equation:

$$BE_{BC} = VSG_{BC} * NCSG_{BC} * 10^{-9} * OH_{BC} \quad (tN_2O)$$

The plant specific baseline emissions factor representing the average N_2O emissions per tonne of nitric acid over one full campaign is derived by dividing the total mass of N_2O emissions by the total output of 100% concentrated nitric acid for that period. The overall uncertainty of the monitoring system is determined and the measurement error is expressed as a percentage (*UNC*). The N_2O emission factor per tonne of nitric acid produced in the baseline period (EF_{BL}) shall then be reduced by the estimated percentage error as follows:

$$EF_{BL} = (BE_{BC} / NAP_{BC}) (1 - UNC/100)$$

where:

EF_{BL} Baseline N_2O emissions factor ($tN_2O/tHNO_3$)

BE_{BC} Total N_2O emissions during the baseline campaign (tN_2O)

$NCSG_{BC}$ Mean concentration of N_2O in the stack gas during the baseline campaign (mgN_2O/m^3)

OH_{BC} Total number of operating hours of the baseline campaign (h)

VSG_{BC} Mean gas volume flow rate at the stack in the baseline measurement period (m^3/h)

The average mass of N_2O project emissions per hour is estimated as product of the NCSG and VSG. The N_2O emissions per campaign are estimates product of N_2O emission per hour and the total number of complete hours of operation of the campaign using the following equation:

$$PE_n = VSG * NCSG * 10^{-9} * OH \quad (tN_2O)$$

Where:

VSG Mean stack gas volume flow rate for the project campaign (m^3/h)

NCSG Mean concentration of N_2O in the stack gas during the project campaign (mgN_2O/m^3)

PE_n Total N_2O emissions of the nth project campaign (tN_2O)

OH The total number of operation hours of the project campaign (h)

A campaign specific emissions factor is calculated by dividing the total mass of N_2O emissions during that campaign by the total production of 100% concentrated nitric acid during that same campaign as follows:

$$EF_n = PE_n / NAP_n \ (tN_2O/tHNO_3)$$

In order to take into account possible long-term emissions trends over the duration of the project activity and to take a conservative approach a moving average emission factor is estimated as follows:

$$EF_{ma,n} = (EF_1 + EF_2 + \ldots + EF_n) / n \qquad (tN_2O/tHNO_3)$$

To calculate the total emission reductions achieved in a campaign, the higher of the two values $EF_{ma,n}$ and EF_n is applied as the emission factor relevant for the particular campaign to be used to calculate emission reductions (EF_p) in equation given for ER above. Thus:

If $EF_{ma,n} > EF_n$ then $EF_p = EF_{ma,n}$
If $EF_{ma,n} < EF_n$ then $EF_p = EF_n$

Further a campaign-specific emission factor shall be used to cap any potential long-term trend towards decreasing N_2O emissions that may result from a potential built up of platinum deposits. After the first ten campaigns of the crediting period of the project, the lowest EF_n observed during those campaigns will be adopted as a minimum (EF_{min}). If any of the later project campaigns results in a EF_n that is lower than EF_{min}, the calculation of the emission reductions for that particular campaign shall use EF_{min} and not EF_n.
Further, EF_{reg} is to be monitored to check if the Host Party introduces regulations set by government to cap N_2O emission from nitric acid (HNO_3) plants.
As per AM0034 version 02 no leakage calculation is required.

2 METHODOLOGY

The verification of the emission reductions has assessed all factors and issues that constitute the basis for emission reductions from the project. These include:

i) Records related to measuring quantity of produced HNO_3 and other parameters /2/;

ii) Emission factors for previous and present campaigns (i.e. 1st, 2nd, 3rd, 4th, 5th and 6th project campaigns) calculated in accordance with formulas described above /2/;

iii) Records on validation and/or calibration of the measuring equipment and calculation software /4/~/7//9//10//14//16/~/18/;

i) All relevant records of data from the N.serve Database Management System for N_2O destruction system (N.DBMS) /2/;

ii) Catalyst information /22/.

The verification team has during its preparations identified the key reporting risks and used the assessment to determine to which extent the project operator's control systems were adequate for mitigation of these key reporting risks. In addition, other areas that can have an impact on reported emission reductions have also undergone detailed audit testing.

Verification team

Role	***Last Name***	***First Name***	***Country***	***Type of involvement***					
				Desk review	Site visit	Reporting	Supervision of work	Technical review	TA 5.1 competence
Team leader (CDM verifier)	Andrtová	Zuzana	Czech Republic	✓	✓	✓	✓		
CDM verifier	Saleem	Fahad	Norway	✓		✓			✓
Expert	Berge	Torkjell	Norway	✓	✓	✓			✓
Technical reviewer	Lin	Wu	China					✓	✓

A summary of the qualifications/CVs of the team members are provided in Appendix C of this verification report.

Duration of verification

Monitoring report publication *29 November 2010*

Preparations: *6 December 2010*

On-site verification: *15 December 2010*

Reporting, calculation checks and QA/QC*: 17 January 2011 to 27 August 2012*

2.1 Review of Documentation

The verification process includes desk review of the monitoring report for the monitoring period from 24 May 2009 to 16 November 2010, version 1 dated 26 November 2010 (published) and any updated versions /1/, emission reduction calculation spread sheets /2/, the registered PDD version 1c dated 25 September 2007 /3/, the validation report /23/, DNV's previous verification report /8/ as well as the approved baseline and monitoring methodology AM0034 version 02 "*Catalytic reduction of N2O inside the ammonia burner of nitric acid plants*" /26/. The project operator has in addition supplied the verification team with procedures from its management system as well as other documentation and spreadsheets with all data necessary for verification of the emission reductions /2/, /4/-/7/,/9/-/22/, /24/, /25/. Further part of the reviewed documents was relevant decisions, clarifications and guidance from the CMP and the CDM Executive Board /26//31/.

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During the desk review, DNV has applied standard auditing techniques to assess the quality of information provided. The following activities were performed:

- A review of the data and information presented to verify their completeness;
- A review of the monitoring plan and monitoring methodology, paying particular attention to the frequency of measurements, the quality of metering equipment including calibration requirements, and the quality assurance and quality control procedures; and
- An evaluation of data management and the quality assurance and quality control system in the context of their influence on the generation and reporting of emission reductions.

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2.2 Site Visits

A site visit was carried out on 15 December 2010, and the key personnel at African Explosives Ltd and N.serve Environmental Services GmbH were interviewed or assisted the verification team /33/-/37/.

During the on-site assessment, the following aspects of the CDM project activity have been confirmed:

- The implementation and operation of the CDM project activity;
- The information flow for generating, aggregating and reporting of the monitoring parameters; and
- The operational and data collection procedures are implemented in accordance with the monitoring plan in the PDD.

Further, the following activities were performed:

- A cross-check between information provided in the monitoring report and data from other sources such as production logs;
- A check of the monitoring equipment including calibration performance and observations of monitoring practices against the requirements of the PDD and the selected methodology;
- Local laboratory procedures relevant for the project
- A review of calculations and assumptions made in determining the GHG data and emission reductions; and
- An identification that quality control and quality assurance procedures in place to prevent or identify and correct any errors or omissions in the reported monitoring parameters.

The data presented in the monitoring report /1/ were assessed by review of the detailed project documentation and production records and by interviews with personnel from African Explosives Ltd and N.serve Environmental Services GmbH, and observation of collection of measurements, observation of established monitoring and reporting practices and assessment

of the reliability of monitoring equipment. This has enabled the verification team to assess the accuracy and completeness of reported monitoring results; to verify the correct application of the approved monitoring methodology AM0034, version 02 and the determination of the emission reductions.

In addition all parameters required by the monitoring methodology AM0034, version 02 /26/, and the management system were assessed during the site visit.

2.3 Reporting of Findings

A corrective action request (CAR) is issued, where:

i. Non-conformities with the monitoring plan or methodology are found in monitoring and reporting, or if the evidence provided to prove conformity is insufficient;
ii. Mistakes have been made in applying assumptions, data or calculations of emission reductions which will impair the estimate of emission reductions;
iii. Issues identified in a FAR during validation to be verified during verification have not been resolved by the project participants.

A clarification request (CL) shall be 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 issued for actions if the monitoring and reporting require attention and/or adjustment for the next monitoring period.

Three CARs, two CLs and three FARs were identified during this verification. CARs requested correction of emission reduction calculation in accordance with down time report and correct excluding data according temperature condition (820 °C), correction of events reporting and zero/span report together with definition of action related with exceeding the range limit. The CLs are related to spare parts information and analysis routine of QAL3. All CARs and CLs were properly addressed in version 4 of the monitoring report.

FARs requested the improvement of calibration gases traceability, QA/QC procedures related to QAL3 and analysis of N_2O standard gas. The FARs were also adequately addressed in the updated version 4 of the monitoring report except for FAR 2 related to QA/QC procedures, implementation of FAR 2 will thus be further investigate during the next verification.

3 VERIFICATION FINDINGS

This section summarises the findings from the verification of the emission reductions reported for the "N2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa" for the period 24 May 2009 to 16 November 2010.

3.1 Remaining Issues, CARs, FARs from Previous Validation or Verification

No remaining issues were identified from the previous (first) periodic verification /8/.

This is the verification of the second monitoring period. There were no remaining issues from validation /23/. The verification of permitted operating ranges was verified by the validating DOE. However the verification of the baseline campaign and the determination of the baseline emission factor following the requirement of EB51 Annex 12 were included in the scope of the verifying DOE*. This is described in detail in section 3.6.3 of this report.

3.2 Project Implementation

As part of the site visit DNV was able to confirm that the project implementation is in accordance with the project description contained in the registered PDD "N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa", Version 1.c. of 25 September 2007.

A baseline campaign was operated from 20 July 2006 to 18 February 2007, which was used towards ex-ante estimate of emission reductions in the PDD. As confirmed in the validation report /23/, the data from this baseline campaign were not verified by the validating DOE, and the confirmation of the baseline campaign data to be used for ex-post emission reduction calculations was included in the scope of the verifying DOE. Thus the baseline campaign was verified by DNV during the first verification period simultaneously with first three project campaigns /8/. After the baseline campaign was completed, the project entity decided not to install the secondary catalyst yet to avoid incurring additional costs while the CDM validation process was still on going. This resulted in an intermediate campaign without secondary catalyst installed from 25 February 2007 to 18 August 2007. DNV finds the justification for the intermediate campaign to be reasonable, and in accordance with the clarification AM_CLA_0234 issued on 2 August 2012. Also, since the operating parameters OTh, OPh, AFR and AIFR measured during the baseline campaign were within the permitted operating range for more than 50% of the time, the selected baseline campaign is found to be valid and in compliance with AM0034. The same issue was also addressed by a request for review for the first verification of this project.

Secondary catalyst was installed on 12 September 2007 and the project was registered on 8 February 2008, which is the starting date of the crediting period.

* According to the EB 31 minutes of meeting, either validating or verifying DOE can undertake the task of the determination of the permitted operating conditions for project activities using approved methodology AM0034.
The determinations of permitted operating ranges were included in the scope of validation /23/, however the baseline emission factor were updated according to EB 51 Annex 12 and these adjustments were verified by DNV. In addition, the normal campaign length wasupdated after verifying calibration of equipment of mass flow meter used for NAP recording /8/.

During this monitoring period three project campaigns were completed:

PC4: from 8 June 2009 till 27 December 2009

PC5: from 30 December 2009 till 3 August 2010

PC6: from 4 August 2010 to 16 November 2010 (the gauze from PC 5 has been kept and two fresh layers were added, which was the reason for considering this period as a new campaign with different gauze composition, refer to 3.3).

The details of previous production campaigns are as follows:

Campaign PC1 12 September 2007 to 19 March 2008
Campaign PC2 20 March 2008 to 28 September 2008
Campaign PC3 04 October 2008 to 23 May 2009

The primary catalyst installed for the ammonia oxidation is composed of Platinum, Rhodium and Palladium supplied by W.C. Heraeus /22/.

The secondary catalyst has been installed beneath the primary catalyst for selective abatement of N_2O to nitrogen and oxygen. The supplier of the secondary catalyst is Johnson Matthey plc, and the abatement efficiency for the secondary catalyst was estimated to be 70-90% /3/. DNV was able to confirm that there have not been any changes in the abatement technology compared to previous project campaigns.

Several shutdowns of the plant were realized during this monitoring period /25/, these shutdown periods are correctly reported in the monitoring report. Further, these periods are reflected in the provided calculations of the emission reductions.

The AMS was shut down due to failty cable connection during the campaign 6 in the period 8 September 16:00 till 5 November 2010 8:00. The situation was reflected by replacing the missing data for NCSG and VSG by the maximum hourly average values of this campaign and OT_h was replaced with the last measured value to avoid failure of automatic counting of operating hours. The described solution was not applied for period 8 September 2010 16:00 till 9 September 2010 02:00 when the plant was also offline due to power failure and thus the values were zero. In addition due to unsteady analyser output during campaign 5 in the period from 28 July 2010 08:00 to 28 July 2010 12:00, the NCSG data was replaced with the campaign maximum values as per the methodology.

The project team crosschecked these situations with the downtime report and found the situation correctly reflected. Furthermore, DNV verified these events by checking the trend curves for the operation and it was confirmed that no further events had occurred during the monitoring period, which require recalculations or exclusion of additional hours in the calculation of emissions reductions. The verification team inspected the installation during the on-site visit and could confirm that all instrumentation necessary for the monitoring of the emission reductions were installed.

3.2.1 Project Implementation in accordance with the registered project design document

As per para 198 (a) of VVM version 01.2, DNV verified that the project is fully implemented according to the description in the registered PDD document version 1.c. dated 25 September 2007. The verification team confirmed, through visual inspection that all physical features of the proposed CDM project activity including data collection systems and

storage have been implemented in accordance with the registered PDD. As per para 198 (b) of VVM version 01.2, DNV confirmed during the on-site visit that the CDM project is completely operational.

3.3 Information (data and variables) provided in the monitoring report that is different from that stated in the registered PDD

The emission reductions in this monitoring period are 391 122 tonnes of CO_2 equivalents in the period from 24 May 2009 to 16 November 2010 (i.e. 542 days) equals to 721.6 tCO_2e/day average. The yearly expected emission reductions according to the registered PDD are 265 460 tonnes of CO_2 equivalents, which corresponds to emission reductions of 727.3 tCO_2e/day.and 394 190 tonnes of CO_2 equivalents (in 542 days). And hence the reported emission reductions in the monitoring period are just slightly lower than the expected in the registered PDD.

The NAP production in this monitoring period is 351 982 $tHNO_3$ (i.e. in 542 days, whereof 499 operational days), which correspond with 649.4 $tHNO_3$/day in average during the monitoring period, and 705.4 $tHNO_3$ per day of operation. The designed daily production in the PDD is 775 $tHNO_3$/day, thus the value of the NAP production is below the design capacity. The NAP used in the estimation of ER in the registered PDD was the average NAP experienced from 2003 to 2007 (available at the time of validation) of 236 097 per year, which corresponds to 350 588 $tHNO_3$ in 542 days. Hence the NAP production is comparable to the NAP used for estimating of ER in the registered PDD.

The regular baseline emission factor of 0.004647 $tN_2O/tHNO_3$ is applied for PC4 and PC5 as the project campaigns' lengths (PC4: 129 361 $tHNO_3$ and PC5: 150 111 $tHNO_3$) exceed CL_{normal} (127 302.4 $tHNO_3$). The default baseline emission factor of 0.0045 $tN_2O/tHNO_3$ defined in AM0034 is applied for PC6 due to different gauze composition. The applied baseline emission factors for this monitoring period are thus slightly higher than the estimated value (0.00403 $tN_2O/tHNO_3$) in the registered PDD (the emission factor for the baseline campaign was recalculated from 0.00403 $tN_2O/tHNO_3$ to 0.004647 $tN_2O/tHNO_3$ during the 1st verification because the results from QAL2 were not available when the PDD was completed). .

The project emission factors applied for individual campaigns covered in this monitoring period are as follow:

PC4: 0.00118 $tN_2O/tHNO_3$

PC5: 0.00096 $tN_2O/tHNO_3$

PC6: 0.00091 $tN_2O/tHNO_3$

The project emission factors were higher than the estimated value in the registered PDD, mainly because the abatement performance (74.5% for PC4, 89.2% for PC5, and 84.5% for PC6) were lower than anticipated (90%).

3.4 Compliance of the monitoring plan with the monitoring methodology

As per para 203 of VVM version 1.2 /27/, the monitoring plan in the registered PDD version 1.c. dated 25 September 2007 /3/ was confirmed to be in accordance with the approved monitoring methodology, AM0034, version 02 "Catalytic reduction of N_2O inside the

ammonia burner of nitric acid plants" /26/, applied by the proposed CDM project activity. Neither a revision nor a deviation to the monitoring plan has been requested to CDM Executive Board.

3.5 Compliance of monitoring with the monitoring plan

As per para 206 of VVM version 1.2, DNV confirms that the monitoring has been carried out in accordance with the monitoring plan contained in the registered PDD version 1.c. of 25 September 2007.

All parameters stated in the validated monitoring plan and the applied methodology AM0034 version 02 /26/ have been sufficiently monitored and updated as applicable, including: project emission parameters; baseline emission parameters; leakage emissions; management and operational system. The responsibilities and authorities for monitoring and reporting are in accordance with the responsibilities and authorities stated in the monitoring plan.

The monitoring report lists each parameter required by the monitoring plan and the information flow (i.e. from data generation, aggregation, recording, calculation and reporting) for these parameters is provided in sections C and D of the monitoring report /1/. The information flow for each parameter is further discussed in the following sections of this report. The monitoring methodologies and sustaining records are sufficient to enable verification of emission reductions.

The results from the QAL2 tests have been provided. The QAL2 test covers all necessary calibration issues as per EN14181 and confirms the determination of the overall uncertainty used in the calculation of the baseline emission factor

3.6 Assessment of Monitoring Parameters

As per para 206 of VVM version 1.2, DNV verified the information flow for each parameter. Section 3.6.1 describes the data generation, aggregation and recording and how it has been verified by DNV. While sections 3.6.2 to 3.6.4 describe the verification of calculations and reporting by DNV for each of the parameters. Furthermore, as per para 209 (d) of VVM version 1.2, DNV confirms that the assumptions, emission factors, default values that are applied have been justified.

3.6.1 Information data flow

DNV can confirm that the information and data flow is in compliance with the description included in the monitoring plan of the registered PDD version 1.c. dated 25 September 2007 /3/.

The verification team confirms that the monitoring report includes all parameters and the monitored data at the interval required by the methodology and the PDD.

The common data flow systems have been used in the project activity for the following parameters:

- Stack gas flow rate and standardization calculation
- Stack gas N_2O concentration and calculation of amount of N_2O
- Operating parameters of the ammonia oxidation reactor (temperature, pressure, ammonia input and air input)

The instrument transmitters continuously provide an analogue signal (4 to 20 mA) from the N_2O analyzer and the stack gas flow meter including the stack gas temperature and pressure.

The signals are converted by the Programmable Logic Controller (PLC) into a digital signal which is then fed into SCADA data acquisition and database system. Thus collected and processed data, i.e. calculation, raw data, calculated values, are stored in the server continuously and available in the network system as digital values. The two AEL nitric acid plants have their own SCADA system on a dedicated PC, however the two SCADA PCs are directly connected to each other and each of the PCs receives all the measured data from the AMS and stores them. The instrumentation engineer in the plant transfers the data at least once a week into AEL's main IT system as well as making a complete copy of that week's data (2-second, hourly and daily averages) onto an external disc drive. That way there are already four copies of the original and unchanged data stored in four different locations. In addition, the hourly data are sent to N.serve on a regular basis (e. g. after each campaign) where they are also stored.
The SCADA system automatically produces comma separated files stored in Microsoft Excel of the 2-second values and it also automatically produces hourly and daily average values for each of the measured parameters (except nitric acid production, which is reported on daily basis). The hourly averages are the basis of the analysis of the data for the purpose of the calculation of the emission factors for the baseline and for the project campaigns. These are then extracted and converted into excel files which can then be imported into the N.serve Database Management System (N.DBMS).
For nitric acid production, the measurement from the mass flowmeter (hourly data) is transferred to the Process Control system of the plant, and daily cumulated production values are printed out for archiving.
In order to verify that correct data is used for ER calculation, DNV checked the data from productions logs and raw data taken from the SCADA system and compared them against the data available in the excel sheets provided by N.serve.

The verification team assessed the information flow and data collection system and confirms that it meets the requirements of the monitoring plan contained in the registered PDD as per the applied and approved methodology AM0034, version 02.

The verification team confirms that the monitoring report includes all parameters and the monitored data measured at the interval required by the methodology and PDD.

Each parameter and its corresponding values verified are listed in detail in Appendix B.

3.6.2 Historical data and permitted operating conditions

Historical data has been verified during the validation by the validating DOE /23/. The average length of historic campaigns (CL_{normal}) was determined in the PDD as 123 290 tonnes of 100% nitric acid, however CL_{normal} was updated to 127 302.4 $tHNO_3$ during the first verification /8/ after verifying the calibration of the mass flow meter used for NAP measurements. The calculation of CL_{normal} was based on average of campaign length during the 5 historical campaigns.

The parameters for determining the permitted operating condition include Oxidation Temperature (OT), Oxidation Pressure (OP), and Ammonia gas Flow Rate (AFR) as well as Ammonia to air ratio (AIFR). The permitted operating conditions were determined as follows:

	OT_{normal}	OP_{normal}	$AIFR_{max}$	AFR_{max}
Data from 5	820 - 905 ºC	365 –	11.5%	9.094 tNH_3/h

historical campaigns		450 kPa(gauge)		

The ammonia oxidation catalyst for the historical campaigns was supplied by W.C. Heraeus with composition of Platinum (Pt) 56.5%, Rhodium (Rh) 3.8% and Palladium (Pd) 39.7% and the same supplier and composition was used in the baseline campaign. The catalyst supplier and composition was verified by the validating DOE /23/, and further confirmed by DNV during the 1st verification /8/. The catalyst composition for the project campaign PC4 (Pt 54.53%, Rh 3.74% and Pd 41.73%) and PC5 (Pt 56.0%, Rh 3.8% and Pd 40.2%) is verified to be the same to that of the baseline campaign (56.5 % Pt, 3.8% Rh,39.7% Pd), without significant differences. However, the primary gauze used for campaign PC6 had composition of Platinum (Pt) 61.7%, Rhodium (Rh) 4.0% and Palladium (Pd) 34.3%, which is significantly different than the normal gauze composition from historical campaigns. This change was reflected by using the default value of the baseline emission factor defined in AM0034, as mentioned in chapter 3.3 and 3.6.3.

3.6.3 Monitored data for baseline emissions

The verification of the baseline campaign data and the determination of the baseline campaign emission factor were included in the scope of the verifying DOE /23/. Baseline parameters were originally described in section B.6.2 of the PDD, and the updated baseline campaign data are described in DNV's verification report for the 1st monitoring period /8/.
During the first verification /8/, the baseline campaign emission factor was determined as 0.004647 t N_2O/ t HNO_3, and the baseline campaign length was determined as 134 700 tonnes of 100% nitric acid. The baseline emission factor should be recalculated, when the project campaign is shorter than CL_{normal} of 127 302.4 tonnes. As the first two campaigns covered in this verification period are longer (129 361 t HNO_3 for PC4 and 150 111 t HNO_3 for PC5) than CL_{normal}, the baseline emission factors have not been recalculated for these campaigns and the applied EF_{BL} is equal to 0.004647 t N_2O/ t HNO_3. The last campaign PC6 included in this monitoring period was shorter than CL_{normal}, however the gauze composition was different than the gauze composition used during the baseline campaign and thus the default baseline emission factor of 4.5 kg N_2O/t HNO_3 was used for emission reduction calculation for this campaign.

3.6.4 Monitored data for project emissions

The only emission source from the project is the remaining quantity of N_2O in the stack gas. The N_2O concentration (NCSG) in the gas stack is measured by N_2O gas analyzer, type of sensor NDIR (ABB AO2040 Uras 14) with continuously measurement, recording frequency 2 s and calculated as hourly average. Due to delays in realization of the annual AST /6//7/, the maximum permissible error of the measurement device was conservatively applied for periods from 8 June 2009 till 12 June 2009 and from 12 June 2010 till 6 July 2010 in the calculation spreadsheets according to the requirements of EB52 Annex 60..
The normal gas volume flow (VSG) rate of the stack gas is measured by flow meter Emmerson Rosemount Annubar, Model 485 on differential pressure principle. The measurement frequency is continuous, recording frequency is 2 second and the 2s data are used for calculation of hourly averages. AOR parameters are also measured continuously and hourly averages are archived in SCADA and reported in the CDM spreadsheet /2/ (see Appendix B for details).

The data (hourly averages) are transported to the database N.DBMS for further analysis and the values taken during times when the plant was out of operation (based on the reported value of AOR temperature OT_h) or during the malfunctions of the monitoring system are eliminated. The statistical analysis for 95% confidence interval is applied to the remaining data and new sample means are calculated from the remaining NCSG and VSG values. Further calculation of emission reductions are executed as per the formulae stated in AM0034 version 02.
According to AM0034, the emission reductions can only be requested for the nitric acid production up to the design capacity. For the AEL11 plant, the design capacity was determined as 282 875 tonnes 100% HNO_3 per year (775 t per day x 365 days). The production of nitric acid during this monitoring period is as follows:

PC4 (08/06/2009 – 27/12/2009): 129 361 t 100% HNO_3
PC5 (30/12/2009 – 03/08/2010): 150 111 t 100% HNO_3
PC6 (04/08/2010 – 16/11/2010): 72 510 t 100% HNO_3

The total nitric acid production is 351 982 t 100% HNO_3 during this monitoring period, which comprises 499 days of operations. The maximum design capacity for 499 days is 386 725 100% HNO_3 (775 t per day x 499 days).. Therefore the NAP production during this monitoring period is lower than the design capacity of the plant and eligible for emission reduction calculations.

The NAP production is measured by Coriolis mass flow meter Emerson CMF 300, which measured continuously density and temperature and these measurements is used for calculation of the produced nitric acid. The resulted value is used for conversion to 100% nitric acid produced.

The gauze supplier was confirmed for this monitoring period the same as for the baseline, i.e. W.C Heraeus. The composition of the catalyst is without significant difference for campaign PC4 and PC5. Composition of gauze for campaign PC6 was different and thus default emission factor was applied for calculation emission reductions of this campaign.

No national or regional regulations for N_2O emissions were issued during this monitoring period, thus no emission cap was applied.

The presented facts are in compliance with information stated in the PDD section B.7.1 and section of project emission parameters of the monitoring methodology. The details about individual monitored parameters are included in Appendix B of this report.

3.6.5 Default data

The default emission factor for baseline 0.0045 $tN_2O/tHNO_3$ was applied for campaign PC6 as the composition of the gauze was significantly different (Pt 61.7%, Rh 4.0% and Pd 34.3%) /22/ than in baseline (Pt 56.5%, Rh 3.8% and Pd 39.7%) /8/.

NCSG data was replaced by maximum value of the campaign PC5 (319.86 mg/Nm^3) in period 8:00 till 12:00 of 28 July 2010 due to unsteady analyzer output.

Further PC6 campaign's maximum of NCSG (274.8 mgN_2O/Nm^3) and VSG (86 197.2 Nm^3/h) value was used in period 8 September 2010 from 16:00 till 5 November 2010 8:00 (except for period 8 September 2010 16:00 till 9 September 2010 02:00 when the plant was also offline due to power failure and thus the values were zero), when the data collection was interrupted due to wrong cable connection.

This is in compliance with AM0034 (version 02).

3.6.6 Emissions outside the project boundary and leakages

There are no additional emissions to be recorded outside the project boundary. As per the requirement of the methodology leakage does not need to be taken into consideration.

3.7 Quality of evidence to determine emission reductions

The monitoring report and calculation spreadsheets were correctly updated to address the findings from the verification. In particular, the emission reductions were updated in order to correctly exclude the raw data for hours when the ammonia oxidation temperature was below 820°C, when the plant was out of operation (see CAR1). Further the calculations correctly reflected the delay of AST tests by applying conservatively the maximum permissible error of the measurement device to the NCSG and VSG data for the periods from 8 June 2009 till 12 June 2009 and from 12 June 2010 till 6 July 2010. The revised calculation /2/ were verified by DNV and found correct. The assessment of emission reduction calculation is further commented below:

a. The hourly averages of N_2O and gas flow in the gas stack were calculated correctly with application of 95% confidence interval. Total N_2O emissions are calculated correctly for each project campaign. The correction coefficients for N_2O concentration was determined as 0.99 in the initial QAL2 performed in February 2008 /5/, and confirmed in subsequent AST tests in 2009 and 2010 /6/,/7/. For the normal gas volume flow rate, the correction factor of 0.96, determined during the latest QAL2 test by Müller BBM (6 – 8 July 2010) is applicable to the project campaign PC6 /7/. The correction factor of 1.01 determined in QAL2 test from August 2007 realized by TÜV SÜD is applicable to the campaigns PC4 and PC5. The correction factors were correctly applied in calculation spreadsheets /2/. In addition, the maximum permissible error is applied for periods when the AST was delayed (ref.3.6.4 above).

b. The nitric acid production at 100% HNO_3 was calculated correctly for the project campaigns. The calculation is based on continuous measurement of the mass flow and recalculation to 100% concentration of nitric acid.

c. The baseline emission factor was correctly determined by comparing a project campaign length with the average historical campaign length. No re-calculation of the baseline emission factor was necessary. The default baseline emission factor was used for the campaign PC6 due to significantly different composition of the gauze according to AM0034 (refer to section 3.7.1 below).

d. The project emission factors were correctly calculated and compared with the corresponding moving average emission factor (refer to section 3.7.2 below).

e. The emission reductions were then correctly calculated and it was confirmed that the nitiric acid production did not exceed the design capacity of the plant during this monitoring period (refer to section 3.6.4).

According to AM0034, the emission reductions for the project activity over a specific campaign are determined by deducting the campaign-specific emission factor from the baseline emission factor and multiplying the result by the production output of 100% concentrated nitric acid over the campaign period and the GWP of N_2O.

As per VVM 1.2 para 209 (c), DNV confirms that appropriate methods and formulae for calculating baseline emissions and project emissions have been applied.

3.7.1 Baseline emission factor

The historic campaign length is 127 302.4 tonnes of 100% nitric acid, and the baseline campaign length is 134 700 tonnes of 100% nitric acid. The first two campaigns verified in this monitoring period are longer than normal campaign length (129 361 t 100% HNO_3 for PC4 and 150 111 t 100% HNO_3 for PC5), the baseline emission factor was applied without recalculation (0.004647 $tN_2O/tHNO_3$) as verified during the first verification by DNV. The composition of the gauze used for the campaign PC6 was significantly different to the baseline gauze composition and thus the conservative IPCC default value 0.0045 $tN_2O/tHNO_3$ was applied as baseline emission factor for this campaign.

No N_2O emission cap from nitric acid production has been applied as no regulation has been issued by the government in the host country.

3.7.2 Project emission factor

The calculation of campaign specific emission factor for each project campaign was confirmed to be in line with the requirements in AM0034 version 02; the resulting campaign specific emission factors, moving average emission factors and respective applied emission factors for each campaign are presented in table below:

No. campaign	EF_n [$tN_2O/tHNO_3$]	$EF_{ma,n}$ [$tN_2O/tHNO_3$]	EF_p [$tN_2O/tHNO_3$]
PC4	0.00118	0.00107	0.00118
PC5	0.00050	0.00096	0.00096
PC6	0.00070	0.00091	0.00091

The moving average emission factors were calculated correctly as the average of all project campaigns emission factors.

The minimum project emission factor will be determined when 10 project campaigns are completed and it will be applicable from the 11th campaign onwards. Thus this value is not relevant for this monitoring period.

The values of all project emission factors for previous campaigns are listed below:

No. campaign	EF_n [$tN_2O/tHNO_3$]	$EF_{ma,n}$ [$tN_2O/tHNO_3$]	EF_{min} [$tN_2O/tHNO_3$]
PC1	0.00106	0.00106	NA
PC2	0.00090	0.00098	NA
PC3	0.00115	0.00103	NA
PC4	0.00118	0.00107	NA
PC5	0.00050	0.00096	NA
PC6	0.00070	0.00091	NA

The calculation of the project emission factors respected all correction factors as they were described in section 3.6 and provided as transparent calculation in excel sheet file. Values of previous campaign specific emission factors and moving average emission factors were verified with this transparent calculation and previous verification report.

3.7.3 Emission reduction

The calculation of emission reductions for each project campaign was conducted as described in the section 1.4 of this report; and was in line with the requirements in AM0034. The total emission reductions for this verification period were correctly calculated as the sum of the emission reductions for the three project campaigns.

The emission reductions in this monitoring period are 391 122 tonnes of CO_2 equivalents in the period from 24 May 2009 to 16 November 2010 (i.e. 542 days), which equals to 721.6 tCO_2e/day in average. The yearly expected emission reductions according to the registered PDD are 265 460 tonnes of CO_2 equivalents, which corresponds to emissions reductions of 727.3 tCO_2e/day in average. The reported emission reductions in the monitoring period are thus lower than the expected in the registered PDD, more details is given in 3.3..

There is limited uncertainty related to the transfer of raw data used in the calculation of emission reduction. All monitored parameters (except nitric acid production which is collected by the process control system) are collected by the automated measurement system and converted automatically to excel files in the SCADA system.

The raw data are stored by SCADA system and simultaneously these data are transferred into main AEL's IT system by instrumentation engineer at least once a week. This backup covers 2-second, hourly and daily averages.

The emission reduction calculations are further realized by using N.serve database N.DBMS. The database is used for setting of max, min and average of individual parameters and for exclusion of data out of 95% confidence interval, when plant is not in operation etc. as it is requested by methodology AM0034 and the PDD. The statistical analysis and determination of correct mean value is also included in the Excel calculation /2/ in order to cross check the results from the database N.DBMS. No deviation was found.

Spot checks between raw data and final excel calculation sheet were performed during the site visit. No mistake of data transfer was identified.

The data and emission reduction calculations in excel spreadsheets were verified during the site visit and cross checked with the monitoring report. They are found consistent, except minor inconsistencies in the table of plant's events, which were corrected in second version of the monitoring report. .

All measurement devices are regularly calibrated and eventual delay in calibration is correctly reflected in the raw data file and verified by DNV. DNV also confirms as correct every application of correction factors from relevant QAL2 reports. No assumptions are used, that have any material influence on reported emission reductions.

As per VVM 01.2 para 208 (a), complete set of data for the monitoring period was made available to DNV.

As per para 208 (c) of VVM version 01.2, DNV confirms that the calculations of baseline and project emission factors have been carried out in accordance with the formulae and methods described in the monitoring plan and the applied methodology document.

3.8 Management System and Quality Assurance

The plant has implemented management system according to ISO 9001 and ISO 14001 /19/-/21/, which covers also instructions relevant for CDM project. These instructions described in detail authority and responsibility established in the monitoring plan included in the PDD.

The monitoring system has quality assurance and quality control ensured by following steps:

- QAL1: According to CDM-EB48 report, para 77, "for project activities where the automated monitoring system (AMS) for the measurement of N_2O is subject to compliance with EN 14181 as stipulated in the applied methodology, the Board further clarified that the suitability test QAL1 for the AMS by any entity is acceptable provided that a documentary evidence is submitted which confirms the measures and method conducted are in accordance with the provisions specified in EN ISO14956". DNV was able to verify that the evaluation has been carried out by a third party laboratory/testing institute with EN/ISO/IEC 17025 accreditation before installation of the AMS and the evaluation is deemed to be acceptable.
- QAL2: The monitoring system is regularly tested under QAL2 tests (every 5 years) according to EN 14181. The relevant QAL2 tests were carried out by TÜV SUD Industrie Services in August 2007 (gas volume flow meter) and in February 2008 (for the ABB AO2040 Uras-14 gas analyser). New QAL2 test was carried out by Müller BBM in July 2010 (for gas volume flow meter).
- QAL3: Span and zero checks are carried out twice a week /24/.
- AST: AST test is carried out annually by accredited company. The relevant AST for this period has been realized by Müller BBM on 11-12 June 2009 /6/ (gas analyser and stack gas volume flow meter) and 6-8 July 2010 (gas analyser only) /7/. Both AST tests confirmed the validity of the correction factors from previous QAL2 tests (while the correction factor for VSG was changed after the latest QAL2 test realized in July 2010). The delay in the realization of both AST tests was adressed by conservatively applying the maximum permissible error of the instruments for NCSG (2.69% /4/) and VSG (2.96% /4/) to the raw data during the period of delayed calibration, as it is required by EB 52 annex 60.

4 CERTIFICATION STATEMENT

DNV Climate Change Services AS (DNV) has performed the verification of the emission reductions that have been reported for the "N2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa" (UNFCCC Registration Reference No. 1364) for the period 24 May 2009 to 16 November 2010. The project was registered on 8 February 2008 and the crediting period is 8 February 2008 to 7 February 2018 (fixed).

The project participants are responsible for the collection of data in accordance with the monitoring plan and the reporting of GHG emissions reductions from the project.

It is DNV's responsibility to express an independent verification statement on the reported GHG emission reductions from the project. DNV does not express any opinion on the selected baseline scenario or on the validated and registered PDD.

DNV conducted the verification on the basis of the monitoring methodology AM0034 (version 02), the monitoring plan contained in the registered Project Design Document version 1.c. of 25 September 2007 and the monitoring report (Version 07) dated 22 August 2012. The verification included i) checking whether the provisions of the monitoring methodology and the monitoring plan were consistently and appropriately applied and ii) the collection of evidence supporting the reported data.

DNV's verification approach draws on an understanding of the risks associated with reporting of GHG emission data and the controls in place to mitigate these. DNV planned and performed the verification by obtaining evidence and other information and explanations that DNV considers necessary to give reasonable assurance that reported GHG emission reductions are fairly stated.

DNV is able to confirm that project is implemented in accordance with the registered project design document version 1.c of 25 September 2007, and that the monitoring plan is in accordance with the approved methodology AM0034, version 02 "Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants" applied by the project. Furthermore, DNV confirms the monitoring is in accordance to the monitoring plan.

In our opinion the GHG emissions reductions of the "N2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa" (UNFCCC Registration Ref. No. 1364) for the period 24 May 2009 to 16 November 2010 are fairly stated in the monitoring report (Version 07) dated 22 August 2012.

The GHG emission reductions were calculated correctly on the basis of the approved baseline and monitoring methodology AM0034 (version 02) and the monitoring plan contained in the registered PDD version 1.c. of 25 September 2007. DNV confirms that the calculations of baseline emissions, project emissions and leakage as appropriate have been carried out in accordance with the formulae and methods described in the monitoring plan and the applied methodology.

DNV Climate Change Services AS is able to certify that the emission reductions from the "N2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa" during the period 24 May 2009 to 16 November 2010 amount to 391 122 tonnes of CO_2 equivalents.

Prague and Oslo, 27 August 2012

Zuzana Andrtová
CDM Verifier
DNV Prague, Czech republic

Trine Kopperud
Head of Approval Centre & Nordic
DNV Climate Change Services AS

5 REFERENCES

Documents provided by the Project Participants that relate directly to the GHG components of the project. These have been used as direct sources of evidence for the periodic verification conclusions, and are usually further checked through interviews with key personnel.

/1/ N.serve Environmental Services Gmbh: Monitoring report of N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa, Version 07 dated 22 August 2012 (published versions: version 1 dated 26 November 2010)

/2/ N.serve Environmental Services Gmbh: excel files for the N2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa

- AEL_No11_PC_Calc_V7_MS_20120817
- CDM Data No. 11 2MP_V02_120110_MS
- Project 1364 Monitoring period 02 24_05_2009-16_11_2010 Emission reduction calculations

/3/ N.serve Environmental Services Gmbh: PDD of N2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa, version 1.c, dated 25 September 2007

/4/ TÜV SÜD: QAL2 report, 1 – 4 August 2007 (QAL 2 for MIR 9000 analyser used in the baseline campaign). Valid until 2012.

/5/ TÜV SÜD: QAL2 report, 9 – 11 February 2008. (QAL 2 for Uras 14 analyzer used in project campaigns). Valid until 8 February 2013.

/6/ Müller BBM: AST report, 11 – 12 June 2009. Valid until 10 June 2010.

/7/ Müller BBM: AST report and QAL2 report for gas flow meter, 6-8 July 2010. QAL 2 valid until 5 July 2015, AST valid until 5 July 2011.

/8/ DNV: Verification report No. 2010-1012, revision 02, 16 December 2011

/9/ African Explosives Ltd.: Calibration procedures:

N_2O gas from analyser No. 11NA AT-76020/2, dated 22 June 2009

N_2O gas from analyser No. NO. 09NA AT-110/2, dated 22 June 2009

/10/ Modderfontein Laboratory Services (Pty) Ltd.: Analytical report, Certification of the N_2O calibration gas, 28 November 2008

/11/ Intergas: Certificate of composition N_2O, 13 November 2006 valid till 12 November 2011

/12/ African Explosives Ltd.: Span gas tracking (period February 2008 till March 2011)

/13/ African Explosives Ltd.: Spare parts for AMS

/14/ TÜV SÜD: QAL 1 report Uras 14

/15/ Afrox Ltd.: Certificates of analysis of calibration test gases (995, 1011, 1012 ppmv) during the monitoring period.
Certification dates: 19 March 2008, 2 September 2009 and 17 March 2010 (filled 19 February 2008, 26 August 2009 and 15 March 2010.
All bottles were consumed prior expiration date

/16/ African Explosives Ltd.: Procedure for CDM data preparation, revision 00, dated 13 February 2008

/17/ ALPRET Controls Specialists: Nitric acid flow meter Tag. No. FT-76010 calibration, dated 24 February 2009

/18/ African Explosives Ltd.: Internal calibration of individual instruments:

- Oxidation temperature (OTh) Tag. No.76159/1-5 - Dates of calibration during project campaigns*:* 30 May 2009, 30 September 2009, 29 December 2009, 3 August 2010
- Oxidation pressure (OPh) Tag.no. PT-76002-1 - Dates of calibration during project campaign: 28 May 2009, 29 September 2009, 28 December 2009, 3 August 2010
- Ammonia flow rate (AFR) Tag.no. 76003/1 - Dates of calibration during project campaigns: 16 February 2009, 29 September 2009, 28 December 2009, 3 August 2010
- Air flow rate (AIFR) Tag no. FT-76002/1- Dates of calibration during project campaigns: 27 May 2009, 29 September 2009, 28 December 2009, 3 August 2010

/19/ SABS: ISO 9001 certificate of Modderfontein Laboratory Services (Pty) Ltd., valid until 24 November 2012

/20/ SABS Commercial Ltd.: ISO 9001:2008 Certificate number LS 0243 valid until 8 September 2012

/21/ SABS Commercial Ltd.: ISO 14001:2004 Certificate number EM 140394 valid until 3 February 2012

/22/ Heraeus: Composition information for gauze catalyst dated 8 June 2009, 30 December 2009 and 2 August 2010

/23/ TÜV SÜD: Validation report "N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa", report no. 1017249, 27 September 2007

/24/ African Explosives Ltd.: QAL 3 records (realized twice in week, reviewed period 4 May 2009 till 25 November 2010

/25/ African Explosives Ltd.: Downtime report, covered period from 25 May 2009 till 16 November 2010

Background documents related to the design and/or methodologies employed in the design or other reference documents.

/26/ CDM Executive Board: Approved Monitoring methodology AM0034, version 02

/27/ CDM Executive Board: Validation and Verification Manual. Version 01.2

/28/ CDM Executive Board: Guidelines on completeness check of requests for issuance, CDM EB in its 48th meeting on 14 – 17 July 2009

/29/ CDM Executive Board: Issuance completeness checklist, version 02 of 1 July 2011

/30/ CDM Executive Board: Issuance information and reporting checklist, version 02 of 1 July 2011

/31/ CDM Executive Board: EB meeting 52, annex 60

/32/ DNV: CDMJI – ICP-5-8-CDMJI-g13: Sampling guidance

Persons interviewed during the initial verification, or persons who contributed with other information that are not included in the documents listed above.

/33/ Martin Stilkenbäumer, Project Manager and Monitoring Expert, N.serve

/34/ Hendrik Burger, Production Manager, Nitrates, AEL

/35/ Thembeka Lucy Dhlodhlo, Production Technical Services, Nitrates, AEL

/36/ Piet de Villiers, AMS calibration, AEL

/37/ Chris Tilley, Modderfontein Laboratory Services (Pty) Ltd.

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APPENDIX A

CORRECTIVE ACTION REQUESTS, CLARIFICATION REQUESTS AND FORWARD ACTION REQUESTS

Corrective action requests

CAR ID	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
CAR 1	The monitoring calculation should be corrected in accordance with the Downtime report (excluding data in calibration time) and finding max values for replaced data in the 5th campaign. These replacing missing values should be determined on basis of data after excluding condition (820°C). The lower limit should be 820°C in excel file as the condition for excluding data.	The calculation has been updated according to the downtime report. Data during calibration of the AMS was excluded. The replacement value for missing data was determined as the remaining maximum value of that campaign after excluding period of plant downtime. The plant is defined to be offline when the operating temperature is below 820°C.	The provided final version of the monitoring report reflects correctly the incorrectness found during the review of primary data. The CAR is closed
CAR 2	The reporting of the events should be improved and corrected in accordance with the Downtime report file. All information, which influences the CER calculations, should be included.	The monitoring report was updated regarding the reporting of the events. Periods of plant downtime and problems with the AMS are clearly mentioned now.	The update was provided and it corresponds with the Downtime report. The CAR is closed
CAR 3	The corrected file for zero/span evaluation is requested. Further it should be made available an updated procedure for including description of actions to be taken when the range of limit is exceeded.	The updated file for NCSG calibration documentation (zero/span – evaluation) was provided. The procedure was updated and provided as well.	The file with information about zero/span evaluation was provided. The procedures for calibration were provided /9/ including description for further actions. The CAR is closed.

Clarification requests

CL ID	Clarification request	Response by Project Participants	DNV's assessment of response by Project Participants
CL 1	Spare information (what is on store), eventual procedure for maintenance should be provided.	Spare parts list provided	The spares list contains all necessary spares to avoid long failure of analyser. The CL is closed

CL ID	Clarification request	Response by Project Participants	DNV's assessment of response by Project Participants
CL2	The analysis routine for QAL3 is not fully consistent with good practice. The gas used is supplied with a certificate of analysis from AFROX. However the certificate is not stating the concentration of N_2O at the sufficient level of accuracy, as this is provided by the local laboratory. The PP is requested to clarify that the gas used for QAL 3 is at a sufficient level of accuracy.	The concentration of the calibration gas provided by AFROX is analysed by an external laboratory (Modderfontain Laboratory services (Pvt) Ltd.) by gas chromatography. The exact concentration of the calibration gas is certified by the laboratory and a respective certificate is issued. For calibration of the gas chromatography a Standard gas provided by "Intergas International Gases and Chemicals Limited – Newcastle-under-Lyme, UK" was used. The accuracy of the certified concentration was recertified. The validity of the new certificate is until 12/11/2011. For the future AEL will procure span gas with sufficient certification from a different supplier. Once this is the case the extra analyses by the laboratory will not be necessary any more.	The provided analytical report from28 November 2008 and certificate of the new bottle of the calibration gas provided evidence about improvement in the process. The future provision, i.e. usage of certified span gas will avoid problem with QAL3 procedure. The CL is closed

Forward action requests from previous verification

FAR ID	Forward action request	Summary of how FAR has been addressed in this reporting period	Assessment of how FAR has been addressed
FAR 1	NA		

Forward action requests from this verification

FAR ID	Forward action request	Response by Project Participants	DNV's assessment of response by Project Participants
FAR 1	The calibration gases information is included as history in a table, but without clear traceability of the bottle used. The original certificates from AFROX are not stored currently. The information about traceability should be clear.	A span gas list with first and last day of use of the different span gas cylinders was provided.	The traceability of the used gases are correctly demonstrate by list of used gases. The FAR is closed.
FAR 2	The steps related to hand-transferring of data should be used for improvement QA/QC procedures (for example typing of QAL 3 results to table for Shewart chart).	The transfer of data is improved by instituting files that are kept at the analysers. In the files will be the calibration reports and a member of the project team will once a week then transfer the data to the Excel file. This would prevent the instrumentation technician from having to use a book to first write down the results before transferring it to the calibration report.	The improvement should be verified on next audit. The FAR is still open
FAR 3	The QA/QC procedures for analysis of "standard" N_2O gas should be improved.	AEL ISO 9001 certificate for the lab as well as laboratory procedure was provided. For the future AEL will procure span gas with sufficient certification from a different supplier. Once this is the case the extra analyses by the laboratory will not be necessary any more.	The FAR is closed in relation with provided procedures and explanation as it was demonstrated by closing of CL2. The FAR is closed.

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APPENDIX B

ASSESSMENT OF MONITORING DATA FOR PROJECT EMISSIONS

Data variable	NCSG	Reported value for the project period
	N_2O concentration in the stack gas at normal conditions (101.325 kPa, 0 °C).	PC4: 441.61 mgN_2O/Nm^3 PC5: 192.04 mgN_2O/Nm^3 PC6: 258.95 mgN_2O/Nm^3
Assessment/Observation		
Instruments and locations:	***Tag no. AT-76020-2*** ABB AO2040 Uras 14 N_2O gas analyser with NDIR spectrometry *Accuracy: 2.69%* *Instrument number: 3.346854.7*	
Accuracy:	The accuracy represents good monitoring practice, however it is not directly set in the PDD	
Measuring and recording frequency:	**Measuring frequency:** Continuously **Recording frequency:** every 2 second	
Calibration information	**Calibration frequency:** Internal calibration by AEL Ltd.: Zero and span check and calibration in case of deviation > 1% of range of analyzer. Realized twice per week External calibration: QAL2 by an authorized ISO 17025 institute every 5 year and AST by an authorized ISO 17025 institute annually **Latest date of calibration:** QAL2: 9 – 11 February 2008 (valid till February 2013) /5/ AST: 11 – 12 June 2009 /6/ and 6 July 2010 (valid until July 2011) /7/ **Validity of calibration:** the validity is 5 year for QAL2 and 1 year for AST **Company performing the calibration:** TÜV SÜD (QAL2) and Müller BBM (AST tests) **Did the calibration confirm proper functioning of monitoring equipment:** Yes The selected periods for individual tests represents good practice. The delays between	

	individual AST tests were reflected by application of maximum permissible error (2.69%) of the instrument to NCSG raw data /2/ in accordance with EB 52 annex 60 /31/. The periods are between scheduled and realized date of the AST: - From 8 June 2009 to 12 June 2009 - From 12 June 2010 to 6 July 2010 DNV confirms that the calibrations are valid throughout the monitoring period and the delays in calibration were correctly addressed.
Information Flow:	The data are automatically stored in the SCADA Data Acquisition System. Once a month the results will be downloaded from SCADA to an excel file for analysis and calculation. The raw data will be saved on a DAT device and will be stored in a strongbox in the IT office. All data necessary for the emission reduction calculation are digitally transferred from the Plant data system (SCADA) to the dedicated relational database management system (N.DBMS). DNV confirms the successful verification of information flow of this parameter (see also chapter 3.6.1).
Verification method:	Raw data of the Excel sheet "CDM Data No. 11 2MP_V02_120110_MS" /2/ from the monitoring period were provided and checked by DNV. Random picked data points were checked against data stored on the monitoring PC.
Cross-check (if applicable)	The data are cross-checked with the concentration measurement by a SRM during the QAL 2 test. Further the raw data were random check as mentioned above following the DNV internal. procedure CDMJI – ICP-5-8-CDMJI-g13
QA/QC:	QAL2: 9 – 11 February 2008 (valid till February 2013) /5/ AST: 11 – 12 June 2009 /6/ and 6 July 2010 (valid until July 2011) /7/ QAL3: twice in week /24//12/ The accuracy and the calibration interval of the monitoring equipment is in accordance with the relevant guidance of EB /31/ and is controlled and calibrated in accordance with the monitoring plan /3/.

Partial data (if applicable)	NA

Data variable	**VSG** Normal gas volume flow rate of the stack gas	**Reported value for the project period** PC4: 78 109 Nm^3/h PC5: 77 173 Nm^3/h PC6: 83 845 Nm^3/h
Assessment/Observation		
Instruments and locations:	***Tag no. FT-76550*** Emerson Rosemount Annubar Model 485 with 3051 DP transmitter *Accuracy: 2.84% per QAL2 and combined uncertainty for normalised gas flow at standard conditions 2.96% per QAL2* *Instrument number: NA*	
Accuracy:	The accuracy represents good monitoring practice, however it is not directly set in the PDD	
Measuring and recording frequency:	**Measuring frequency:** Continuously **Recording frequency:** every 2 second	
Calibration information	**Calibration frequency:** Internal calibration by AEL Ltd.: after each campaign External calibration: QAL2 by an authorized ISO 17025 institute every 5 year and AST by an authorized ISO 17025 institute annually **Latest date of calibration:** QAL2: 1 – 3 August 2007 (valid till August 2012) /4/ and 6-8 July 2010 (valid until July 2015) /7/ AST: 11 – 12 June 2009 /6/ and 6-8 July 2010 (valid until July 2011) /7/	

	Validity of calibration: the validity is 5 year for QAL2 and 1 year for AST **Company performing the calibration:** TÜV SÜD (QAL2) and Müller BBM (AST, QAL2 tests) **Did the calibration confirm proper functioning of monitoring equipment:** Yes The selected periods for individual tests represents good practice. The delays between individual AST tests were reflected by application of maximum combined permissible error for VSG, TSG and PSG (2.96%) to the normalised VSG raw data /2/ in accordance with EB 52 annex 60 /31/ (hence no correction to the TSG and PSG data is needed). The periods are between scheduled and realized date of the AST: - From 8 June 2009 to 12 June 2009 - From 12 June 2010 to 6 July 2010 DNV confirms that the calibrations are valid throughout the monitoring period and the delays in calibration were correctly addressed.
Information Flow:	The data are automatically stored in the SCADA Data Acquisition System. Once a month the results will be downloaded from SCADA to an excel file for analysis and calculation. The raw data will be saved on a DAT device and will be stored in a strongbox in the IT office. All data necessary for the emission reduction calculation are digitally transferred from the Plant data system (SCADA) to the dedicated relational database management system (N.DBMS). DNV confirms the successful verification of information flow of this parameter (see also chapter 3.6.1).
Verification method:	Raw data of the Excel sheet "CDM Data No. 11 2MP_V02_120110_MS" /2/ from the monitoring period were provided and checked by DNV. Random picked data points were checked against data stored on the monitoring PC.
Cross-check (if applicable)	The data are cross-checked with the stack gas flow measurement by a SRM during the QAL 2 test. Further the raw data were random check as mentioned above following the DNV internal. procedure CDMJI – ICP-5-8-CDMJI-g13

QA/QC:	The accuracy and the calibration interval of the monitoring equipment is in accordance with the relevant guidance of EB /31/ and is controlled and calibrated in accordance with the monitoring plan /3/.
Partial data (if applicable)	NA

Data variable	**TSG** Temperature in the stack gas	**Reported value for the project period** **NA**
Assessment/Observation		
Instruments and locations:	***Tag no. TE-76170*** Stack temperature probe situated directly next to the volume flow meter, type PT100_385 3-wire RTD with transmitter Rosemont Model 644 RAI *Accuracy: 2.55% per QAL2* *Instrument number: NA*	
Accuracy:	The accuracy represents good monitoring practice, however it is not directly set in the PDD	
Measuring and recording frequency:	**Measuring frequency:** Continuously **Recording frequency:** every 2 second	
Calibration information	**Calibration frequency:** Internal calibration by AEL Ltd.: after each campaign External calibration: QAL2 by an authorized ISO 17025 institute every 5 year and AST by an authorized ISO 17025 institute annually **Latest date of calibration:** QAL2: 1 – 3 August 2007 (valid till August 2012) /4/ 6-8 July 2010	

	(valid until July 2015) /7/ AST: 11 – 12 June 2009 /6/ and 6-8 July 2010 (valid until July 2011) /7/ **Validity of calibration:** the validity is 5 year for QAL2 and 1 year for AST **Company performing the calibration:** TÜV SÜD (QAL2) and Müller BBM (AST, QAL2 tests) **Did the calibration confirm proper functioning of monitoring equipment:** Yes. No correction due to delayed AST calibration is needed as the maximum combined error for VSG, TSG and PSG was applied to the normalised stack gas flow data. The calibration procedures are fully in compliance with the PDD and EN 14181. DNV confirms that the calibration(s) is (are) valid throughout the monitoring period.
Information Flow:	The data are automatically stored in the SCADA Data Acquisition System. Once a month the results will be downloaded from SCADA to an excel file for analysis and calculation. The raw data will be saved on a DAT device and will be stored in a strongbox in the IT office. All data necessary for the emission reduction calculation are digitally transferred from the Plant data system (SCADA) to the dedicated relational database management system (N.DBMS). DNV confirms the successful verification of information flow of this parameter (see also chapter 3.6.1).
Verification method:	Raw data of the Excel sheet "CDM Data No. 11 2MP_V02_120110_MS" /2/ from the monitoring period were provided and checked by DNV. Random picked data points were checked against data stored on the monitoring PC.
Cross-check (if applicable)	The data are cross-checked with the temperature measurement by a SRM during the QAL2 test. Further the raw data were random check as mentioned above following the DNV internal. procedure CDMJI – ICP-5-8-CDMJI-g13.
QA/QC:	The accuracy and the calibration interval of the monitoring equipment is in accordance with the relevant guidance of EB /31/ and is controlled and calibrated in accordance with the monitoring plan /3/.

Partial data (if applicable)	NA

Data variable	**PSG** Pressure in the stack gas	**Reported value for the project period** **NA**
Assessment/Observation		
Instruments and locations:	***Tag no. PT-76506*** Stack pressure probe situated directly next to the volume flow meter, type P type 3051Ta12B21BB4I1M5Q4 with transmitter Rosemont *Accuracy: 0.7% per QAL2* *Instrument number: NA*	
Accuracy:	The accuracy represents good monitoring practice, however it is not directly set in the PDD	
Measuring and recording frequency:	**Measuring frequency:** Continuously **Recording frequency:** every 2 second	
Calibration information	**Calibration frequency:** Internal calibration by AEL Ltd.: after each campaign External calibration: QAL2 by an authorized ISO 17025 institute every 5 year and AST by an authorized ISO 17025 institute annually **Latest date of calibration:** QAL2: 1 – 3 August 2007 (valid till August 2012) /4/ 6-8 July 2010 (valid until July 2015) /7/ AST: 11 – 12 June 2009 /6/ and 6-8 July 2010 (valid until July 2011) /7/ **Validity of calibration:** the validity is 5 year for QAL2 and 1 year for AST	

	Company performing the calibration: TÜV SÜD (QAL2) and Müller BBM (AST, QAL2 tests) **Did the calibration confirm proper functioning of monitoring equipment:** Yes. No correction due to delayed AST calibration is needed as the maximum combined error for VSG, TSG and PSG was applied to the normalised stack gas flow data. The calibration procedures are fully in compliance with the PDD and EN 14181. DNV confirms that the calibration(s) is (are) valid throughout the monitoring period.
Information Flow:	The data are automatically stored in the SCADA Data Acquisition System. Once a month the results will be downloaded from SCADA to an excel file for analysis and calculation. The raw data will be saved on a DAT device and will be stored in a strongbox in the IT office. All data necessary for the emission reduction calculation are digitally transferred from the Plant data system (SCADA) to the dedicated relational database management system (N.DBMS). DNV confirms the successful verification of information flow of this parameter (see also chapter 3.6.1).
Verification method:	Raw data of the Excel sheet "CDM Data No. 11 2MP_V02_120110_MS" /2/ from the monitoring period were provided and checked by DNV. Random picked data points were checked against data stored on the monitoring PC.
Cross-check (if applicable)	The data are cross-checked with the pressure measurement by a SRM during the QAL 2 test. Further the raw data were random check as mentioned above following the DNV internal procedure CDMJI – ICP-5-8-CDMJI-g13.
QA/QC:	The accuracy and the calibration interval of the monitoring equipment is in accordance with the relevant guidance of EB /31/ and is controlled and calibrated in accordance with the monitoring plan /3/.
Partial data (if applicable)	NA

Data variable	**OH_n** Total operating hours during each project campaign	**Reported value for the project period** PC4: 4 444 h PC5: 5 073 h PC6: 2 451 h
Assessment/Observation		
Instruments and locations:	NA – measured from Process Control System	
Accuracy:	*NA*	
Measuring and recording frequency:	**Measuring frequency:** Continuously **Recording frequency:** hourly	
Calibration information	NA	
Information Flow:	The hours are sourced from Process Control System DNV confirms the successful verification of information flow of this parameter (see also chapter 3.6.1).	
Verification method:	The data were re-calculated from raw data presented in excel sheet /2/	

Cross-check (if applicable)	The data were re-calculated from raw data presented in excel sheet /2/
QA/QC:	NA
Partial data (if applicable)	NA

Data variable	**NAP** Metric tonnes of 100% concentrated nitric acid during each project campaign	**Reported value for the project period** PC4: 129 361 $tHNO_3$ PC5: 150 111 $tHNO_3$ PC6: 72 510 $tHNO_3$
Assessment/Observation		
Instruments and locations:	***Tag no. FT-76010*** Coriolis mass flow meter Emerson CMF300 *Accuracy: ≤0.1%* *Instrument number: 414940*	
Accuracy:	≤=0.1%, which is fully in compliance with the PDD description	
Measuring and recording frequency:	**Measuring frequency:** Continuously, Concentration is determined by density and temperature **Recording frequency:** every hour	

Calibration information	**Calibration frequency:** 3 years **Latest date of calibration:** 24 February 2009 (valid until 23 February 2012) /17/ **Validity of calibration:** valid 3 years **Company performing the calibration:** ALPRET Controls Specialist /17/ **Did the calibration confirm proper functioning of monitoring equipment:** Yes. The PDD does not specify the frequency of calibration. The selected frequency represents good monitoring practice. DNV confirms that the calibration(s) is (are) valid throughout the monitoring period.
Information Flow:	The measurements from the mass flowmeter are transferred to the Process Control System, and print out the cumulative production is made daily for archiving. DNV confirms the successful verification of information flow of this parameter (see also chapter 3.6.1).
Verification method:	Raw data of the Excel sheet "CDM Data No. 11 2MP_V02_120110_MS" /2/ from the monitoring period were provided and checked by DNV. Random picked data points from the escel sheetwere checked against raw data from the PCS.
Cross-check (if applicable)	The raw data were random checked as mentioned above following the DNV internal. procedure CDMJI – ICP-5-8-CDMJI-g13.
QA/QC:	The calibration is realized every 3 years as was presented above /17/. The accuracy and the calibration interval of the monitoring equipment is in accordance with the relevant guidance and is controlled and calibrated in accordance with the monitoring plan.
Partial data (if applicable)	NA

Data variable	**CL_n** Length of each project campaign measured in metric tonnes of 100% concentrated nitric acid produced during that campaign	**Reported value for the project period** PC4: 129 361 $tHNO_3$ PC5: 150 111 $tHNO_3$ PC6: 72 510 $tHNO_3$
Assessment/Observation		
Instruments and locations:	***Tag no. FT-76010*** Coriolis mass flow meter Emerson CMF300 *Accuracy: ≤0.1%* *Instrument number: 414940*	
Accuracy:	≤=0.1%, which is fully in compliance with the PDD description	
Measuring and recording frequency:	**Measuring frequency:** Continuously, Concentration is determined by density and temperature **Recording frequency:** every hour	
Calibration information	**Calibration frequency:** 3 years **Latest date of calibration:** 24 February 2009 (valid until 23 February 2012) /17/ **Validity of calibration:** valid 3 years **Company performing the calibration:** ALPRET Controls Specialist /17/ **Did the calibration confirm proper functioning of monitoring equipment:** Yes. The PDD does not specify the frequency of calibration. The selected frequency represents good monitoring practice. DNV confirms that the calibration(s) is (are) valid throughout the monitoring period.	

Information Flow:	The measurements from the mass flowmeter are transferred to the Process control system, and print out of the cumulative production is made daily for archiving. DNV confirms the successful verification of information flow of this parameter (see also chapter 3.6.1).
Verification method:	Raw data of the Excel sheet "CDM Data No. 11 2MP_V02_120110_MS" /2/ from the monitoring period were provided and checked by DNV. Random picked data points from the excel sheet were checked against data from the process control system,.
Cross-check (if applicable)	The raw data were random check as mentioned above following the DNV internal. procedure CDMJI – ICP-5-8-CDMJI-g13
QA/QC:	The calibration is realized every 3 years as was presented above /17/. The accuracy and the calibration interval of the monitoring equipment is in accordance with the relevant guidance and is controlled and calibrated in accordance with the monitoring plan.
Partial data (if applicable)	NA

Data variable	**OP_h** Oxidation Pressure for each hour	**Reported value for the project period** **NA (**OP_h is measured to check if the parameter is within the permitted operating range during the baseline campaign or if the plant is out of operation during project campaigns).

Assessment/Observation	
Instruments and locations:	Pressure meter at discharge of the air compressor before ammonia to air mixer. Yokogawa, type Pressure Tx TAG: PT-76002-1
Accuracy:	The accuracy of the monitoring is not stated in the PDD. However the measurement uncertainty is 1.7% (as per AEL calibration requirements)
Measuring and recording frequency:	**Measuring frequency:** Continuously **Recording frequency:** hourly
Calibration information	Internal calibration: 28 May 2009, 29 September 2009, 28 December 2009, 3 August 2010 /18/
Information Flow:	The data are automatically stored in the SCADA Data Acquisition System. Once a month the results will be downloaded from SCADA to an excel file for analysis and calculation. The raw data will be saved on a DAT device and will be stored in a strongbox in the IT office. DNV confirms the successful verification of information flow of this parameter (see also chapter 3.6.1).
Verification method:	Raw data of the Excel sheet "CDM Data No. 11 2MP_V02_120110_MS" /2/ from the monitoring period were provided and checked by DNV. Random picked data points were checked against data stored on the monitoring PC.
Cross-check (if applicable)	NA
QA/QC:	The accuracy and the calibration interval of the monitoring equipment is in accordance with the relevant guidance of EB /31/ and is controlled and calibrated in accordance with the monitoring plan /3/.

Partial data (if applicable)	NA

Data variable	**OT_h** Oxidation temperature in the ammonia oxidation reactor (AOR)	**Reported value for the project period** **NA** **(**OT_h is measured to check if the parameter is within the permitted operating range during the baseline campaign or if the plant is out of operation during project campaigns).
Assessment/Observation		
Instruments and locations:	Thermocouples inside the AOR. Thermocouple type K310S/steel TAG: TE- 76159/1; 76159/2; 76159/3; 76159/4; 76159/5	
Accuracy:	The accuracy of the monitoring is not stated in the PDD. However the measurement uncertainty is 1% (as per AEL calibration requirements)	
Measuring and recording frequency:	**Measuring frequency:** Continuously **Recording frequency:** hourly	
Calibration information	Internal calibration: 30 May 2009, 30 September 2009, 29 December 2009, 3 August 2010 /18/	
Information Flow:	The data are automatically stored in the SCADA Data Acquisition System. Once a month the results will be downloaded from SCADA to an excel file for analysis and calculation. The raw data will be saved on a DAT device and will be stored in a strongbox in the IT office. DNV confirms the successful verification of information flow of this parameter (see also chapter 3.6.1).	

Verification method:	Raw data of the Excel sheet "CDM Data No. 11 2MP_V02_120110_MS" /2/ from the monitoring period were provided and checked by DNV. Random picked data points were checked against data stored on the monitoring PC.
Cross-check (if applicable)	NA
QA/QC:	The accuracy and the calibration interval of the monitoring equipment is in accordance with the relevant guidance of EB /31/ and is controlled and calibrated in accordance with the monitoring plan /3/.
Partial data (if applicable)	NA

Data variable	**AFR** Ammonia gas flow rate to ammonia oxidation reactor (tNH_3/h)	**Reported value for the project period** **NA** **(**AFR is measured to check if the parameter is within the permitted operating range during the baseline campaign or if the plant is out of operation during project campaigns).
Assessment/Observation		
Instruments and locations:	Orifice plate. Yokogawa D.P. Transmitter TAG: FT-76003/1	
Accuracy:	The accuracy of the monitoring is not stated in the PDD. However the measurement uncertainty is 1.25 % (as per AEL calibration requirements)	

Measuring and recording frequency:	**Measuring frequency:** Continuously **Recording frequency:** hourly
Calibration information	Internal calibration: 16 February 2009, 29 September 2009, 28 December 2009, 3 August 2010
Information Flow:	The data are automatically stored in the SCADA Data Acquisition System. Once a month the results will be downloaded from SCADA to an excel file for analysis and calculation. The raw data will be saved on a DAT device and will be stored in a strongbox in the IT office. DNV confirms the successful verification of information flow of this parameter (see also chapter 3.6.1).
Verification method:	Raw data of the Excel sheet "CDM Data No. 11 2MP_V02_120110_MS" /2/ from the monitoring period were provided and checked by DNV.
Cross-check (if applicable)	NA
QA/QC:	The accuracy and the calibration interval of the monitoring equipment is in accordance with the relevant guidance of EB /31/ and is controlled and calibrated in accordance with the monitoring plan /3/.
Partial data (if applicable)	NA

Data variable	**AIFR** Ammonia to air ratio into the AOR	**Reported value for the project period** **NA** **(**AIFR is measured to check if the parameter is within the permitted operating range during the baseline campaign or if the plant is out of operation during project campaigns).

Assessment/Observation	
Instruments and locations:	Calculated from AFR and the primary airflow to the AOR. For air flow: Yokagawa type D.P. transmitter TAG: FT-76002/1
Accuracy:	The accuracy of the monitoring is not stated in the PDD. However the measurement uncertainty is 1.66% (as per AEL calibration requirements)
Measuring and recording frequency:	**Measuring frequency:** Continuous **Recording frequency:** hourly
Calibration information	Internal calibration of the primary air flow to AOR: 27 May 2009, 29 September 2009, 28 December 2009, 3 August 2010
Information Flow:	The data are automatically stored in the SCADA Data Acquisition System. Once a month the results will be downloaded from SCADA to an excel file for analysis and calculation. The raw data will be saved on a DAT device and will be stored in a strongbox in the IT office. DNV confirms the successful verification of information flow of this parameter (see also chapter 3.6.1).
Verification method:	Raw data of the Excel sheet "CDM Data No. 11 2MP_V02_120110_MS" /2/ from the monitoring period were provided and checked by DNV.
Cross-check (if applicable)	NA
QA/QC:	The accuracy and the calibration interval of the monitoring equipment is in accordance with the relevant guidance of EB /31/ and is controlled and calibrated in accordance with the monitoring plan /3/.
Partial data (if applicable)	NA

Data variable	**$GS_{project}$** Gauze supplier for the project campaign	**Reported value for the project period** W.C.Heraeus (PC4, PC5, PC6)
Assessment/Observation		
Instruments and locations:	NA	
Accuracy:	*NA*	
Measuring and recording frequency:	**Measuring frequency:** NA **Recording frequency:** NA	
Calibration information	NA	
Information Flow:	NA	
Verification method:	The supplier was confirmed from invoices and compared with information in the PDD /3/, validation report and previous verification report /8/. The records confirmed that the catalyst supplier is the same as in previous campaigns including baseline.	
Cross-check (if applicable)	NA	

QA/QC:	NA
Partial data (if applicable)	NA

Data variable	**$GC_{project}$** Gauze composition during the project campaign expressed as % by weight of the precious metals Pt, Rh and, if applicable, Pd comprising Amonia Oxidation Catalyst gauzes.	**Reported value for the project period** PC4: Pt (54.53%), Rh (3.74%), Pd (41.73%) PC5: Pt (56.0%), Rh (3.8%), Pd (40.2%) PC6: Pt (61.7%), Rh (4.0%), Pd (34.3%)
Assessment/Observation		
Instruments and locations:	NA	
Accuracy:	*NA*	
Measuring and recording frequency:	**Measuring frequency:** NA **Recording frequency:** NA	
Calibration information	NA	

Information Flow:	NA
Verification method:	The composition was confirmed from invoices and compared with information in the PDD /3/, validation report and previous verification report /8/. The records confirmed that the catalyst composition is the same as in previous campaigns including baseline except mentioned campaign PC6.
Cross-check (if applicable)	NA
QA/QC:	NA
Partial data (if applicable)	NA

Data variable	**EF_{reg}** Emission cap for N_2O from nitric acid production set by government regulation	**Reported value for the project period** **No regulation**
Assessment/Observation		
Instruments and locations:	NA	

Accuracy:	*NA*
Measuring and recording frequency:	**Measuring frequency:** NA **Recording frequency:** NA
Calibration information	NA
Information Flow:	NA
Verification method:	Confirmed from database of QMS department, where legislation is monitored.
Cross-check (if applicable)	NA
QA/QC:	NA
Partial data (if applicable)	NA

APPENDIX C

CURRICULA VITAE OF THE VERIFICATION TEAM MEMBERS

Mrs. Zuzana Andrtová *holds Msc. Degree in Technology of Protection Environment on Prague's University of Chemical Technologies. Has more than 12 years experience with implementation of quality systems in various type of organizations. Her experience also covers machine technology design, analytical laboratory processes and implementation of environmental system.*

She has experience of 3 years in validation of CDM projects, determination and verification of JI projects in DNV and EU ETS verification as lead verifier. She participates as team member on accreditation audits for Czech Accreditation Institute as expert assessor for EU ETS scheme.

Her qualification, industrial experience and experience in CDM demonstrate her sufficient sectoral competence in Energy generation from renewable sources.

She has also been actively involved in Management System Audits such as ISO 9001, ISO 140001 and OHSAS 18001 standards in various industrial sectors for more than 5 years in DNV.

Mr. Torkjell Berge *holds a Master's Degree in Chemical Engineering with an overall experience of 36 years in industry. Prior to being engaged by DNV as an expert he had 29 years within the fertilizer industry as plant manager, project engineer and manager, research engineer and manager, and senior corporate technical staff member. In these positions a wide range of competencies has been developed. Out of these 29 years 14 has been within nitric acid production and research activities.*

In addition he has experience from melting industry being production responsible for the Rockwool insulation production in Norway for 7 years. In this process certain rock raw material is mixed with coke in a smelter to make rock fibres mainly used for building insulation.

Mr. Fahad Saleem *holds a Master Degree in Chemical Engineering. He has an overall experience of 3.5 years. Prior to joining DNV, he has 3 years' experience in Fertilizer industry covering plant operation.*

He has an experience of around 6 months in validation and verification of CDM/JI projects and other 3rd party validation/verification services.

His qualification, industrial experience and experience in CDM demonstrate his sufficient sectoral competence in TA 5.1/11.1/12.1.

Mr. Lin Wu *holds a Master Degree in Chemical Engineering & Process, a Bachelor Degree in Chemical Engineering & Process and a Bachelor Degree in Computer Science & Technology, having an overall experience of around seven years. Prior to joining DNV, he has around four years' experience in chemical industry covering design of chemical process and system, piping design, commissioning and project management on site. His experience also covers the fields of desulfurization of flue gas in power plant industry.*

He has experience of around 4 years in validation and verification of CDM/JI projects and other 3rd party validation/verification services.

His qualification, industrial experience and experience in CDM demonstrate his sufficient sectoral competence in "Energy Generation from Renewable Energy Sources" and "Chemical Processes Industries".